LAKE SAKAKAWEA PIPELINE CROSSING REPORT

BakkenLink Pipeline Project
Western North Dakota

BakkenLink Pipeline, LLC

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1. Project Description

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline (Project) to provide much-needed capacity to transport the increasing supplies of crude oil produced from the Bakken oil play. The pipeline will consist of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from Beaver Lodge, North Dakota to a proposed crude oil rail loading facility located near Fryburg, North Dakota (Rail Facility). Additional initial outlets being considered include third party interconnects in the Beaver Lodge/Ramburg area south of Tioga, North Dakota

The Project will address anticipated regional pipeline and outlet constraints due to increased development of the Bakken formation. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will immediately reduce crude oil truck hauling distances. Over the longer term, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The crossing of Lake Sakakawea is an integral part of the Project as it will provide Bakken oil producers in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, with pipeline access to additional export options both north and south of the lake. It will reduce the amount of crude being transported by trucks on both sides of the lake.

Several meetings have been held with the relevant federal agencies over the past eleven months to collaborate on the preferred crossing location.

This report describes selection of the selected crossing location, the studies performed to date at the site, and the evaluation of various construction methodologies. Also the report includes case study discussion and relevant marine experience of the engineering and construction contractor.

2. Description of Proposed Project

The proposed Project is a crude oil pipeline system consisting of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from multiple receipt points in Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, to an interconnect with a new Rail Facility at Fryburg, North Dakota. The trunkline will have bi-directional capability, and will be able to transport crude oil to/from the Rail Facility and Beaver Lodge. BakkenLink is developing and intends to construct, own and operate the pipeline. Another entity is developing the Rail Facility.

The proposed Project will provide much-needed pipeline capacity to transport the increasing supplies of crude oil produced in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota. The system will only accept for transport light sweet crude, typical of production from Bakken formation in North Dakota.

The Project will be designed, constructed, and operated in compliance with applicable portions of the United States Department of Transportation (USDOT) regulations as set forth in 49 CFR Code of Federal Regulations (CFR) Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations encompass general requirements, accident reporting and safety related condition reporting, design requirements, construction, pressure testing, operation and maintenance, qualification of pipeline personnel, and corrosion control. Relevant industry standards are incorporated into these regulations by

reference, including those of the American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), and the American Standard for Testing and Materials (ASTM) and others.

The proposed trunkline is designed to initially carry up to 65,000 barrels per day (BPD) and will have expansion capabilities.

The Project will consist of the following assets:

- Approximately 122 miles of 12-inch steel trunkline for the transportation of crude oil originating from, initially, up to six proposed receipt points including existing and proposed crude oil truck receipt locations and pipeline gathering receipt stations. This trunkline will be bi-directional and will transport crude oil to/from the Rail Facility and Beaver Lodge.
- Approximately 18 miles of 8-inch steel lateral from the Dunn Receipt Point, which will deliver into the trunk line approximately 30 miles north of Belfield.
- Approximately 4 miles of 8-inch steel lateral from the Belfield Receipt Point, which will deliver into the trunk line just north of Belfield.
- Initially, six receipt points will be constructed for input of product. The receipt points will be located at:
    - Beaver Lodge Receipt Point, Williams County
    - Keene Receipt Point, McKenzie County
    - Arrow Midstream Receipt Point, McKenzie County
    - Watford City Receipt Point, McKenzie County
    - Dunn Receipt Point, Dunn County
    - Belfield Receipt Point, Stark County

The Project will be located in the following North Dakota counties: Billings, Dunn, McKenzie, Stark and Williams. Maps depicting the Project location are provided in Appendix 9.2.

BakkenLink anticipates receiving necessary pre-construction permits and approvals, acquiring the necessary right-of-way (ROW), and finalizing other agreements no later than April 2012. The commencement of construction activities is dependent upon permitting, ROW acquisition, and other development activities. The anticipated in-service date for the Arrow to Belfield portion of the Project is September 2012. The anticipated in-service date for the Beaver Lodge to Arrow portion of the Project is December 2012. BakkenLink proposes to develop the Project on the following schedule:

Project Milestone	**Completion Date**
Certificate of Corridor Compatibility and Route Permit	November 2011
Engineering and Design	November 2011
Construction/Environmental Permitting	March 2012
ROW Land Acquisition	April 2012
Start Construction	April 2012
Construction Complete (Arrow to Belfield)	September 2012
Commissioning (Arrow to Belfield)	September-October 2012
In Service (Arrow to Belfield)	October 2012
Construction Complete (Beaver Lodge to Belfield)	November 2012
Commissioning (Beaver Lodge to Arrow)	November-December 2012
In Service (Beaver Lodge to Arrow)	December 2012

In the future, additional receipt points may be developed, as well as outlet connections with third party pipelines, including potentially the Enbridge North Dakota pipeline system, the Tesoro High Plains Pipeline system, the Bridger Pipeline system, and if approved and it moves to construction, the Keystone XL Pipeline system. An extension of the Project to an interconnect with TransCanada's Marketlink and Keystone XL Pipeline system projects is currently being assessed by BakkenLink.

3. Need for Facility

The Project will address anticipated regional pipeline and outlet constraints as development of the Bakken formation continues. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will provide a number of producers in western North Dakota with a much needed alternative means of transporting their crude oil. Additionally, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

Over the last five years, development of the middle Bakken and upper Three Forks formations has steadily increased in North Dakota. Technological advancements in horizontal drilling and fracture stimulation have made recovering the oil in these formations economically feasible. Favorable oil prices have further accelerated this development.

An initial study by the United States Geological Survey (USGS) released in 2008 claimed stated that the middle Bakken had 4 billion barrels of recoverable oil in the Williston Basin. The latest official estimate from the North Dakota Industrial Commission (NDIC) is that up to 11 billion barrels may be recoverable from the middle Bakken and upper Three Forks formation in North Dakota. Continental Resources, Inc., a leading Bakken producer, has indicated that at current economics and with current technology the Bakken and Three Forks has 24 billion barrels of recoverable oil. As technological advances continue, even these higher estimates may be exceeded.

Production is forecasted to grow in North Dakota from a record 444,000 BPD in August 2011 to up to and in excess of 1,000,000 BPD over the next five years. During August 2011, there were approximately 192 rigs drilling for oil in North Dakota. According to the NDIC, over 95% of drilling is targeting the middle Bakken and upper Three Forks formations. It is expected that the rig count could rise above 200 rigs during 2012.

This Project will provide an environmentally sensitive method of transporting crude oil from the heart of the Bakken play, greatly benefiting producers, landowners, citizens in the State of North Dakota, local municipalities, and mineral interest owners.

4. Lake Crossing Information

4.1. Routing Selection Process

BakkenLink evaluated several options for the proposed Project route. Each option was considered with respect to regional access to markets, economics, engineering design, construction feasibility, and environmental impacts. Efforts were coordinated with the regional US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), and US Fish & Wildlife Service (USFWS) offices. The location of the proposed route was selected to have minimal effects on resources and residents while maintaining a strong positive impact for the region.

The route design for the Project will provide multiple origination points (Receipt Points) in the most prolific

and active parts of the middle Bakken and upper Three Forks development in addition to opening up new areas that are not currently accessible to pipeline service, especially between Johnson's Corner and Watford City and between Watford City and Belfield. The planned 12-inch trunkline allows for economic expansion opportunities that are supported by the proprietary catchment study, including the original oil in place estimates.

Key routing considerations included:

- Location and number of receipt points in relation to existing and proposed oil field production facilities;
- The crossing of the Missouri River at Lake Sakakawea;
- The pipeline route across the Little Missouri National Grasslands (LMNG).

The Lake Sakakawea crossing is a key logistical consideration. Several crossing locations were evaluated during preliminary design and planning of the Project. The proposed route is a crossing north of Keene, ND. Another location given consideration, east of Williston, was approximately 10 miles west of the proposed location and provided a more favorable approach to the lake shoreline. The total crossing length would have been reduced by nearly 4,000 feet compared to the proposed route; making the use of HDD technology more feasible. Two other crossing locations were evaluated – at the Four Bears Bridge near New Town and another route near Williston. BakkenLink presented the different crossing location options for discussion at meetings with federal agencies on October 5, and December 9, 2010, and on February 8, 2011. In these meetings, the USACE identified the current crossing location as their preferred route due to the presence of existing pipelines at that location. Other entities in the region reportedly have also been exploring the same river crossing location and certain advantages exist for locating their pipeline adjacent to this route.

As a result of the aforementioned meetings, all other crossing locations were abandoned in favor of the proposed route north of Keene. A summary of the meeting minutes concerning lake crossing locations and methods is below in Section 4.3. Further information and meeting minutes can be provided upon request.

4.2. Pipelines and Facilities in the Vicinity

In the evaluation of the Lake Sakakawea approach, the following pipelines have been identified in the vicinity of the proposed BakkenLink Pipeline crossing:

Pipeline Owner	Outer Diameter of Pipe	Number of Pipelines	Construction Method	Product
Amerada Hess	8"	3	Open cut – 1950s	Gas
Amerada Hess	16"	1	Open cut – 1950s	Gas
Dakota Gassification Company		1	Open cut	Carbon Dioxide

During interagency discussions, the USACE noted that Amerada Hess has three 8" and one 16" lines across the Lake that that were installed in the 1950's. These pipelines predate the lake and were installed utilizing open cut trenching methods. The Dakota Gassification Company (DGC) pipeline, also installed using open cut techniques, was constructed when the lake water level was only 10 feet in the center of the Missouri River Thalweg (old river channel). The alignment of the proposed pipeline is approximately 200 feet away from the existing DGC pipeline.

4.3. Summary of Agency Meetings for Lake Crossing Site

- October 5, 2010 -- USACE/USFWS – Meeting held in USACE office in Riverdale
    - Notified by USACE-Riverdale that water depth at time of construction would be +/- 48 ft. Advised the agencies the water depth increase would change the recommended construction methodology.

- December 9, 2010 – USACE-Bismarck interagency meeting – Meeting held in USACE office in Bismarck
    - Presentation of crossing methodology at the proposed location. Assumed maximum water depth was +/- 20 ft. Proposed methodology was pre-trenching using backhoe/excavator on a floating platform. Jetting was discussed and expressed as not feasible due to limited water depth and desire to minimize turbidity.
    - USACE advised that Enbridge indicated findings that an HDD would be possible at a depth of 300 feet below surface due to pressure and soil conditions. BakkenLink related that HDD crossing of the lake would require a world record 14,000 LF drill using a "hand-shake" method, where the drill begins on both banks and meets in the middle. The USACE asked if another location would be more favorable and received the response that no locations within a reasonable distance would reduce the HDD length and risk. The proposed location was recommended because the existing corridor at this location would be favorable for the alternative trenching-based installation method.
    - Bucket dredging and jetting techniques were discussed but not ideal because of turbidity issues

- February 8, 2011 -- USACE-Bismarck, United States Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), US Forest Service (USFS) – Meeting held in USFWS office in Watford City
    - Discussed Lake Sakakawea pipeline crossing in general terms. Alternative crossing locations were discussed. USFS preference was western alternative to move the route off of Forest Service lands. After BakkenLink confirmed that other locations would not produce more favorable HDD conditions, USACE's preference was the current proposed location. USACE maintained its preference of an HDD crossing but was open to discussing alternative methods.
    - Construction methodology options were discussed including discussion of the favorability of the proposed location due to knowledge of the existing soil conditions in the corridor.

- September 20, 2011 -- North Dakota Department of Health Water Quality Division – Teleconference
    - Presentation of Push/Pull Crossing method of Lake. Discussions of turbidity control during construction operations. ND Dept. of Health communicated comfort level with proposed construction method and turbidity control relative to resuspension of soils and elutriate testing

4.4. Schedule Restrictions for this Area

As part of the project development the regulatory agencies have been consulted regarding temporal construction restrictions around Lake Sakakawea. The species of concern in and around the lake are Pallid Sturgeon and shoreline birds nesting along the banks of the lake. The USACE advised that the Pallid Sturgeon spawning period ended around June 15. Additionally, the shoreline avian species of concern nesting period ends around July 15. BakkenLink was advised to add a one month temporal buffer to address any concerns related to nesting and spawning activities. Therefore, the commencement of any construction activities around Lake Sakakawea was discouraged prior to August 15.

4.5. Description of Selected Crossing

The crossing location preferred by the USACE (see map, Appendix 9.2) is approximately 12,100 linear feet from shore to shore. At the time of the hydrographic survey, the maximum water depth was approximately 50 feet and the bottom substrate is characterized by one to two foot layer of fine silt and mud. The relic Thalweg of the Missouri River can be seen in the hydrographic survey data

A key aspect in the design of a pipeline is a thorough review of the protection of the asset with reference to operating conditions, potential third party interactions, and other circumstances or events that might impact the safety and operating ability of the pipeline. Each marine pipeline project is unique and requires specific design and construction efforts to ensure that the pipeline is installed and operated in a safe manner based on the location and marine traffic plying the waters in the immediate vicinity. For the Lake Sakakawea crossing, an assessment of the marine traffic determined that the weight of mooring systems is less than 40 pounds and will not damage or impact a bare, uncoated steel pipeline. Appendix 9.4 expands on this premise and refers to the results of a previous field test for a project crossing an active seaway. For the test, large anchors were deliberately dropped on a series of pipe joints (40 feet sections) ranging from bare pipe to pipe with 3 or more inches of concrete weight coating.

The conclusion that was reached after review of these test results was that the crossing pipeline was safe from damage in its original bare pipe state however, as additional protection, it was decided to increase the steel wall thickness by 20% and to apply a 2 to 3 inch concrete weight coating outer sheath for pipeline stabilization purposes as well as for additional protection. Burial of the pipeline will further serve the purposes of added protection and stabilization. The proposed burial depth is 3 feet to the top of the pipe for the lake crossing, as required by 49 CFR Part 195 regulations.

Based on these conditions, PCS is satisfied that with the pipeline, as designed and lowered with the top of pipe below the natural lake bed, will be adequately protected and safe for operation.

4.6. Studies

4.6.1. Hydrographic Surveys

The hydrographic and geophysical survey was performed by Chris Ransome and Associates (CRA) during the period May 18 to June 8, 2011. Prior to the mobilization of the CRA survey crew, the onshore survey team established the crossing centerline alignment on both sides of the lake and installed bench marks to ensure compatibility between the onshore and marine surveys (see figures on following pages).

The purpose of the high-resolution survey was to:

- Acquire bathymetric data
- Identify and map lake bed hazards to construction and debris
- Identify and locate adjacent existing foreign pipelines and identify and map possible environmental and cultural resources within the proposed pipeline corridor.

The survey scope of work included bathymetric, side scan sonar, shallow penetration sub-bottom profiler and magnetometer survey lines run along 50 foot spaced lines parallel to and along the proposed pipeline route and extending 250 feet to each side giving a total corridor width of 500 feet. Tie-lines surveyed perpendicular to the pipeline were run in both directions every 500 feet. Supplemental survey lines were also run in areas of special interest or geological complexity.

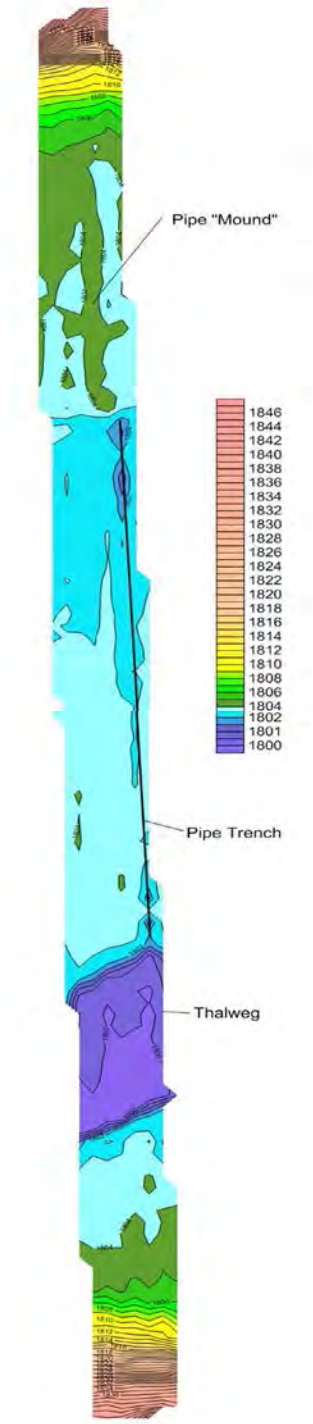
The results of the magnetometer and side-scan surveys did not reveal any significant objects on the lake bottom that could be a hazard to the construction of the proposed pipeline (see crossing bottom contours). The spoil side cast during the trenching of the adjacent Dakota Gasification (DGC) pipeline (when the depth of the lake was less than 20 feet) is evident on the northern side of the crossing but has naturally returned to the trench on the southern side of the lake. There is a 1 to 2 feet thick layer of fine silt and mud over most of the crossing deepening to over 2 feet in the Thalweg. The longitudinal profiles indicated that the original ground level is below this thin layer and contains a stiffer and more consolidated material than the first layer.

Bottom Contours

The lake bottom contours, based on the high frequency data, and produced in the program “Surfer”, are shown in diagrammatic form in the graphic to the right. Overall, after the initial slopes from the current shoreline (elev. 1853.8 feet), the majority of the lake is extremely flat with elevations of between 1802 and 1804 feet. A slight change of slope appears about 500 feet from the northern shoreline, but the most prominent topographic feature is the Missouri River Thalweg, denoting the original river route prior to the flooding and creation of the lake. In the work area, the Thalweg runs in a southwest to northeast direction with respect to the shorelines, with bank elevations of 1803 feet and a bottom elevation approximately 3 feet deeper to 1800 feet. It is centered approximately 3300 feet from the southern shoreline.

Other features to note include the trench from the existing DGC pipeline on the east side of the proposed corridor, and, in some areas, the small mound which runs parallel to the pipeline trench and which has been interpreted as the material excavated from the lake bottom during past trenching. In each case where these features could be identified on the cross-lines, a central coordinate was picked to be plotted on the final plan view drawing as further evidence of the location of the existing pipeline. In addition, these cross-lines over the existing pipe show the depth of the trench, and, in many sections, the amount of infilling material now over the pipe (typically about 1.5 feet of very soft unconsolidated sediment).

Finally, when the images from the depth sounder records were imported into the CAD drawings, the reflectors beneath the lake bed revealed by the lower operational frequency were examined and compared with the same results from the sub-bottom profiler.

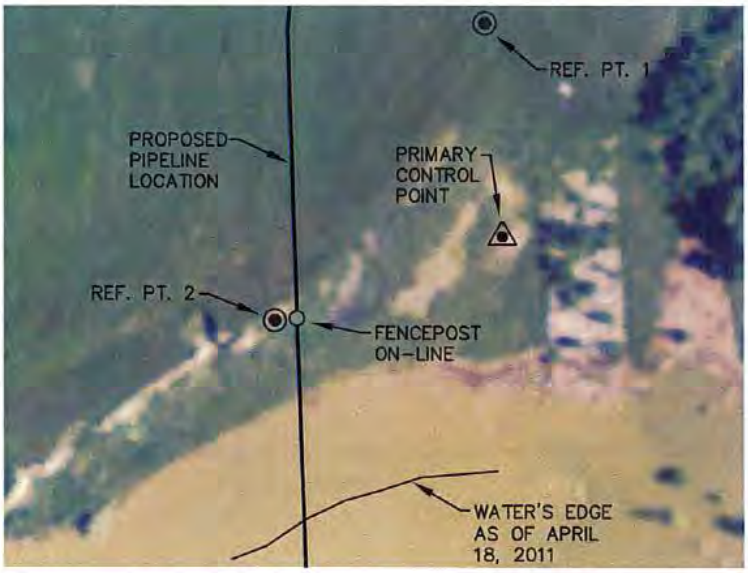


Bottom Contours

SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (NORTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



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E 1,384,273.98
EL 1860.34

REF. POINT 1
N 429,214.90
E 1,384,262.83
EL 1876.27

REF. POINT 2
N 429,024.26
E 1,384,127.15
EL 1875.25

FENCEPOST ON-LINE
N 429,025.62
E 1,384,141.43

GRAPHIC SCALE

100 0 50 100

(IN FEET)
1 inch = 100 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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Bruce P. Zelmer, L.S. #3756 Date

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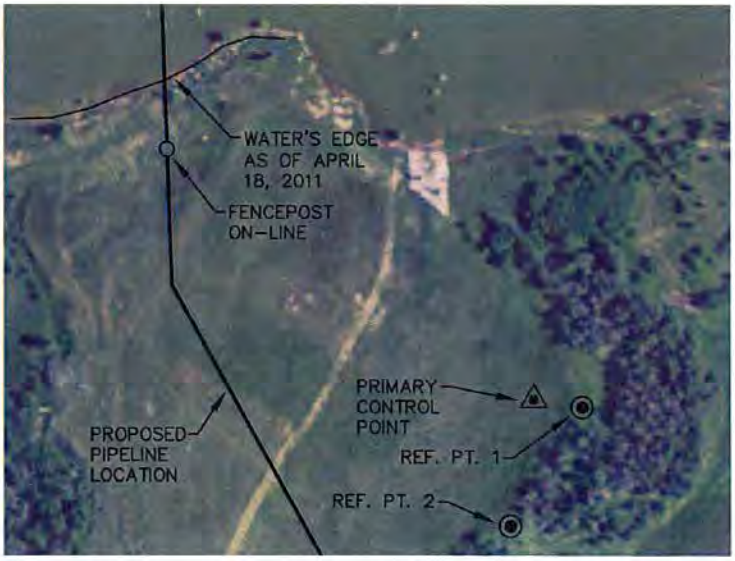
SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (SOUTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



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EL 1858.26

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EL 1858.03

REF. POINT 2
N 416,066.04
E 1,385,043.35
EL 1862.62

FENCEPOST ON-LINE
N 416,558.72
E 1,384,594.75

GRAPHIC SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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4.6.2. Soil Investigation

Soil boring sites and spacing were determined in consultation with North Dakota Department of Health (NDDH). Six bores locations were chosen and were evenly spaced across the crossing location. Standard penetration test borings were performed from July 25 - 27, 2011, with a trailer mounted core and auger drill equipped with 3 1/4-inch, inside diameter hollow-stem auger to a depth of 10-feet below the lake bottom. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." The boreholes were advanced with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 2 feet below the tip of the hollow-stem auger. The blows for the middle foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 foot vertical intervals down to the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment was encountered in four of the six borings and appeared to consist of 1-foot of sediment classified as fat clay; however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the deposited sediment layer, alluvial soils were encountered having textures matching that of lean clay, silty sand, and poorly graded sand with silt and gravel. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency, and the granular portions were very loose to medium dense soils. The soils below the lake sediment were determined to adequately support the lowered pipeline or any supporting structure.

Additional information regarding the soils investigation and boring logs can be found in Appendix 9.3.

4.6.3. Water Quality Standards

The North Dakota Department of Health is a cooperating agency with the USACE to certify federal licenses and permits in accordance with Section 401 of the Federal Clean Water Act. Specifically, the NDDH will make a determination if the proposed construction will violate applicable standards of water quality (Standards of Quality for Waters of the State - North Dakota Administrative Code Section 33-16-02.1). The certification, if issued, will express the NDDH's opinion that the project will not result in a violation of applicable water quality standards. Although water quality certification is a prerequisite for issuance of a USACE permit, certification alone does not guarantee a permit will be issued for the project.

Consultation with the NDDH and USACE directed BakkenLink to perform analytical testing of lake sediments for certain parameters in order to characterize the chemistry of the soil relative to maintaining water quality during construction activities. Sediments normally contain constituents that exist in various chemical forms and in various concentrations in several locations within the sediment. These include: Nitrogen, Phosphorous, and metals.

Composite samples of sediment were obtained at the locations and as described in Section 4.6.2 above. Samples were composites of sediments obtained during the soil testing. Samples were obtained at two depth ranges: 0-4' and 6-10'. These depth ranges were selected to represent typical pipeline installation depths.

An elutriate test may be used to predict the effect on water quality due to release of contaminants from the sediment to the water column. The results of the analysis are reported as 4:1 elutriate results (table below) for sediment from the proposed crossing, and the values are reported as comparisons against the North Dakota surface water quality criteria. Presumably, the intent is to show a "worst case" water quality if sediment is suspended in/near the trench.

Constituent	ND Surface Water Quality Standards Acute/Chronic	Sample 4, Boring 1, 0-4'	Sample 4, Boring 2, 0-4'	Sample 4, Boring 3, 0-4'	Sample 4, Boring 4, 0-4'	Sample 4, Boring 5, 0-4'	Sample 4, Boring 6, 0-4'	Sample 7, Boring B-1, 6-10'	Sample 7, Boring 2, 6-10'	Sample 7, Boring 3, 6-10'	Sample 7, Boring 4, 6-10'	Sample 7, Boring 5, 6-10'	Sample 7, Boring 6, 6-10'
	All Measurement in mg/L (ppm)												
Organic Nitrogen		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.19	< 5	6.02
Ammonia-Nitrogen as N		2.93	6.01	4.23	4.43	1.82	3.25	5.87	0.21	0.42	0.41	0.99	0.28
Phosphorus as P - Total	0.02	0.12	0.11	0.51	0.57	< 0.1	< 0.13	< 0.78	< 0.1	< 0.34	1.13	< 0.52	1.37
Total Kjeldahl Nitrogen		< 5	< 7.1	< 5	< 6.9	< 5	< 5	< 8.1	< 5	< 5	5.6	< 5	6.3
Mercury - Total	0.0017/0.00012	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	< 0.0002	0.0006
Chromium - Total	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.11	0.07	0.25
Copper - Total	0.014/0.093	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.16	0.07	0.37
Nickel - Total	0.47/0.052	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.09	0.04	0.22
Zinc - Total	0.12/0.12	0.06	0.11	0.16	0.12	0.05	0.11	0.12	< 0.05	< 0.12	0.45	0.21	0.92
Arsenic - Total	0.34/0.15	0.003	0.002	0.004	0.0137	0.0032	0.0029	0.0068	< 0.002	< 0.0151	0.0458	0.0239	0.1058
Cadmium - Total	0.0021/.00027	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.00132	< 0.001	< 0.001	< 0.001	0.00166	0.00115	0.0054
Lead - Total	0.082/0.0032	< 0.002	< 0.002	0.0049	0.0237	0.0026	0.0031	0.0088	< 0.002	< 0.0238	0.0712	0.043	0.1862
Selenium - Total	0.020/0.0005	< 0.002	< 0.002	< 0.002	0.0029	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.0042	0.0027	0.0093

Results are reported in volume(s) of mg/L or parts per million (ppm). Generally, the results show that the parameters meet or exceed Water Quality Standards except for three samples:

- Sample 7, Boring-4
- Sample 7, Boring-5; and
- Sample 7, Boring-6

These three samples indicate levels of zinc that exceed the Water Quality Standards. In addition, cadmium and lead in Sample 7, Boring-6 also exceeds Water Quality Standards. Zinc as reported in Sample 4, Boring-3 is within statistical error analysis when considering levels of ppm.

The proposed pipeline will be installed with approximately three feet of cover to the top of the pipe (four feet total depth) with approaches near the shorelines installed at deeper depths. These results indicate that constituents within the sediments across the majority of the crossing – at the installation depth – meet or exceed the Water Quality Standards.
Results should also be evaluated in light of the volume and rate of the intended discharge, the type of discharge, the hydrodynamic regime at the site, and other information relevant to the impact on water quality. The mixing zone should also be considered when evaluating water column effects. In addition, the reporting levels are based on tenths (or hundreds) of ppm. Other considerations include:

- The criteria for several metals are hardness related. The ND Water Quality Standards are based on an assumed hardness of 100 mg/L. To derive a hardness adjusted value, it would be necessary to get a value for lake hardness. A higher lake hardness would result in higher criteria standards for these metals.
- The criterion for most metals is based on dissolved metals. The data here is reported as total metals.
- Nutrients (phosphorus and nitrogen) are not toxicity concerns. The values listed are related to possible eutrophication increase from liberation of nutrients. This increase would be temporary, and of little immediate consequence if it occurs outside the growing season.
- The phosphorus is reported as total phosphorus. The listed criterion is a guidance value for lake management based on phosphate phosphorus. The criterion is not toxicity based, but based on eutrophication. Free phosphate phosphorus is only a small portion of the total phosphorus in the system. There is no total phosphorus criterion.
- The Water Quality Standards present an eutrophication guidance value for NO3-N of 0.25 mg/L, but the data were reported for three types of nitrogen: organic, Kjeldahl, and ammonia nitrogen,

but not for nitrate N. Each stream or lake has unique characteristics which determine the concentration of this constituent that will cause excessive plant growth.

- The disturbance from trenching would be on a relatively short term basis, and therefore the higher (acute) value is a better indicator of potential toxicity than the lower (chronic) value.
- The nature of the trenching disturbance will generate fairly localized suspension of sediments, silting and turbidity. However, these also can be controlled.

In summary, the contamination investigation provides evidence that metals should not be an issue for this site. However, turbidity and silting might be a larger concern, in terms of narrative water quality.

5. Construction Methodology Evaluation

5.1. General

Discussed below are several possible crossing options evaluated during the project development of the proposed 12" OD crude line across Lake Sakakawea in North Dakota. The options considered include:

- Horizontal Directional Drill (HDD) across the entire lake crossing from a single onshore location
- HDD from both sides of the crossing to a midpoint in the crossing and then an intermediate tie-in operation.
- HDD from the center of the crossing to each onshore location and then an intermediate tie-in operation.
- Trench and conventional lay of the entire pipeline from a marine barge accompanied by separate shore crossing operations at each end.
- Trench and perform a push-pull operation with a buoyant pipeline constructed on an offshore barge positioned midstream and then push-pull the line toward each shore line in sequence. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the intermediate tie-in operation from the vessel.
- Trench and perform a push-pull operation with the pipeline made up along one shoreline and then push-pull the line across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.
- Trench and perform a push-pull operation with the pipeline made up in sections within a pre-constructed onshore trench and then pulled across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.

5.2. Horizontal Direction Drill (HDD)

Because of the length of the crossing of 2.3 miles, a single HDD operation across the entire lake crossing is not feasible for the pipeline diameter required for this Project. Although such a lengthy HDD operation could be technically feasible, there are many risks involved, which no construction contractor consulted would consider undertaking. The risks include loss of pipe due to sticking, buckling of the pipe during the push operation, large surface units and space requirements for the operation, etc. In addition, the success of an HDD depends on the soil characteristics. In this area, the undisclosed soil investigations anecdotally indicated the plausibility of such an HDD; however, the exact conditions will require further investigation to confirm this method.

A more feasible and less risk adverse approach using HDD technology was discussed using two drills instead of the single drill.

The first dual HDD option was to drill from both the north and south banks and join the pipeline in the middle of the lake. The length for each drill would be approximately 6000 feet leaving a 650 feet length of pipe for each section (a total of 1300 feet length) in the middle of the lake to make the connection. This section would then to be lowered and protected. This option requires extensive dredging activities to dig the two exit holes and pipeline break-over areas. The amount of bottom disturbance was considered unacceptable plus the risk of a failed drill in these soils was a serious concern and one without a valid contingency plan or remedial action.

The second dual HDD option consists of drilling from the center of the lake but was not feasible due to the excessive water depth. Additionally, HDD's originating from a marine location would require extensive specialized marine equipment that is limited to a 20 to 30 feet water depth. The proposed crossing has a mid-stream water depth of 50 feet rendering this option invalid.

5.3. Conventional Pipe Lay

A conventional pipe lay operation into a pre-trenched ditch across the waterway was evaluated as an alternative option. The concrete weighted pipeline would be laid across the waterway by constantly changing the position of the lay barge in a similar manner to a conventional offshore pipelay operation. A separate shore approach method involving trenching would be developed at each shoreline. Due to the nature of the bottom topography, some type of jetting or trenching operation along with a pull operation would be required in the near shore marine and terrestrial land areas.

Due to the isolated nature of the lake and the difficulties in mobilizing large, specialized equipment to the area, a small scale pipe lay inland barge system would be mobilized in sections and rigged on site. The barge would consist of a deck length having at least one or two pipe-welding stations, a nondestructive testing station to evaluate welds and a coating station to apply the protective corrosion coating to the welded pipe joints. The individual barge sections would be attached bow to stern and would require a crane and several positioning winches for anchoring operations. With the use of spuds not feasible due to the water depths, an option to conventional anchoring could be the installation of mooring piles at strategic locations along the pipeline route to moor the barge and to progress the barge across the lake as it installs the pipeline.

The lack of local marine equipment and the cost to mobilize, fabricate, and rig-up an extensive marine pipe lay spread, in addition to the mobilization of support vessels and other marine equipment, makes the conventional pipe lay option impractical, inefficient and unworkable.

5.4. Push-Pull Method – Preferred Method

The push-pull method of installation is a highly proven and successful technique used for installing pipelines in water depth ranges similar to that of the lake. Lake Sakakawea is an inland lake with a crossing distance (2.3 miles) that would be suitable for this operation. This technique requires that the concrete coated pipe be welded into one or more strings either on land, along the shore, or off a permanently positioned marine barge on the lake and have temporary buoyancy flotation collars keep the pipe afloat. The floating pipe strings are maneuvered by pushing or pulling operations until in the desired position. Once in position, the floatation collars are sequentially removed and the pipe settles onto the lake bottom.

In order to lower and bury the pipeline beyond the reach of the land-based excavators, a pair of mud/slurry submersible pumps (Toyo brand or equivalent) fitted to a purpose-built lowering sled will be

used. The burial sled will extract soil from beneath the installed pipeline and discharge the resulting slurry into the pipeline ditch astern of the sled. The exact design of the burial sled will be specific for this Project; however, the concept of the dual slurry pumps has been utilized before by several construction groups for pipeline lowering in difficult and environmentally sensitive locations. The ability to trail a turbidity mat over the discharge diffuser is designed to direct the slurry back into the trench to reduce lateral dispersion, provide positive backfill over the lowered pipeline, and reduce the water column turbidity. Further detail about this proposed construction methodology can be found in Appendix 9.1.

The burial operation will be performed immediately after the installed pipeline is flooded and after the installed pipeline elevation is surveyed. The Project Team will deploy turbidity monitoring instrumentation at agreed locations with STOP authority in case of the construction activity exceeding a turbidity level above that observed prior to work commencement (the control measurement). The depth of cover achieved over the pipeline with the lowering sled will be verified real time with divers positioned aft of the jet sled. If the adequate coverage is not being achieved, the lowering sled can be slowed until the pipe is buried to a sufficient depth. The pump employed on the lowering sled is well suited for the classification of substrate on the lake floor.

Although the purpose-built lowering sled will be specific to this project, the USACE Waterways Experiment Stations (WES), as part of their Dredging Research Program (DRP), has tested similar hydraulic excavators. Among the competing vendors, the results found that a Toyo brand slurry pump had the overall best performance. See Appendix 9.3 for full report. In practice, the pumps have been proven effective in multiple projects world-wide where pipeline lowering was required in confined or sensitive areas. One such project involved successfully lowering 7,000 linear feet of 36-inch live gas pipelines in the shallow waters of the Gulf of Mexico. Additional details concerning this burial technique and the engineering firm's experience with this equipment see Appendix 9.5.

6. Code Compliance

The pipeline and pipeline system will be designed in accordance with the Code of Federal Regulations Title 49, Part 195, "Transportation of Hazardous Liquids by Pipeline" (latest edition). Provided all minimum federal safety standards have been met, ASME B31.4-2009 "Pipeline Transportation of Hydrocarbons and Other Liquids" will be used to supplement the requirements of 49 CFR, Part 195. For issues where both of the above publications are silent or additional guidance is required, codes and/or recommended practices from the following organizations are incorporated into the design as applicable (latest edition unless otherwise noted):

Code	Title
ASME B31.8	American Society of Mechanical Engineers: Gas Transmission and Distribution Piping Systems
API Spec. 5L	American Petroleum Institute: Specification for Line Pipe
API RP 1102	American Petroleum Institute: Steel Pipelines Crossing Railroads and Highways
API Std. 1104	American Petroleum Institute: Welding of Pipelines and Related Facilities
API Std. 1130	American Petroleum Institute: Computational Pipeline Modeling for Liquid Pipelines
API RP 5LW	American Petroleum Institute: Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels
NACE SP0169	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0177	National Association of Corrosion Engineers: Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE MR0175 /ISO 15156	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
ISO 15589-1	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 1: On-land Pipelines
ISO 15589-2	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 2: Offshore Pipelines
API Spec. 6D	American Petroleum Institute: Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves)
ASME B16.5	American Society of Mechanical Engineers: Pipe Flanges and Flanged Fittings
ASME B16.9	American Society of Mechanical Engineers: Factory-Made Wrought Steel Butt Welding Fittings
MSS-SP-44	Manufacturers Standardization Society: Steel Pipe Line Flanges
MSS-SP-75	Manufacturers Standardization Society: Specification for High Test Wrought Butt Welding Fittings
MSS-SP-97	Manufacturers Standardization Society: Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Butt Welding Ends
ASME Section IX	American Society of Mechanical Engineers: Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications

Consultation was sought with PHMSA Central Region regarding the Lake Sakakawea crossing. PHMSA indicated that pipe would need to be lowered to provide the necessary protection of the pipeline. If statutory burial depth could not be achieved, mechanical protection would need to be provided that would provide equivalent protection.

Mainline Valve Assemblies

The mainline valve sites will provide means for isolation of segments of the pipeline and limits release of the product in the unlikely event of a pipeline leak. The valves shall be installed in a location, accessible to authorized employees and protected from damage or tampering **[49 CFR, 195.258(a)].**

All valves will be of a class pressure-temperature rating for the specified design pressure in Section 2.3.1 and meeting the requirements of 49 CFR, Part 195.104. The valves shall meet the requirements and stamped API 6D as well as the following minimum design requirements:

- Compatible with the pipe or fittings to which the valve is attached
- Compatible with the liquid the pipeline may carry
- Both hydrostatically shell and seat tested without leakage per Section 10 of API 6D
- Equipped with a means for clearly indicating open or closed
- Marked on the body or nameplate with the following:
- Manufacturer's name or trademark
- Class designation or maximum working pressure
- Body material
- Nominal size **[49 CFR, 195.116]**

Each mainline valve installation, extending 5 pipe diameters beyond the last fitting, will have 0.60 design factor. Mainline valve sites will be in accordance with the requirements of **49 CFR, Part 195.260**:

- On the suction and discharge of a pump station to permit isolation of the pump station equipment
- On each line entering or leaving a breakout storage tank area that permits isolation of the tank area from other facilities
- Along the mainline at locations that minimize damage or pollution from accidental discharge as appropriate for the terrain in open country or for populated areas
- On each lateral takeoff from a trunk line that permits shutting off the lateral without interrupting the flow in the trunk line
- On each side of a water crossing that is more than 100 feet wide from high-water mark to high-water mark
- On each side of a reservoir holding water for human consumption

Mainline valve sites shall be designed to provide adequate access and work space for operation personnel, vehicles and equipment. Roadways shall be graveled and raised to permit drainage. Sub-surface drainage structures other than culverts under roadways are not anticipated. The area within 1-foot outside a station fence shall be covered with 4-inch of crushed stone, over a geotextile fabric, for weed control. The fencing shall be 6-foot high chain link, topped with three strands of barbed wire. The main entrance gate shall be a double swing gate 12-ft wide. Steel guard posts will be installed as appropriate at each mainline valve to protect the installed facility.

7. Spill Mitigation

BakkenLink has prepared a Spill Prevention, Containment, and Countermeasures (SPCC) Plan to be implemented during construction of the BakkenLink Pipeline Project (Project) in accordance with Section IV.A of the Federal Energy Regulatory Commission Wetland and Waterbody Construction and Mitigation Procedures, January 17, 2003 version. The SPCC Plan describes specific preventive measures to be followed to reduce the likelihood of the accidental release of a hazardous or regulated liquid during construction activities and sets forth procedures and response actions in the event of an actual release.

The goal of the SPCC Plan is to minimize the potential for a spill of these materials, to contain any spillage to the smallest area possible, and to protect areas that are considered environmentally sensitive (e.g. streams, groundwater wells, wetlands, etc.). The policies are outlined in a general way below:

- Preventive measures will be in place that restrict the location of fuel storage, refueling activities, and construction equipment maintenance along the construction right-of-way, staging area and work yards.
- Release of any petroleum product or hazardous liquids in vulnerable aquifer areas will be mitigated by immediate actions dictated in the SPCC. These areas will be treated with the highest levels of sensitivity.
- The response action priorities upon discovery of a spill are to protect the safety of personnel and the public, minimize environmental impacts, and control costs associated with cleanup and restoration.
- BakkenLink will provide spill prevention, response training and safety training to its personnel and contractors. The training program will be designed to improve awareness of safety requirements, pollution control laws, proper operation and maintenance of equipment, and implementation of spill response actions.
- BakkenLink will approve of a Contractor appointed Field Coordinator who will be responsible for reporting spills, coordinating Contractor personnel for spill cleanup, completing subsequent site investigations, and preparing incident reports.
- BakkenLink will prepare Spill Report Forms and notify state and federal agencies as required in the event of a release.
- Further details are to be found in the SPCC.

In addition to the SPCC, BakkenLink will be joining the Sakakawea Area Spill Response team. Six companies with oil interests in the area of Lake Sakakawea are forming a joint company (Sakakawea Area Spill Response, LLC) whose primary purpose is spill response for the area. The joint effort will share the equipment and training costs to handle small-to-medium oil spills, with an initial $300,000 going toward three vessels, two oil skimmers and a boom. This effort is in response to saltwater and oil spills occurring in the spring of 2011, many having been caused by the historic flooding in the area. At least sixteen other companies have shown interest in joining the group effort. BakkenLink intends to pursue agreements to join this response effort.

8. Qualifications of Engineering Firm for the Work

Project Consulting Services, Inc. (PCS) is a company specializing in the design, engineering, and construction management of onshore and offshore pipelines, platforms, and subsea facilities. Since PCS began operations in 1992, it has successfully completed over 2000 projects. Corporate headquarters are located in Metairie, Louisiana, with regional offices in Houston, Texas; Atlanta, Georgia; and Birmingham, Alabama. Internationally, with foreign project offices, PCS has provided services to clients for projects in South America, Russia, Southeast Asia, Canada, Mexico, and West Africa. The company's knowledge of pipeline operations is exceptional, with engineers who have participated in and played a key role in many industry firsts. In addition to its qualifications in the onshore pipeline industry, PCS' personnel have extensive experience in other marine construction projects such as the conceptual and engineering development of Deep Water Ports (DWP) plus offshore platform installation, modification, and salvage. Project responsibilities have included feasibility studies, cost analysis and scheduling, design, permitting, project management for installation of onshore and offshore pipeline project.

Some pipeline projects, having pertinent similarities to the lake crossing, with which PCS has been involved include:

- Denbury Green Pipeline: Galveston Bay Crossing – 320 miles of 24-inch CO_2 pipeline with a shallow water crossing at Galveston Bay, TX
- Creole Trail Pipeline: a 42" natural gas pipeline from Creole Trail LNG Facility, through low lands and shallow water to a transmission system near Carlyss, LA
- Louisiana Offshore Oil Port – Gulf of Mexico deepwater oil port Phase 2 expansion project;
- Main Pass Energy Hub – Gulf of Mexico LNG Terminal (Proposed)
- Northeast Gateway – Boston Harbor DWP
- Broadwater and Islander East proposed installations in Long Island Sound
- Gulfstream Natural Gas System – 744-mile natural gas system, over 430 miles of which are 36-inch-diameter marine pipeline within the coastal areas of Alabama to Tampa, Florida
- Gathering and flowline systems for major producers in and around Mobile Bay, Alabama, to transport natural gas, some of it with corrosive and dangerous properties, to onshore processing facilities

Further information about PCS' experience with this crossing technique is included in Appendix 9.5.

9. Appendix

9.1. Detail Lake Crossing Methodology Document
9.2. Maps
9.3. Soil Boring Report and Logs
9.4. Memo on Concrete Weight Coating of Marine Pipeline Protection
9.5. Memo on Lake Crossing Lowering Equipment, Experience and Planning