Sandpiper Pipeline: Comparison of Environmental Effects of Reasonable Alternatives

In the Matter of the Application of North Dakota Pipeline Company LLC for a Certificate of Need for the Sandpiper Pipeline Project in Minnesota

Minnesota Public Utilities Commission Docket CN-13-473

Minnesota Department of Commerce
Energy Environmental Review and Analysis | December 2014

Abstract

North Dakota Pipeline Company LLC (NDPC) is proposing to construct the Sandpiper Project, a 565 to 608-mile long pipeline and associated facilities from the Tioga, North Dakota, through Minnesota to Superior, Wisconsin. On November 8, 2013, NDPC filed two applications with the Minnesota Public Utilities Commission (Commission): the first for a Certificate of Need (CN) and the second for a pipeline route permit for the project.

The CN rules at Minn. R. 7853.0130 require, in determining if a certificate of need should be granted, that consideration be paid to the "natural and socioeconomic environments compared to the effects of reasonable alternatives," and "the effect of the proposed facility, or a suitable modification of it, upon the natural and socioeconomic environments compared to the effect of not building the facility."

For the Sandpiper Project, the Commission concluded that an environmental analysis of six system alternatives, which were identified in the Route Permit docket, and six alternatives to the proposed project identified by NDPC in its CN application would provide it with valuable information to be weighed along with other information while making its need decision. This document is intended to provide that analysis. It is intended for the use of any party who chooses to advocate for or against consideration of an alternative in the certificate of need docket.

This document, and all other documents related to the Sandpiper Project CN proceeding, is available on the Commission's website at: http://mn.gov/puc/; select Search eDockets and enter the year (13) and docket number (473). The document is also available on Department of Commerce website at: http://mn.gov/commerce/energyfacilities/Docket.html?Id=33599.

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SANDPIPER PIPELINE:
COMPARISON OF ENVIRONMENTAL EFFECTS OF REASONABLE ALTERNATIVES

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LIST OF ACRONYMS	
Acronym	**Meaning**
BWSR	Minnesota Board of Water and Soil Resources
CN	Certificate of Need
U.S.EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
GIS	Geographic Information Systems
HCA	High Consequence Area
HPA	High Population Area
MDNR	Minnesota Department of Natural Resources
MLRA	Major Land Resource Area
MPCA	Minnesota Pollution Control Agency
MPUC	Minnesota Public Utilities Commission
NAAQS	National Ambient Air Quality Standards
NCA	National Conservation Area
NDPC	North Dakota Pipeline Company
NHIS	Natural Heritage Information System
NPL	National Priorities List
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
OPA	Other Population Area
PHMSA	Pipeline and Hazardous Materials Safety Administration
SA	System Alternative
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
WMA	Wildlife Management Area
WPA	Wildlife Production Area

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1 Introduction

North Dakota Pipeline Company LLC (NDPC) is proposing to construct the Sandpiper Project, a 565 to 608-mile long pipeline and associated facilities. The Minnesota portion of the Sandpiper Project is approximately 300 miles long and will include the installation of a proposed 24-inch diameter pipeline from the North Dakota border to Clearbrook, Minnesota, and a 30-inch diameter pipeline from Clearbrook to the Wisconsin border. The initial capacity of the Project will be 225,000 barrels per day (bpd) into Clearbrook and 375,000 bpd into Superior, Wisconsin.

Prior to any construction of the proposed facilities, the Minnesota Public Utilities Commission (Commission) must grant a Certificate of Need (CN) and a Route Permit for the Project.

The CN rules at Minn. R. 7853.0130 require, in determining if a certificate of need should be granted, that consideration be paid to the "natural and socioeconomic environments compared to the effects of reasonable alternatives," and "the effect of the proposed facility, or a suitable modification of it, upon the natural and socioeconomic environments compared to the effect of not building the facility."

For the Sandpiper Project, the Commission concluded that an environmental analysis of six system alternatives[1], would provide it with valuable information to be weighed along with other information while making its CN decision[2]. The six system alternatives, as identified in the Route Permit docket, are System Alternative (SA) 03, 04, 05, 06, 07 and 08 (Appendix A, Map A-1, and see Figure 1-1).

The Commission stated that it recognized in requesting this analysis that the environmental review conducted at the CN stage will not be equivalent in terms of the specificity and level of detail to environmental review undertaken in a route permit proceeding. Instead, the Commission noted that the CN decision is a preliminary decision, involving a high level of examination and review appropriate for the type of decision being made. Accordingly, the Commission noted that it is seeking to ensure that the record in the CN proceeding contains an adequate, albeit preliminary, environmental analysis of the system alternatives. The Commission also noted that the environmental analysis, of necessity, will be a more tiered, broader-based analysis, reflecting a high-level review appropriate to the level of detail of the alternative being considered. The more detailed and site-specific environmental review would be completed as part of the routing proceeding, if a CN is granted.

This document is intended to provide the analysis requested by the Commission at this CN phase. It is intended for the use of any party who chooses to advocate for or against consideration of a system alternative in the CN docket.

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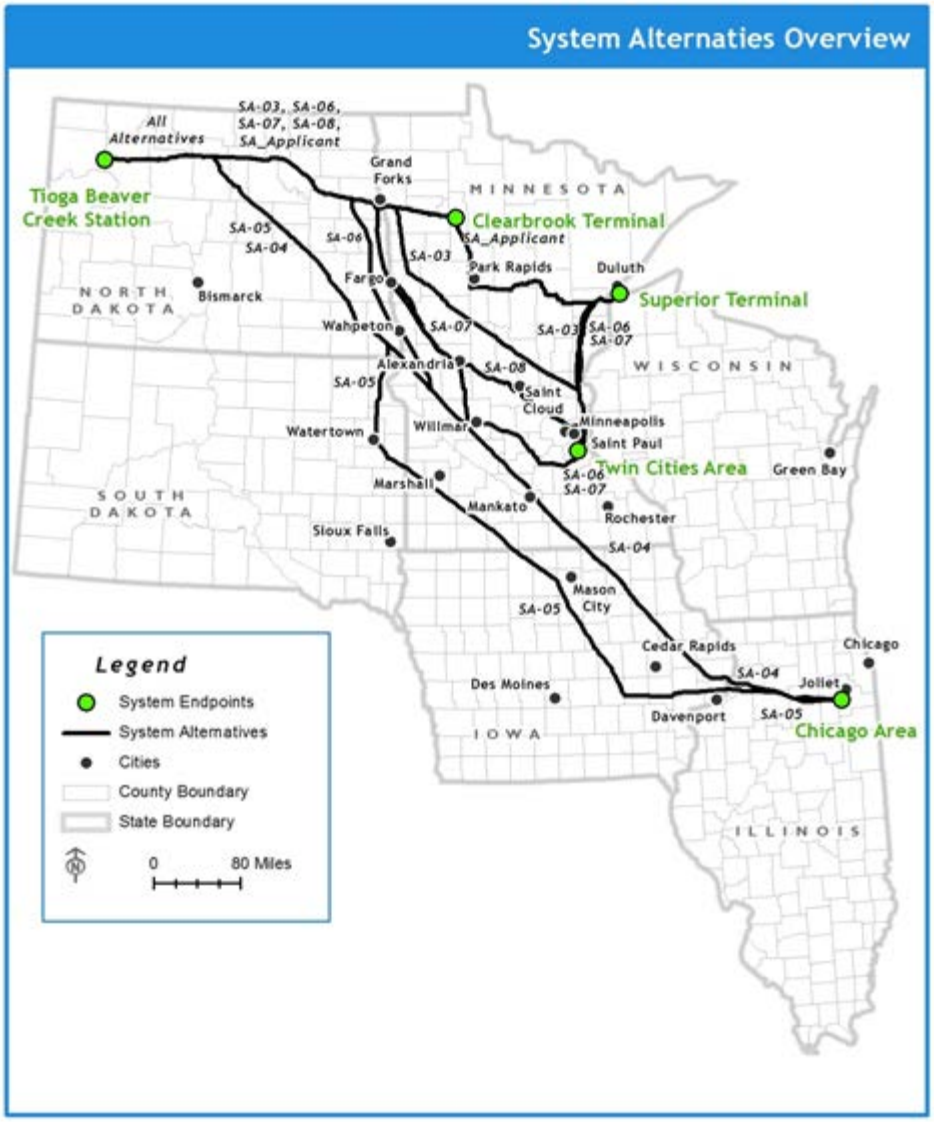
[1] which were identified in the Route Permit docket

[2] The Commission's October 7, 2014 Order in Docket 14-373 and 14-374 201410-103639-01.

Figure 1-1 Overview of System Alternatives



This broad-based analysis was conducted by establishing two-mile-wide analysis corridors around the general location of the identified system alternatives. In addition, a two-mile-wide analysis corridor was established around NDPC's proposed route to create the Applicant System Alternative (SA-Applicant). This adaptation of NDPC's proposal was intended to yield a level of specificity or granularity appropriate for the system alternatives and to ensure a reasonable basis for comparison and contrast.

Finally, this document includes a description and discussion of potential impacts of the six alternatives to the proposed project identified by NDPC in its CN application.

The Comparison of Environmental Effects is organized into the following sections:

- **Chapter 1 – Introduction** – introduction to the analysis and document.
- **Chapter 2 – Certificate of Need Application Alternatives – Description and Potenital Impacts** – description of other alternatives considered by NDPC including trucking, rail and other pipeline systems.
- **Chapter 3 – System Alternatives – Description** – description of the six system alternatives and SA-Applicant.
- **Chapter 4 – System Alternatives – Environmental Overview and Analysis** – broad-level review describing the existing resources within a two-mile-wide corridor for each system alternative and SA-Applicant.
- **Chapter 5 – Mitigation and Incident Response** – description of approaches for avoiding, minimizing and mitigating potential impacts.
- **Chapter 6 – Comparison of System Alternatives** – summary of the differences in the environmental resource areas among system alternatives.
- **Chapter 7 – References** – references accessed to develop information contained in the Comparison of Environmental Effects.

The Department of Commerce, Energy Environmental Review and Analysis staff hopes this document is helpful to the Commission in response to its request, to any party and the public.

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2 Certificate of Need Application Alternatives – Description and Potential Impacts

North Dakota Pipeline Company (NDPC) identified six alternatives to its proposed project in its Certificate of Need Application (CN) (Docket No. 13-473):[3]

- No Action Alternative
- Rail Alternative
- Trucking Alternative
- Plains Bakken North Pipeline Project
- High Prairie Pipeline Project
- Koch Pipeline Company Dakota Express Pipeline

The CN application included a description of the alternatives, as well as: (1) a discussion of the design and the geographical area affected, (2) an estimate of the in-service date, (3) a discussion of the method of operation, (4) its costs, (5) its economic life, and (6) its reliability; and, a summary of the conclusions reached with respect to the alternative and the reasons for its rejection.

NDPC's analyses of the environmental, engineering and economic factors of these alternatives can be found in Section 2.0 of the "*Minnesota Environmental Information Report*" (EIR) filed with the applications of NDPC for a certificate of need and a route permit.[4]

The Project scope used by NDPC to evaluate the alternatives they examined included:

- Five pump stations, booster pumps and manifold connections in North Dakota and Minnesota. Of these, one is located in Minnesota at a new NDPC Terminal near Clearbrook, Minnesota.

- Integration near Clearbrook for delivery of an annual capacity of 60,000 barrels per day (bpd) as redundant service for NDPC's existing Line 81, and receipt of 150,000 bpd from the existing Line 81 for transportation to Superior.

- Ability to interconnect new pipeline facilities at the Superior Terminal with other petroleum pipelines east and south of Superior to maximize potential markets served and flexibility for shippers.[5]

This chapter draws upon NDPC's analysis and other sources as noted to both describe the alternatives and their potential impacts.

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[3]"North Dakota Pipeline Company, Certificate of Need Application", part 7853.0540, p. 1-13.
[4] Minnesota Environmental Information Report, (EIR). See eDockets at 13-473, for filings by NDPC dated November 8, 2013 and January 31, 2014.
[5] Certificate of Need Application, part 7853.0540, p. 1-2.

2.1 No-Action Alternative

Under the No-Action Alternative, the proposed Sandpiper Pipeline Project would not be built and operated as stated in the Project description. Thus, no direct environmental impacts associated with construction and operation of a new pipeline would take place.

However, NDPC has indicated that the No-Action alternative would not meet the purpose and need for the proposed action. As stated in its CN application, the purpose of the Project is to move oil produced in the Bakken to Clearbrook, Minnesota, Superior, Wisconsin and points east in the upper and lower Midwest portions of the United States.[6]

Assuming the existence of this need, if the Sandpiper Pipeline Project is not built, other oil transportation projects may be proposed. The demand for Bakken crude might instead be met by alternative modes of transportation, such as rail or tank trucks, or by other yet-to-be proposed and built pipelines.

Impact Analysis of No-Action Alternative

Under the No-Action Alternative the proposed project would not be built. Consequently, under this scenario, there would be no new impacts from the project.

The No-Action alternative would require producers and shippers to identify other transportation systems to deliver their product to markets, which may be by rail, truck or other potential pipeline projects that could be permitted and constructed. Any of these other alternatives may result in environmental impacts that are less than, equal to, or greater than those of the currently proposed Sandpiper Project. NDPC suggests that the No-Action Alternative may also result in more expensive and less reliable crude oil supplies for refineries thereby increasing costs and availability of refined products for end-uses.[7] Thus, the No-Action Alternative would not necessarily result in an overall reduction or elimination of impacts to physical, biological and human resources.

2.2 Rail Alternative

The transport of oil by rail involves moving oil from where it is produced to an oil-train terminal for temporary storage and subsequent transport by rail to an interconnection point or refinery where it may be processed into petroleum products.

Oil transport begins at each production well (see example in Figure 2-1). At these wells, oil is loaded onto trucks or transported by gathering pipelines to oil terminals for temporary storage and transfer to other modes of transportation (railroads, trucks and pipelines) for delivery to destination points, typically refineries that process the raw material into various finished products. Oil terminal facilities may be designed specifically for pipelines, unit trains, manifest trains, truck terminals or a combination thereof.

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[6] Ibid.
[7] Ibid, p. 2

Figure 2-1 Production Well in North Dakota

Oil transport begins at production wells where it is loaded onto trucks or gathering pipelines.

Source: Online stock photo.

When oil is transported by rail, it is normally carried on what is referred to as "unit trains" that are typically comprised of between 100 to 120 individual tank cars. Unit trains are assembled at a single origin and disassembled at a single location, and only carry one commodity.

Oil may also be shipped on smaller trains, referred to as a "manifest trains." These trains are typically comprised of small blocks of mixed car types and cargos that carry multiple commodities. Manifest trains may also have different points of origin as well as destinations. Sidings or loading facilities for manifest trains typically accommodate 40 cars or less. Manifest trains are more labor intensive and, therefore, more expensive than unit trains. They travel on non-dedicated tracks and take a longer time to deliver to their destination points.

Figure 2-2 Example of DOT-111 Tank Car

Hazardous liquids are transported on rail in specialized (DOT-111) tank cars.

Source: Online stock photo.

Crude oil transported by train (unit or manifest) requires the use of specialized tank cars that are designed to haul liquefied freight. Tank cars for crude oil and other similar products are designated by the United States Department of Transportation as DOT-111 tank cars.

Figure 2-2.

These cars may also be heated depending on what is being transported. These specialized tank cars, depending on size, may hold from 600 to 760 barrels of oil or 25,200 to 31,800 gallons). A barrel is equal to 42 gallons. Consequently, a unit train may carry approximately 66,000 to 83,600 barrels of oil or 2.8 to 3.5 million gallons of crude oil.

New rail safety regulations proposed in 2014 call for a two year phase-out of older DOT 111 tank cars unless they have been retrofitted to comply with new tank car standards for shipments of Packing Group 1 flammable liquids, including most crude oil. Consequently, oil tank cars, due to domestic oil production increases, are not readily available and the backorders for new tank cars that comply with new rail safety regulations exceed 15 months.[8]

As proposed, Sandpiper Pipeline Project would transport 25,000 bpd from Beaver Lodge to Berthold, 225,000 bpd from Beaver Lodge to Superior, and up to 150,000 bpd from Clearbrook to Superior. To carry an equivalent amount of oil on a unit trains would require several additional unit trains a day. NDPC estimates that more than 2,000 rail tank cars would be required to transport an equivalent amount of oil on a daily basis, given the number of cars loading, unloading and making return empty trips per day (Table 2-1).[9]

In its CN application, NDPC calculated that the costs of the rail alternative to be in the hundreds of million dollars per year for rolling stock and necessary infrastructure facilities. As an example, NDPC indicated that the base capital investment needed to order a fleet of 2,052 tank cars is estimated to be $285.2 million. However, this estimate was based on new-build prices ($139,000 to $143,000) for a 25,500 gallon/600 barrel coiled/insulated tank car in 2013 when the CN application was filed prior to the 2014 proposed rail safety standards.[10]

Table 2-1 Total Daily Rail Tank Car Requirements

More than 2,000 rail tank cars per day would be required to transport an equivalent amount of oil as the Sandpiper Pipeline Project.					
	Crude oil volume (bpd)[1]	Rail Cars in Transit (#)	Rail Cars Returning Empty (#)	Rail Cars Loading, Unloading (#)[2]	Total Rail Car Requirements (#)
Beaver Lodge, ND to Berthold, ND	25,000	42	42	17	101

[8] Wall Street Journal, July 18, 2013.
[9] Certificate of Need Application, part 7853.0540, p. 9-13
[10] http://www.rbnenergy.com/i-can-see-for-miles-and-miles-and-miles-and-miles-tank-cars.

Beaver Lodge to Superior, WI	225,000	563	563	225	1,351
Clearbrook, MN to Superior	150,000	250	250	100	600
TOTAL					**2,052**
1. Bpd = barrels per day. A barrel is equal to 42 gallons 2. Assumed as 20 percent of total of in transit and returning empty					

Therefore, an initial capital investment of at least $285.2 million would be needed to move 375,000 bpd by rail.[11] This cost estimate does not include new rail infrastructure, railway maintenance, labor costs, fuel or other associated expenses. NDPC also indicated that they were unsure if rail carriers have or would provide a joint rail tariff(s) for the service contemplated.[12]

The oil-by-rail alternative also requires the construction (by NDPC or its shippers) of rail car loading and off-loading facilities referred to as terminals, as well as construction and maintenance of any new rail service lines to connect with the existing rail infrastructure. These facilities would need to be constructed at Beaver Lodge and Berthold, North Dakota; Clearbrook, Minnesota; and Superior, Wisconsin. NDPC would also need to contract with a rail service provider to operate the trains.[13]

The capital required for a North Dakota Unit Train terminal facilities (loading and off-loading) varies from $85 to $125 million. These facilities require 200 or more acres of flat land for a full or complete loop for 120 cars (see Figure 2.3). Two complete loops may be required for Class 1 railroads for optimum design. Oil storage tanks will also be required and the design norm is around three times daily transportation capacity of the loading facility. Covered loading facilities in northern climates are required due to operational concerns for safety and environmental conditions. A loading system may have from 10 to 18 loading stations to accommodate the unit trains. The time to load a unit train is approximately 12 hours.[14]

The loading and off-loading terminal facilities must also provide for spur lines, railroad siding, metering equipment, underground piping, secondary containment and vapor control systems, catch basins, retention ponds, electric power, water and other associated facility requirements.

[11] CN application, part 7853.0540, p.12.
[12] Ibid, p.12.
[13] CN application, part 7853.0540, p.11.
[14] "*Comparing the Economics of Using Unit Trains and Manifest Trains, Relative to Pricing at Destination, to Determine Which System is Most Effective in Increasing Netback*," presented by Jarrett Zielinski, TORQ Transporting.

Figure 2-3 is an example of an oil terminal facility in Tioga, North Dakota.

Figure 2-3 A Hess Rail Terminal in North Dakota

These rail oil loading facilities require 200 or more acres of flat land for a full or complete loop for 120 cars.

Source: Online stock photo.

A crude oil unloading facility has similar requirements to loading facilities and includes an arrival and departure track, an enclosed transfer structure, an unloading area with two tracks and concrete containment area, repair facilities, support buildings, road connections, pumps, above and below ground pipelines to connect to the required storage tanks, electric power and associated substation facilities, stormwater infrastructure, sanitary sewer, water, and an oil/water separation area.

Aside from the necessary spur lines needed at all of the required terminal facilities, it is expected that the unit trains will use existing Class 1 rail lines to move the oil from North Dakota to Clearbrook and Superior, Wisconsin.

The transportation of oil by rail is typically more expensive than transporting oil by pipelines; however, the ability to move oil by rail also provides greater flexibility for end point deliveries.

Impact Analysis of the Rail Alternative

Construction of rail loading terminals in North Dakota and unloading terminals in Minnesota and Wisconsin will result in construction and operation related impacts that would include, but not be limited to, loss of vegetation and habitat, displacement of wildlife, increased rail traffic, noise, air emissions, and the potential for accidents.

Construction of the rail terminal loading and unloading facility and their respective associated facilities will require 200 acres of land or more for each of the three facilities. The land would be graded and leveled as necessary and converted from its existing use to industrial land use for the life of the project. It should be assumed that these facilities will be located in areas that are relatively flat and open, outside of designated floodplains, and not located near areas associated with seismic hazards, landslides or subsidence. It is assumed that the land acquired for these facilities is open agricultural land, except in Superior, Wisconsin, where existing land uses around the Superior Oil Terminal are more varied (residential, golf course, industrial and open).

Construction related impacts include soil erosion, loss of topsoil, soil compaction and soil contamination from fuel leaks. Many of these impacts may be mitigated by the use of standard erosion and sediment control methods (i.e., silt fences, sediment ponds) and as required by permit conditions from the responsible governmental unit.

Any potential surface and ground water impacts associated with terminal construction are expected to be related to releases of refined petroleum products used as fuel or lubricants. In addition, there is also the potential for releases and/or spills associated with the loading and unloading of railcars, derailments, and underground piping failure. Containment facilities within the terminal would be designed to limit the potential for impacts to water resources.

The proper implementation of spill prevention, control and countermeasures (SPCC) plans would minimize the potential for releases of crude oil or other hazardous materials (diesel fuel, motor oil, lubricant, etc.) to reach water bodies during terminal construction and operation. Stormwater management plans would also help mitigate impacts to water quality and runoff volumes at the terminals.

Construction of the terminals would result in emission of criteria pollutants [hydrocarbons (HCs) or volatile organic compounds, carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$)]; however, because there is no terminal design data it is not possible to quantify the amount of emissions. Construction related emissions are short-term in nature. The emissions from terminals, trains and operations are on-going.

Because the location of any required terminal facilities are not identified, it is not possible to determine specific impacts on wetlands, terrestrial vegetation, wildlife, threatened and endangered species and cultural resources.

The oil-by-rail transportation alternative would require adding several unit trains per day to move oil from the Williston Basin to Clearbrook, Minnesota, and Superior, Wisconsin.

Train operations would produce additional gaseous and particulate emissions. NDPC in its CN application presented data on "rail alternative airborne emissions," which is presented in the Table 2-2.[15]

Table 2-2 Rail Alternative Airborne Emissions

Transportation of oil by rail produces hazardous emissions along with greenhouse gases.							
Emission Source Description	**Pollutant Emissions (tons per year)**						
	NO_X	**CO**	**SO_2**	**HC**	**PM_{10}**	**$PM_{2.5}$**	**GHG (CO_2e)**
Railroad diesel combustion emissions	11,629	1,145	139	429	286	278	437,416
• Emissions are calculated based on 42,755,574 total rail car ton-miles/day. • Emissions from the loading/unloading of crude oil have not been included. • The transportation method would require construction of railcar loading and unloading facilities at the North Dakota stations, Clearbrook, MN and Superior, WI							

Other impacts of the oil-by-rail alternative are dependent upon the specific rail routes used to move the oil. NDPC retained the services of William J. Rennicke, a Partner at Oliver Wyman, Inc. to provide testimony on the oil-by-rail alternative. Schedule 2 of that testimony, "*Report on the Impact of Crude Oil-By-Rail and the 'No-Action' Scenario for the Sandpiper Pipeline Project in Minnesota,*"[16] provides background on the rail transportation system and identified four potential rail routes that would likely be used if the Sandpiper Pipeline Project were not built.

In the continental United States, there are approximately 570 operating railroads on 140,000 miles of track that provide for a highly interconnected transportation system that moves freight (intermodal containers and trailers, coal, plastics, fertilizers, food, motor vehicles, farm products, lumber, paper, sand, stone, gravel, oil and other miscellaneous products), as noted in Figure 2-4.[17]

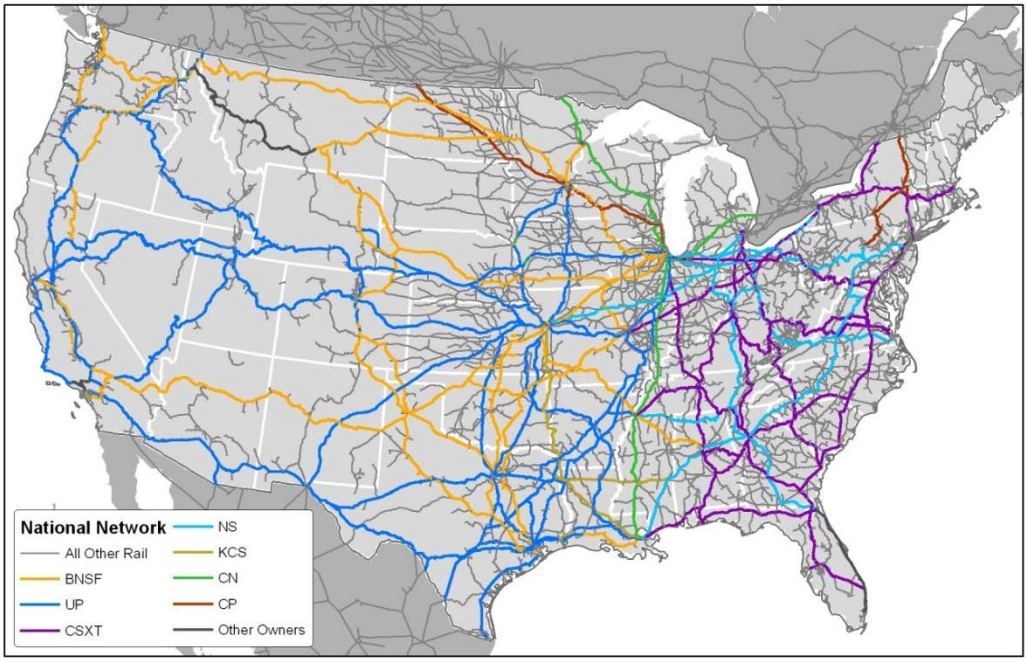
[15] CN Application, part 6853.0600, p. 15.

[16] "*Report on the Impact of Crude Oil-By-Rail and the 'No-Action' Scenario for the Sandpiper Pipeline Project in Minnesota*." See eDockets, document ID No. 20148-102135-05.

[17] "National Rail Freight Infrastructure Capacity and Investment Study," AAR, September 2007, Figure 4.1.

Figure 2-4 National Rail Freight Network and Primary Rail Freight Corridors

There are approximately 570 operating railroads moving freight on 140,000 miles of track in the continental United States.



Source: National Rail Freight Infrastructure Capacity and Investment Study

Minnesota has an extensive rail network that includes approximately 4,500 miles of track as shown in Figure 2-5[18]. More than 18 freight railroad companies provide service to numerous industries (minerals, sand, forest products, manufacturing, agricultural, fertilizer, etc.) throughout the state. Railroads providing service include four Class One railroads (Burlington Northern Santa Fe, Canadian National, Canadian Pacific and Union Pacific), one regional railroad (Red River Valley), nine local railroads and three switching and terminal railroads. The rail system is also used by Amtrak's Empire Builder service and Northstar commuter passenger trains.[19]

[18] Freight Railroads in Minnesota, Fast Facts for 2011, AAR.

[19] "*Report on the Impact of Crude Oil-By-Rail and the 'No-Action' Scenario for the Sandpiper Pipeline Project in Minnesota*." See eDockets, document ID No. 20148-102135-05, p. 20.

Figure 2-5 Railroad Map of Minnesota

Class I railroads are labeled. Regional, local, terminal, and switching railroads are shown in gray.

Source: William Rennicke Direct Testimony

In examining the oil-by-rail alternative, the report prepared by Mr. Rennicke made the following assumptions:[20]

- The Bakken area originations on the Burlington Northern Santa Fe will be at Tioga, North Dakota.

[20] Rennicke Report, p. 32-33

- The Bakken area originations on the Canadian Pacific will be at New Town, North Dakota.
- The volume moved by rail will be 375,000 barrels per day. Of this, 225,000 bpd will originate in North Dakota, and the remaining 150,000 will move through an existing NDPC pipeline (Line 81) to Clearbrook, Minnesota, from which point it will be transported by rail.
- Rail could be used to move oil to Superior for distribution through the existing Enbridge pipeline network or rail could also move the oil to Chicago where it can interchange with other railroads for distribution to refineries.
- Chicago may be a more logical interchanges because of the large number of railroads that serve the Chicago area.
- Because of the distance between Clearbrook and Superior (approximately 210 miles on the BNSP and 282 miles on the CP), the crude oil could be moved by truck; however, this would require approximately 667 trucks per day and another 667 empty trucks back to Clearbrook from Superior. These 1,340 trucks would require a departure approximately every minute, 24 hours a day, 365 days per year.
- The destinations of Superior, Wisconsin, and Western Avenue in Chicago represent locations where crude oil may be transferred into existing pipelines or interchanged with railroads for movement to refineries in the Midwest, Mid-Continent, Eastern Canada and the Eastern United States.

Other considerations in establishing the rail routes that could be used between crude oil loading points in North Dakota and the Superior and Chicago destinations made by Mr. Rennicke include the following:[21]

- Whether the railroad that picks up the shipment from the shipper, known as the "originating railroad," also serves the destination (i.e., the refinery), then the railroad generally will move the shipment from the origination point to the destination point. This is referred to as "single-line" service.
- If the originating railroad does not serve the destination, then it will haul the traffic as far as it can, and then hand off the traffic to the railroad that does serve the destination. This is known as an "interchange" or "interchange service." Routes with the fewest interchanges are generally used, since these routes tend to have lower costs and a higher probability of on-time delivery.

The report also points out that other rail line characteristics that influence shipping time and safety must be considered in determining how traffic is routed, such that distance, maximum allowable speed, track quality, available track capacity and type of signaling control system.[22]

The Rennicke report identified the Burlington Northern Santa Fe and Canadian Pacific railroads as the two originators of crude oil traffic in North Dakota; both can make deliveries to Superior and Chicago.[23] Based on the above considerations, Rennicke's report identified the four rail routes described in Table 2-3 and illustrated in Figure 2-6 and Figure 2-7.[24]

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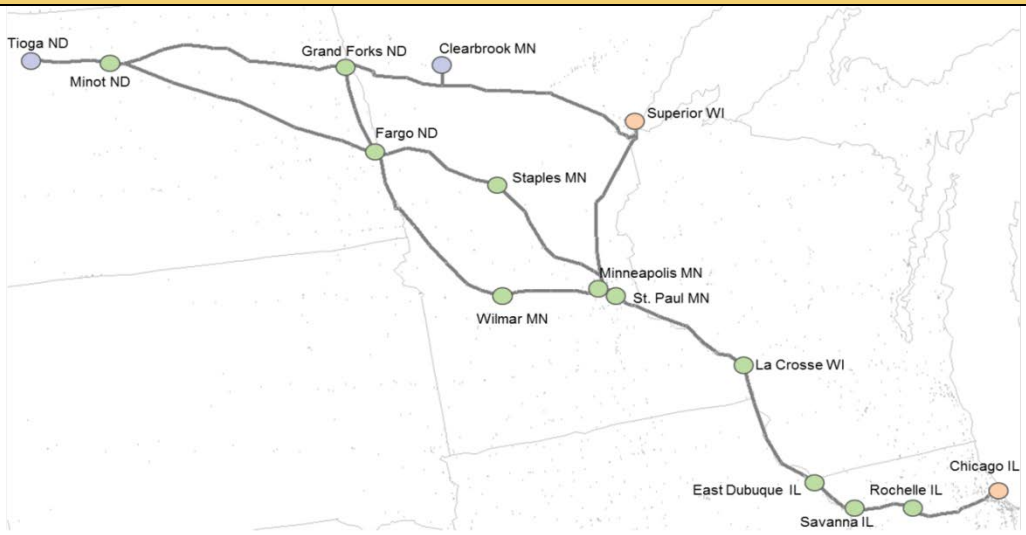
[21] Ibid., p. 33
[22] Rennicke Report, p. 33.
[23] Ibid, p. 34.
[24] Ibid, p. 34-41.

Table 2-3 Rail Routes from Bakken through Minnesota to Superior and Chicago

Oil transportation originates in North Dakota and is carried by BNSF and CP railroads to destinations in Superior and Chicago.			
Origin	**Destination**	**Burlington Northern Santa Fe (BNSF)**	**Canadian Pacific (CP)**
Bakken Region, North Dakota	Superior, WI	Tioga to Superior via Grand Forks, Bagley, Schley and Brookston (577 miles)	New Town to Superior via Glenwood, Minneapolis and north using trackage rights on the BNSF (671 miles)
Clearbrook, MN	Superior, WI	Clearbrook to Superior via Bagley, Schley, and Brookston. A new 11 mile line is required from Clearbrook to Bagley. (209 miles)	Clearbrook to Superior via Erskine and then via BNSF trackage rights via Bagley, Schley, and Brookston. A new 11 mile line is required from Clearbrook west to the CP line. (282 miles)
Bakken Region, North Dakota	Chicago Area	Tioga to Western Avenue (Chicago). There are multiple options, but the two most likely are 1) via Fargo, Staples, and Minneapolis (988 miles) and 2) via Fargo, Willmar, and Minneapolis. (998 miles).	New Town to Western Avenue (Chicago) via Glenwood and Minneapolis (975 miles)
Clearbrook, MN	Chicago Area	Clearbrook to Western Avenue (Chicago) via Bagley toward Superior and then on BNSF line south through Coon Creek and Minneapolis. A new 11 mile line is required from Clearbrook to Bagley. (772 miles)	Clearbrook to Western Avenue (Chicago) via Erskine, Glenwood, and Minneapolis. A new 11 mile line is required from Clearbrook west to the CP line. (769 miles)
Source: William Rennicke Direct Testimony			

Figure 2-6 BNSF Routes from Tioga, ND to Superior, WI and Chicago, IL[25]

A new connecting line would need to be constructed into Clearbrook, Minn.

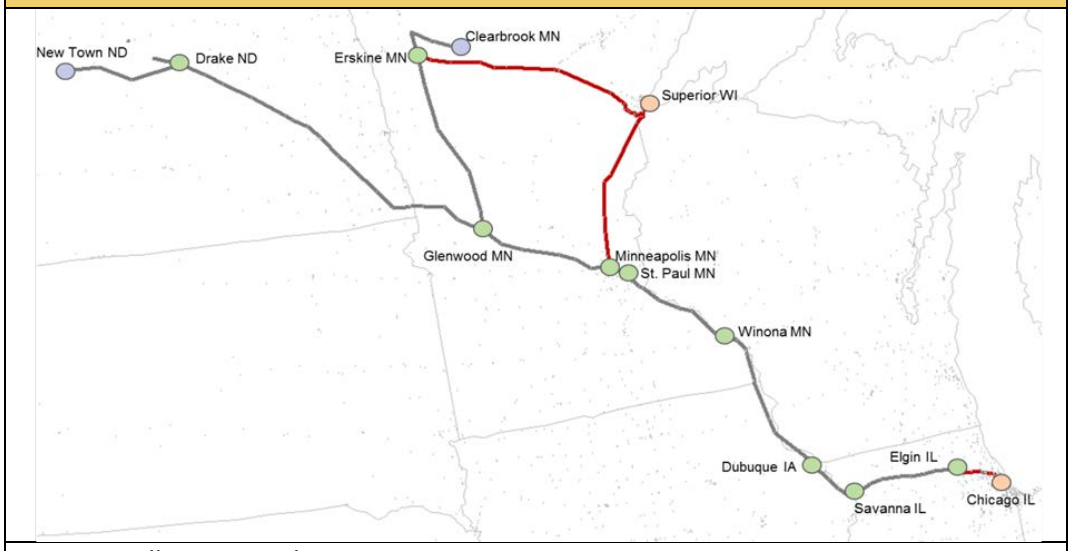


Source: William Rennicke Direct Testimony

[25] Map generated by Oliver Wyman using Oak Ridge National Laboratory railroad network and Oliver Wyman's MultiRail software.

Figure 2-7 CP Routes from New Town, ND to Superior, WI and Chicago, IL[26]

A connection to Clearbrook, Minn. would need to be constructed. Lines in red are trackage rights on routes owned by BNSF



Source: William Rennicke Direct Testimony

2.3 Trucking Alternative

Transporting crude oil by tanker truck is another potential alternative to constructing the proposed Sandpiper Pipeline Project. Tanker trucks are commonly used to move crude oil from wellhead locations not served by pipeline gathering systems to aggregation points and storage facilities. Typically oil tanker trucks are used where the travel distances are not significant. All oil loading and unloading operations are covered in Title 40 Code of Federal Regulations 112.7 (General Requirements for Spill Prevention, Control and Countermeasure Plans).

To transport an equivalent amount of oil by truck as the proposed Sandpiper Pipeline Project, will require expansion of existing or construction of new truck loading terminal facilities in Beaver Lodge and Berthold, North Dakota, and construction of new unloading facilities in Clearbrook, Minnesota, and Superior, Wisconsin. Substantial upgrades and ongoing maintenance may also be required to the connecting roadways along the truck transportation routes.[27]

The expansion of existing or construction of tank truck facilities (see example in Figure 2-8) will require additional lands to accommodate loading and unloading the oil. The amount of land needed will be determined by the number of loading/unloading stations necessary to support the number of trucks required to move the same amount of oil as the proposed pipeline.

[26] Ibid.
[27] CN Application, part 7854.0540, p. 6-9.

Figure 2-8 Oil Tank Truck Loading Area

Tank truck loading and unloading facilities will need to be constructed to transfer oil.

Source: Stock online photo.

Loading and unloading facilities are comprised of loading and unloading bays, storage tanks, piping, containment facilities, catch basins, roads, water, wastewater systems and other associated facilities.

Both tank car (railroad) and tank truck loading and unloading areas have high probability for spills. Loading/unloading areas are typically designed to permit vehicle accesses and egress and also incorporate a secondary containment system. Typically the loading/unloading containment system is a covered, curbed and graded area that drains to a sump. Drainage normally flows into retention ponds, catchment basins, or treatment systems designed to retain oil or return it to the facility. These facilities may also include a method to clean or retain oily stormwater or return it to the loading/unloading area of the facility. The system should also minimize the volume of water, ice and show that enters the containment area. The facility should also provide a containment area for trucks that are parked overnight, whether full or empty.

The containment facility must also be designed to hold the maximum capacity of the largest compartment of a tank truck whether it is loaded or not. For example, if an 8,400 gallon tank truck has three compartments, the loading/unloading area should hold at least 2,800 gallons. When there are separate areas for different loading or unloading operations, each area should be designed to hold the capacity of the largest carrier anticipated to be used in that area. Additionally, a warning light or physical barrier or warning signs should be provided in loading and unloading areas to prevent a vehicle from leaving before disconnecting from the fuel transfer lines. All outlet drains should be examined for leakage and if necessary adjusted or replaced to prevent leaking in transit.[28]

For the trucking analysis, NDPC assumed that a trucking company would optimize the use of its trucking fleet to transport equivalent crude oil volumes as the Sandpiper Pipeline Project. NDPC also assumed that the trucking

[28] Miscellaneous Reference Documents for Truck Terminals.

company will divide its transportation requirements into three individual truck hauls that will make round-trips between specified locations: two beginning at the Beaver Lodge Station near Tioga and ending at Berthold, North Dakota, or Superior, and a third that begins at Clearbrook and ends at Superior. To achieve maximum optimization of trucking operations, NDPC also assumed a fleet of trucks would be scheduled to run round-trip deliveries between the following three locations:[29]

- Leaving Beaver Lodge Station near Tioga, North Dakota, to deliver 25,000 bpd at Berthold, North Dakota; returning empty from Berthold back to Beaver Lodge;
- Leaving Beaver Lodge to deliver 225,000 bpd at Superior, Wisconsin; returning empty from Superior back to Beaver Lodge; and
- Leaving Clearbrook, Minnesota, to deliver up to 150,000 bpd at Superior; returning empty from Superior back to Clearbrook.

As proposed, Sandpiper Pipeline Project would require transporting 25,000 bpd from Beaver Lodge to Berthold, 225,000 bpd from Beaver Lodge to Superior, and up to 150,000 bpd from Clearbrook to Superior. NDPC estimates that more than 4,000 trucks per day would be required to transport an equivalent amount of oil on a daily basis (Table 2-14). Each tanker truck can hold approximately 200 barrels of oil or 8,400 gallons.

Table 2-4 Total Daily Truck Requirements[30]

More than 4,000 trucks per day would be required to transport an equivalent amount of oil as the proposed Sandpiper Pipeline Project.

	Crude oil volume (bpd).[1]	Trucks in Transit (#)	Trucks Returning Empty (#)	Trucks Loading, Unloading[2]	Total Truck Requirements
Beaver Lodge, ND to Berthold, ND	25,000	32	32	13	77
Beaver Lodge to Superior, WI	225,000	1,407	1,407	563	3,377
Clearbrook, MN to Superior	150,000	375	375	150	900
TOTAL					**4,354**

1. Bpd = barrels per day. A barrel is equal to 42 gallons
2. assumed as 20 percent of total in transit and returning empty

[29] CN Application, part 7853.0540, p. 7-9.
[30] CN Application, part 7853.0600, p. 2-3 (Table 2.2.2-1).

The trucking alternative would be a very labor intensive operation, would require significant work force at all terminal locations to assist in loading and unloading and could require a significant amount of time to obtain the services of a trucking fleet of the size estimated above and recruit and train the necessary drivers. Tanker truck drivers must possess a commercial driver's license with a hazardous materials endorsement. An oil tanker truck fleet will also require a large number of repair facilities and mechanics available to provide maintenance service and repair on the trucks as necessary.

NDPC estimates that the trucking costs for this alternative could be in the hundreds of millions of dollars per year range (not including the costs of maintaining and replacing vehicles over the economic life of the project, fuel, additional overhead costs such as general administration, and necessary public and private infrastructure).

NDPC calculated that the base capital investment needed to order a fleet of 4,354 trucks for transporting 375,000 bpd of crude oil to be $870,800,000, assuming each trucking rig would cost approximately $200,000. Annual wages are estimated to be approximately $384,588,820 which assumes 4,354 drivers are on the road 365 days per year at the rate of $242 per day per driver. This means the initial capital investment for the first year of operation would be $1,255,388,820 for just the fleet of trucks and its drivers. Additionally, the $870,800,000 cost of the 4,354 trucks will be accrued at least 5 more times over the life of the project.[31]

With mileage that the trucks would incur in steady service, NDPC also estimates that the economic life of a truck would not exceed 4 to 5 years.[32] The truck loading and unloading terminals would have an estimated economic life of 30 years.

Impact Analysis of Truck Alternative

Similar to rail terminals, construction of truck terminals in North Dakota, Minnesota and Wisconsin will result in construction and operations related impacts that would include loss of vegetation and habitat, displacement of wildlife, increased traffic congestion, noise, air emissions and spills, increased wear and tear on roads, and accidents, possibly resulting in the loss of life.

The oil-by-truck alternative would create point discharges to water at the loading and unloading facilities. Water discharges will come from the washing of vehicles and tank trailers at the terminals and accidental water releases. The terminal facilities would be required to have an approved Environmental Protection Plan specifying steps that would be taken to ensure the proper handling of site stormwater. In addition, a Spill Prevention Plan would identify the precautions and measures to be taken in the event of a release. The terminal facilities may also require an emergency response plan.

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[31] Ibid, part 7853.0540, 8-9.
[32] Ibid.

There would also be an increase in water run-off from construction of the expanded and new loading/unloading facilities. Erosion controls measures may be necessary during and after construction, where appropriate, to minimize erosion and sedimentation as well as surface runoff from the facility.

Fire and explosion hazards at crude oil terminals may result from the presence of combustible gases and liquids, oxygen and ignition sources during loading and unloading activities, and leaks and spills of flammable products. There are a number of design and construction standards that would be followed to minimize the risk of fire and explosion at these facilities. Also, safeguards during loading and unloading operations would include vapor control measures and containment barriers, as well as adherence to rigorous safety protocols identified above.

Emissions of volatile organic compounds (VOCs) may result from evaporative losses during storage oil at the terminals (typically referred to as "breathing, storage, or flash losses"), and from operational losses such as loading and unloading, additive blending, leakage from seals, flanges and other types of equipment connections, referred to as fugitive losses. Additional emissions may occur from vapor combustion units and vapor recovery units. The drivers or terminal staff would be required to follow loading/unloading procedures in Title 49 Code Federal Regulations (CFR) 171, 173, 174, and 177) to minimize such losses.

As discussed above the oil-by-truck alternative will require approximately 4,354 trucks and trailers to move oil between Beaver Lodge, North Dakota to Clearbrook, Minnesota and Superior Wisconsin. Assuming that 20 percent (approximately 870) of all the trucks and trailers are either being loaded and unloaded, approximately 3,628 trucks and trailers will always be on the major roadways between Beaver Lodge and Superior.

NDPC identified two primary truck routes between Beaver Lodge and Superior:

- The first is US. Highway 2, which goes from Williston eastward through Stanley, Minot, Towner, Rugby, Devils Lake, Lakota and Grand Forks, and in Minnesota through East Grand Forks, Crookston, Erskine, Bagley, Bemidji, Cass Lake, Grand Rapids, Warba, Floodwood and Duluth, and in Wisconsin to Superior. Highway 2 generally parallels and is adjacent to the existing Burlington Northern Santa Fe railroad right-of-way for nearly all of this distance.[33]
- The second is Highway 2 in North Dakota from the Williston area to Minot, then Highway 52 through Velva, Harvey, Fessenrden, Carrington and Jamestown, then continuing eastward on I-94 through Valley City, Casselton and Fargo in North Dakota. The Minnesota portion continues eastward on Highway 10 through Detroit Lakes, then picks up Highway 34 through Park Rapids and Walker, until joining Highway 200 south of Walker, through Remer until intersecting Highway 2 northwest of Floodwood, then continuing on Highway 2 through Hermantown and Duluth before entering Superior.[34]

The increase in heavy truck traffic may increase wear and tear on the existing highway infrastructure system, thereby requiring more maintenance and repairs on the existing roadways used for the oil-by-truck alternative.

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[33] CN Application, part 7853.0600, p. 12-13.
[34] Ibid.

Increased truck traffic will also result in additional noise levels to residents and communities along the truck routes used.

It will also account for point sources of airborne emissions along the truck routes used. NDPC calculated that the oil-by-truck alternative would require approximately 577,247,500 vehicle miles per year. Assuming the trucks average somewhere between 4 and 8 miles per gallons, the tanker truck fleet would consume anywhere from 72,155,937 to 144,311,875 gallons of fuel per year. This would result in the following airborne emissions (see Table 2-5) on an annual basis.

Table 2-5 Trucking Alternative Airborne Emissions[35]

Transportation of oil by truck produces hazardous emissions along with greenhouse gases.

Emission Source Description	Pollutant Emissions in Tons Per Year (tpy)						
	NO_X	CO	SO_2	HC	PM_{10}	$PM_{2.5}$	GHG (CO_2e)
On-road vehicle diesel combustion emissions	4,130	6,573	11	1,336	73	69	1,101,880
Particulate matter emissions from paved roads	-	-	-	-	22,246	5,460	-
Total	4,130	6,573	11	1,336	22,320	5,529	1,101,880

- Emissions are calculated based on 577,247,500 vehicle miles traveled per year.
- Transport of crude oil in trucks will result in diesel engine emissions and particulate matter from the trucks driving on paved roads.
- Truck emissions are calculated based on vehicle miles driven and EPA emission factors.
- The trucking emission only quantifies emissions from truck operation to Superior. Emissions from truck idling and emissions from the loading of crude oil into the transport trucks have not been included.

The oil by truck alternative would be subject to safeguards and controls required of commercial drivers under U.S. Department of Transportation, Federal Motor Carrier Safety Administration Regulations and state laws. These include drug testing, special training, insurance requirements and mandatory driver rest periods. Additional safeguards would come through enforcement of traffic regulations and a vigorous maintenance program.

Even with all proper safeguards in place, which includes proper vehicle maintenance, extensive driver training, and following all applicable safety statutes, rules and regulations, the tanker truck option would not be as reliable as a train or pipeline due to weather conditions, mechanical failure, manpower (driver shortages), and other

[35] CN Application, part 7853.0600, p. 10 (Table 7853.0600-B-3)

factors. Based on U.S. Department of Transportation statistics, reports by both the Fraser Institute ("Intermodal Safety in the Transport of Oil"[36]) and the Manhattan Institute for Policy Research ("Pipelines are Safest for Transportation of Oil and Gas"[37]) concluded that trucks have a significantly higher rate of accidents affecting driver and public safety than pipelines or rails. Hazardous material incidents are also higher with trucks than with trains or pipelines.

2.4 Plains Bakken North Pipeline Project

The Bakken North Pipeline Project, is a 12.75-inch outside diameter (O.D.) pipeline approximately 103 miles in length intended to provide crude oil transportation service extending from the Plains Pipeline Trenton Station near Trenton, North Dakota, to an interconnection point with the existing Wascana Pipeline approximately 2.5 miles north of the town of Outlook in Sheridan County, Montana. The North Dakota portion of the project is approximately 44 miles long and will extend from the Trenton Station to the North Dakota/ Montana border. In Montana, the pipeline proceeds in a northerly direction terminating into the Plains Midstream Canada's Wascana Pipeline, where the crude would be transported to Regina, Saskatchewan. From there, the pipeline will interconnect with third party pipeline systems providing access to Cushing, Okla., and PADD II delivery points. [38]

The 12.75-inch outside diameter (OD) Bakken North pipeline will have an initial design capacity of 48,000 b/d (expandable to 75,000 b/d). According to the State of North Dakota Public Service Commission's Findings of Fact, Conclusions of Law and Order, the cost of the North Dakota portion of the project is estimated at $25 million.[39] Plains' estimated the entire project cost (to the 75,000 b/d capacity) at $160-200 million.[40]

Plains Pipeline, L.P. (Plains Pipeline), on November 10, 2010, filed a Letter of Intent with the North Dakota Public Service Commission for a combined application for a Certificate of Corridor Compatibility and a Route Permit to reverse its Wascana pipeline system in Montana and build the new crude oil pipeline, Bakken North, to the Wascana pipeline to provide additional takeaway capacity for growing Bakken crude production.

On August 12, 2011, Plains Pipeline filed with the North Dakota Public Service Commission an application for a certificate of corridor compatibility and an application for a route permit to authorize pipeline construction (Docket No. PU-10-630).[41] The Montana portion of the Plains Pipeline falls below Montana's permitting threshold.

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[36] http://www.fraserinstitute.org/research-news/display.aspx?id=20490 (October 2013).
[37] http://www.manhattan-institute.org/html/ib_23.htm#.VID4yXv-lWI (June 2013)

[38] State of North Dakota Public Service Commission, Docket No. PU-10-630, Findings of Fact, Conclusions of Law and Order, February 1, 2012.
[39] Ibid,
[40] Ibid.
[41] State of North Dakota Public Service Commission, Docket No. PU-10-630, Findings of Fact, Conclusions of Law and Order, February 1, 2012.

On February 1, 2012, the North Dakota Public Service Commission issued Plains Pipeline, L.P., a Certificate of Corridor Compatibility Number 127 and a Route Permit Number 136 for the North Dakota portion of the project.[42] A route permit was not required for the Montana portion of the project.

The North Dakota Public Service Commission in an Order dated February 1, 2012, directed Plains to construct, operate and maintain the pipeline in accordance with all applicable federal/state rules and regulations and industry standards as an interstate common carrier crude oil pipeline.[43]

As an interstate common carrier crude oil pipeline, Bakken North will be operated and maintained in accordance with extensive federal and state regulations, specifically 49 C.F.R. Parts 194 and 195 of the PHMSA Rules and Regulations, and any applicable national technical standards.

The Plains Pipeline has been constructed and was placed into service in May 2014.[44]

Impact Analysis of Plains Bakken North Pipeline Project

This pipeline project, as noted above, was placed into service in May 2014 and was designed to carry oil out of the Bakken by moving it westward and then north into Canada to tie into other third party pipelines that would deliver the oil to Cushing, Oklahoma, and PADD 2 delivery points.

The project as proposed has a maximum design capacity of up to 75,000 barrels per day (bpd); therefore, its design capacity does not meet the demands of shippers who want to transport oil on the proposed Sandpiper Pipeline Project. The Plains Bakken Pipeline Project and the Sandpiper Pipeline Project also serve different markets and customers.

As built maps have been filed with the North Dakota Public Service Commission and are available for review online in the project docket page in North Dakota (PU-10-630). Because a route permit for the Montana of the project was not required, no detailed maps are available for review.

2.5 High Prairie Pipeline Project

In 2012, High Prairie Pipeline, LLC (HPP) proposed to construct an approximately 450-mile, 16-inch outside diameter, underground crude oil pipeline and associated facilities from McKenzie County, North Dakota, to Clearbrook, Minnesota (High Prairie Project), where it would connect with the Enbridge pipeline system to move the oil eastward. HPP was proposed with an initial capacity of 150,000 bpd and total design capacity of 300,000 bpd. The route proposed for the High Prairie Pipeline generally paralleled Enbridge's existing Line 81 across North Dakota to Clearbrook. High Prairie was also proposing to construct two laterals: a 17-mile lateral originating at Johnsons Corner, North Dakota, in McKenzie County and connecting with the High Prairie Pipeline, and an 8-mile

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[42] Ibid.
[43] Ibid.
[44] North Dakota Public Service Commission

lateral beginning near Robinson Lake, North Dakota, in Mountrail County and connecting with the High Prairie Pipeline.[45]

HPP anticipated that there would be approximately 65 miles of pipeline located within Minnesota through the counties of Polk, Red Lake and Clearwater. The High Prairie Project was proposed to cross the Minnesota/North Dakota border near Bygland, Minnesota. The associated facilities in Minnesota were anticipated to include 300,000 barrels of operational transfer capacity in Clearbrook, to be located adjacent to the existing Clearbrook Transfer Station, necessary valves, metering and monitoring equipment, and one to two pumping stations.

The estimated Project cost in 2012 dollars was approximately $650 million. Based on current production forecast from the Bakken region, the project life, similar to other pipelines would be approximately 30 years or more.

As an interstate common carrier crude oil pipeline, High Prairie would have been required to be operated and maintained in accordance with federal and state regulations, specifically 49 C.F.R. Parts 194 and 195 of the PHMSA Rules and Regulations, and any applicable national technical standards, as well as permit conditions required by the Commission.[46]

The High Prairie Pipeline Project, as proposed, would require a Certificate of Need (Docket No. PL-6884/CN-12-127) and a Route Permit (Docket No. PL-6884-/PPL-12-126) from the Minnesota Public Utilities Commission, as well as any other required federal, state and local approvals. Two dockets (CN and Routing) were established for the Project in early 2012; however, High Prairie never filed the required applications with the Commission.

In order to connect with the Enbridge pipeline system to move oil eastward, HPP would need an interconnection agreement with Enbridge Energy. In February 2012, High Prairie Pipeline entered into negotiations with Enbridge Energy regarding an interconnection at Clearbrook; however, the parties were not able to reach an agreement on terms. The Project as proposed is not viable without an interconnect agreement.

Impact Analysis of High Prairie Pipeline Project

HPP anticipated locating the pipeline adjacent to the existing NDPC Line 81 right-of-way to Clearbrook. Thus, the impacts from that project would have been very similar to the impacts associated with NDPC's proposed Sandpiper Project, which also follows the existing Line 81 right-of-way.

The impacts of both projects to Clearbrook would have been similar with respect to the land use and environmental features crossed. These impacts are outlined in section 4.2 of this document, which covers System Alternative-Applicant, and are examined in greater detail in NDPC's CN and Route Permit applications (Dockets: 10-473 and 10-474) filed with the Commission.

2.6 Koch Pipeline Company Dakota Express Pipeline

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[45] CN Application, part 7853.0540, p. 4
[46] Ibid.

On July 1, 2013, Koch opened a non-binding, 45-day open season seeking shipper interest in a new pipeline called the Dakota Express, with a capacity of approximately 250,000 barrels per day to move Bakken crude from western North Dakota to Hartford, Illinois, and Patoka, Illinois. As proposed, the pipeline would start with a new 600-mile pipeline from somewhere in "Western North Dakota" going to the Flint Hills Refinery area where it would connect with the existing Wood River crude oil pipeline. At this time the Wood River pipeline runs south to north from Wood River, Illinois, to the Flint Hills Resources refinery. The project, as proposed, called for reversing the Wood River pipeline to flow from Flint Hills to a Koch terminal at Hartford; from there a new pipeline would be built to link the Hartford terminal with the oil terminal in Patoka. No proposed project route maps for the new pipeline portion were available for review; consequently, it is not known where the pipeline would be located. However, it is possible that it may have followed or tried to parallel existing rights-of-way.[47]

In January 2014, Koch Pipeline Company announced that this project will not move forward.[48] Accordingly, it was no longer considered a viable alternative pipeline system.

Impact Analysis of Koch Pipeline Company Dakota Express Pipeline

Because no detailed maps were available for the Dakota Express Pipeline, it is not possible to determine where the pipeline would be located, except to note that it would have tied in to the existing Wood River pipeline that connects the Flint Hills Refinery in Rosemount and an oil terminal point in Hartford, Illinois. The Wood River Pipeline is not operational at this time, but may be placed into service in the future if warranted.

Assuming that the Dakota Express Pipeline may have followed or paralleled other pipelines or linear features where possible, the Dakota Express would likely have utilized portions of the System Alternatives SA-04 and SA-05 in North Dakota and SA-06 and SA-07 in Minnesota. The impacts of the Dakota Express on land use and natural resource features associated with these system alternatives and combinations thereof would be similar.

[47] Ibid, p. 5-6.
[48] http://www.bloomberg.com/news/2014-01-22/koch-ends-plans-for-pipeline-to-illinois-from-bakken.html

3 System Alternatives – Descriptions

Seven system alternatives are considered in this document: SA-Applicant, SA-03, SA-04, SA-05, SA-06, SA- 07 and SA-08. System alternatives 03 through 08 were developed based on descriptions received during the public comment period for the Sandpiper Project route permit proceeding. Many of the comments expressed a preference for system alternatives to follow existing pipelines or other linear features such as transportation corridors. The exact locations of existing pipelines and pumping stations are not publically available data; therefore, all routes and locations are approximate. Comments for SA-03, SA-06 and SA-07 also preferred that the northern lakes area of Minnesota be avoided, preferring alternatives that travel south to the Twin Cities Metropolitan area and then proceed north to Superior, Wisconsin. Comments for SA-04 and SA-05 also preferred that the northern lakes area of Minnesota be avoided, but generally preferred that the system alternative travel south through the western part of Minnesota and continue southeast to the Chicago, Illinois, area. SA-08 was suggested to avoid the northern lakes area of Minnesota, travel south to the Twin Cities Metropolitan area, and terminate in the Twin Cities Metropolitan area, without going north to Superior, Wisconsin.

A two-mile-wide corridor was developed around existing linear features using aerial photography and publically available data to locate suggested system alternatives as accurately as possible. As represented, the system alternatives account for bends or curves in features that are too detailed to identify from publically available information. Each of the system alternatives is described below. Table 3.1 provides the length in miles, counties and states that each system alternative crosses.

System Alternative – Applicant (SA-Applicant)

- Approximately 615 Miles
- Crosses 3 states and 21 counties: 11 in North Dakota, 10 in Minnesota and 1 in Wisconsin.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and travels east following Enbridge's existing pipeline system. The existing system passes to the North of Minot, North Dakota, and crosses into Minnesota south of Grand Forks to just west of Clearbrook, Minnesota, where a new terminal is being proposed by NDPC. SA-Applicant follows an existing pipeline corridor south to just north of Park Rapids, Minnesota. It then turns generally east following existing electric transmission lines or other linear features for much of the way before it terminates in Superior, Wisconsin. SA-Applicant is approximately 615 miles long and passes through nine counties in North Dakota and 11 counties in Minnesota.

System Alternative – 03 (SA-03): Viking-North Branch-Superior

- Approximately 700 miles long
- Crosses 3 states and 25 Counties: 11 counties in North Dakota, 14 in Minnesota and 1 in Wisconsin.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east into Minnesota. Just west of Crookston, Minnesota, it turns south and follows the

Viking Pipeline. In Clay County, Minnesota, it continues southeast following the Viking Pipeline toward North Branch, Minnesota. It then turns north to Superior, Wisconsin, following existing pipeline corridors.

System Alternative – 04 (SA-04): Alliance-Chicago

- Approximately 940 miles
- Crosses 4 states and 48 counties: 15 counties in North Dakota, 1 county in South Dakota, 14 counties in Minnesota, 10 counties in Iowa, and 8 counties in Illinois.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to McHenry County, North Dakota. SA-04 turns southeast and follows the Alliance Pipeline and proceeds generally southeast through Minnesota, Iowa and Illinois to its termination point in Joliet, Illinois.

System Alternative – 05 (SA-05): Alliance-Enbridge-Chicago

- Approximately 1,000 miles
- Crosses 5 states and 50 counties: 15 counties in North Dakota, 6 counties in South Dakota, 6 counties in Minnesota, 15 counties in Iowa, and 8 counties in Illinois.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to McHenry County, North Dakota, where it intersects with the Alliance Pipeline and travel southeast to Richland County, North Dakota, where it turns south and follows the I-29 corridor. In Deuel County, South Dakota, SA-05 intersects with the Northern Border Pipeline and travels southeast across Minnesota and Iowa to Poweshiek County, Iowa, where it intersects with an Enbridge Pipeline and continues east through Illinois to its termination point in Joliet, Illinois.

System Alternative – 06 (SA-06): RR-Alliance-MinnCan-TC-Superior

- Approximately 800 Miles
- Crosses 3 states and 33 counties: 14 counties in North Dakota, 18 counties in Minnesota and 1 in Wisconsin.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to Grand Forks County, North Dakota, where it follows the railroad corridor southeast to Wahpeton, North Dakota. It then travels southeast along Minnesota Highway 9 until it intersects with the Alliance Pipeline and continues southeast to just southwest of Willmar. It then turns east and continues southeast towards the Twin Cities Metropolitan area where it intersects with the MinnCan Pipeline and continues to the vicinity of the Flint Hills Refinery in Rosemount. It then turns north and follows existing pipelines to North Branch where it continues north following Interstate 35 to Carlton County where it turns generally east and follows SA-Applicant to Superior, Wisconsin.

System Alternative – 07 (SA-07): I-29-Magellan-MinnCan-TC-Superior

- Approximately 810 Miles
- Crosses 3 states and 34 counties: 12 counties in North Dakota, 21 counties in Minnesota, and 1 in Wisconsin.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to Grand Forks, North Dakota, where it intersects with I-29 corridor and travels south to Fargo, North Dakota. It then continues traveling southeast along the Magellan Pipeline corridor toward Alexandria, Minnesota. At Alexandria, it turns south toward Willmar, Minnesota, and then turns southeast toward the Twin Cities Metropolitan area where it intersects with the MinnCan Pipeline and continues to the vicinity of the Flint Hills Refinery in Rosemount. It then turns north and follows existing pipelines to North Branch where it continues north following Interstate 35. It then continues to Carlton County where it turns generally east and follows SA-Applicant to Superior, Wisconsin.

System Alternative – 08 (SA-08): I-29-I-94-TC

- Approximately 635 Miles
- Crosses 2 states and 27 counties: 12 counties in North Dakota and 15 counties in Minnesota.

Proposed system alternative begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to Grand Forks, North Dakota, where it intersects with Interstate 29 corridor and travels south to Fargo, North Dakota. It continues traveling southeast along the Interstate 94 corridor towards the Twin Cities Metropolitan area. Just northwest of Maple Grove, it turns east and follows an existing pipeline generally east across the north suburbs before turning south and following another existing pipeline across the east suburbs before terminating in Rosemount, Minnesota

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Table 3-1 System Alternatives County Locations and Approximate Lengths

System Alternative	Length (Miles)	Counties Crossed by State					
		North Dakota	South Dakota	Minnesota	Iowa	Illinois	Wisconsin
SA-Applicant	615	Benson, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Ward, Williams		Aitkin, Becker, Carlton, Cass, Clearwater, Crow Wing, Hubbard, Polk, Red Lake, Wadena			Douglas
SA-03	700	Benson, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Ward, Williams		Becker, Benton, Carlton, Chisago, Clay, Isanti, Mille Lacs, Morrison, Norman, Otter Tail, Pine, Polk, Todd, Wadena			Douglas
SA-04	940	Barnes, Benson, Cass, Eddy, Foster, McHenry, Mountrail, Pierce, Ransom, Richland, Sargent, Stutsman, Ward, Wells, Williams	Roberts	Blue Earth, Chippewa, Freeborn, Kandiyohi, Le Sueur, Mower, Nicollet, Renville, Sibley, Stevens, Swift, Traverse, Waseca	Bremer, Buchanan, Chickasaw, Clinton, Delaware, Fayette, Howard, Jones, Linn, Mitchell	Bureau, Grundy, Kendall, La Salle, Lee, Rock Island, Whiteside, Will	
SA-05	1012	Barnes, Benson, Cass, Eddy, Foster, McHenry, Mountrail, Pierce, Ransom, Richland, Sargent, Stutsman, Ward, Wells, Williams	Brookings, Codington, Deuel, Grant, Hamlin, Roberts	Cottonwood, Jackson, Lincoln, Lyon, Martin, Murray	Cedar, Cerro Gordo, Franklin, Grundy, Hancock, Hardin, Iowa, Johnson, Kossuth, Marshall, Muscatine, Poweshiek, Scott, Tama, Winnebago	Bureau, Grundy, Kendall, La Salle, Lee, Rock Island, Whiteside, Will	
SA-06	800	Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson,		Carlton, Carver, Chippewa, Chisago, Dakota, Grant, Kandiyohi, McLeod, Meeker,			Douglas

System Alternative	Length (Miles)	Counties Crossed by State					
		North Dakota	South Dakota	Minnesota	Iowa	Illinois	Wisconsin
		Pierce, Ramsey, Richland, Steele, Towner, Traill, Ward, Williams		Pine, Rice, Scott, Sibley, Stevens, Swift, Traverse, Washington, Wilkin			
SA-07	810	Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Traill, Ward, Williams		Carlton, Carver, Chippewa, Chisago, Clay, Dakota, Douglas, Grant, Kandiyohi, McLeod, Meeker, Otter Tail, Pine, Pope, Rice, Scott, Sibley, Swift, Washington, Wilkin			Douglas
SA-08	635	Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Towner, Traill, Ward, Williams		Anoka, Clay, Dakota, Douglas, Grant, Hennepin, Otter Tail, Ramsey, Sherburne, Stearns, Todd, Washington, Wilkin, Wright			

4 System Alternatives – Environmental Overview and Analysis

The first step in developing the broad-based analysis of the two-mile-wide system alternative corridors was to identify the available datasets. A review of national, regional and state environmental databases was performed. Data that extended across North Dakota, South Dakota, Minnesota, Iowa and Illinois was used in the analysis to ensure that all of the system alternatives were being evaluated with similar data.

Datasets were identified in 12 resource areas:

- Geology/Soils/Groundwater
- Ecoregions
- Land cover
- Water Resources
- Special species and critical habitat
- Public resource and recreational lands
- Cities and population
- Community features
- Cultural resources
- Contaminated areas
- Air emissions
- High-consequence areas

The following section provides background information on each resource area and on methodologies used to analyze the resources, and provides an environmental overview in the each of the seven system alternatives. The analysis was done by evaluating publically available data within a two-mile-wide corridor centered on defined linear features such as pipelines and roads. Maps for each resource topic are included in Appendix A. Each resource topic has an overview figure that displays all seven system alternatives on one map. Some of the resource topics have a second figure that is a set of four larger scale maps that show more detail for the resource topic they cover. Map A-2 shows the extent of the larger scale maps.

Appendix B provides additional information for the Minnesota portions of the system alternatives drawing on natural resource datasets from the Minnesota Department of Natural Resources Data Deli and other sources.

4.1 Resource Background Information and Methodologies

Information discussed in the background section for each resource area is common to all of the system alternatives and is intended to provide base information to better understand the context of the analysis.

The methodology discussion provides information on where the data was obtained and how the data was used in the analysis. The data evaluated for each of the resources discussed below was selected to provide a broad high-level analysis for each system alternative. A more detailed list of spatial data sources is provided in Appendix C.

4.1.1 Geology/Soils/Groundwater (Maps A-3, 4, 5 and 6)

Geology, soils and groundwater were grouped together as they represent the subsurface area of potential impact. Subsurface characteristic can influence both route selection and the techniques use to minimize and mitigate impacts. Exposed bedrock might present construction challenges. Future extraction of valuable mineral deposits might be hampered by the pipeline location. Soil structure and fertility, vital to agricultural production across the system alternatives, can be damaged. Both construction and operation of a pipeline could affect groundwater aquifers that are used for municipal drinking water supplies.

Geology (Map A-3)

Bedrock geology was analyzed to give a general view of the subsurface landscape. Depth-to-bedrock maps were reviewed to identify areas where bedrock is shallow within each of the system alternative's 2-mile wide corridors.

Today's varied geologic landscape is a product of weathering and erosion that occurred over millennia as layers of rock and sediment within Earth's crusts were shifted to release heat and pressure from its core (USGS 2014a). Landscapes with similar rockbed compositions, features and geographic location are grouped into geologic provinces. Ten distinct geologic provinces span the lower 48 states (USGS 2014a). All of the system alternative corridors are located within the Interior Plains (the largest of the geologic provinces).

The Interior Plains geologic province is a vast region that comprises the central portion of the North American Continent (USGS 2014b). The geologic province extends all the way from the north coast of Canada down to southwestern Texas, as far east as Ohio, and as far west as Montana. The relatively flat topography of the Interior Plain is a reflection of the marine and stream deposits laid down during the Mesozoic and Cenozoic Eras.

Within the system alternative corridors, sedimentary bedrock from the Cretaceous Period is the most prevalent in the uppermost bedrock unit. In primarily the northern half of Minnesota, the underlying

Archean (over 2.5 billion years) gneiss and granitic rocks (the oldest in the country) are found nearest the surface. The youngest bedrock units along the system alternative corridors are found in western North Dakota. In the southeastern portion of Minnesota, eastern half of Iowa, and in Illinois, Paleozoic sedimentary bedrock units are dominant.

Much of the bedrock along the system alternative corridors is masked by glacial sediment (unconsolidated silt, clay, sand, gravel and boulders) deposited by multiple advancements of ice lobes from the Laurentide Ice Sheet during the Pleistocene Epoch (2 million years ago to 10,000 years ago). Glacial sediments are present at the surface in the eastern portions of North Dakota and South Dakota and the majority of Minnesota, Iowa and Illinois (Lusardi 1997). The Paleozoic Plateau or "driftless area" is primarily located in Wisconsin, but also extends into portions of southeast Minnesota, northeast Iowa and northwest Illinois. This area was untouched by the last glaciation (Wisconsinan Glaciation) and is marked by exposed bedrock with varying thicknesses of loess deposits.

Impacts to mineral resources could occur. Mineral resources present in the vicinity of the system alternatives may include dimensional stone, ferrous metals, rare earth metals, peat, coal, oil and natural gas, sand and gravel and silica sand.

Methodology

Bedrock geology data was collected from USGS, Mineral Resources Spatial Database. The uppermost bedrock units encountered were grouped by geologic age and general rock type as categorized by the United States Geological Survey (USGS). Acres of each geologic grouping within each system alternative were developed using spatial analysis tools in ArcGIS.

Soils (Map A-4)

Major Land Resource Areas (MLRA), as defined by the Natural Resource Conservation Service (USDA 2006), provide a broad overview of soil characteristics in the study area. MLRAs are geographically associated land areas that share physiography, geology, climate, water, soils, biological resources and land use characteristics. Land Resource Regions are geographically associated MLRAs which approximate broad agricultural market regions. Descriptions of MLRAs are provided in Appendix D.
Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the System Alternatives.

Impacts to soils are particularly of concern in agricultural areas; they can be temporary, construction-related, and they can be long-lasting and even permanent. Excavation activities will disturb the soil profile, with mixing of the horizons. Once mixing of topsoil and subsoil has occurred, it is very difficult and costly to mitigate. Rocks may be brought to the surface, creating cultivation issues for years. Compaction, rolling topography and organic agriculture also must be considered.

Some of the MLRAs have characteristics that may impact construction. Soils that are shallow or have bedrock near the surface may require careful routing and alternative construction techniques. Soils that have shrink/swell characteristics may require alternative designs and maintenance to ensure the stability of the pipe.

Soil also can be contaminated should a leak occur and landscapes that have sinkholes may have higher potential for groundwater impacts, should a leak occur. Soil permeability also influences potential for groundwater impacts; however, permeability is so varied within Major Land Resource Areas that no conclusions can be made.

Hydraulic conductivity (Map A-5)

In addition to obtaining information about soil types, soil hydraulic conductivity was reviewed for each of the system alternatives. Hydraulic conductivity is important information to assess because it is a measure of how quickly a liquid such as oil could move through the soil profile based on soil type. Conductivity ratings can vary greatly within the soil profile and across the soil surface based on soil characteristics. While hydraulic conductivity is important, other factors, such as the presence of drain tile and specific localized soil conditions have greater importance when considering potential impacts. The presence of drain tile would increase the potential for oil dispersal, once the soil profile becomes saturated.

Hydraulic conductivity is extremely variable, both within an individual soil profile and when looking at different soil types. Liquids will move along a preferred path, for example, through the soil horizon that has the highest hydraulic conductivity. Following are some of the variables that affect the direction and speed with which a liquid will move through soils.

- Generally, coarse textured soils have higher hydraulic conductivity than fine textured soils.
- The presence of restricting layers within a soil profile will restrict liquid movement, and may force it to move in a different direction.
- Liquids with higher viscosity, such as oil, will move slower than liquids with lower viscosity, such as water.
- Liquids at higher temperature will move faster than liquids at a lower temperature.
- Soils with high organic matter, such as peat soils, have low hydraulic conductivity.
- Drain tiles provide a potential underground path for faster movement of liquids.
- The pressure the liquid is under, such that liquids under higher pressure, will move through soils at a faster rate than liquids under low atmospheric pressure.

Hydraulic conductivity measurements are provided for various depths in a soil profile, based on the profile characteristics. Thus, a single soil profile extending up to 6 feet deep will have a number of hydraulic conductivity ratings. Conductivity values are measured using water, which has a much lower viscosity than oil. Oil would be expected to move much more slowly than water, all other conditions being equal (Georgia State University 2014). Once the spill moves below the soils surface (5 to 6 feet), then the surficial geology controls how quickly the oil would disperse.

Methodology

Soils data was collected from the Major Land Resource Areas (MLRA) as defined by the Natural Resource Conservation Service (USDA 2006). Acres of each soil type within each system alternative were developed using spatial analysis tools in ArcGIS.

The Digital General Soil Map of the United States or STATSGO2 was used to develop the hydraulic conductivity information. The measurements for hydraulic conductivity are a composite of soil horizon measurements averaged for each soil type as described below.

1. For each Soil Survey Geographic Database (SSURGO) area that makes up a State Soil Geographic Database (STATSGO2) polygon, the average conductivity was calculated: *SUM((Vertical Subdivision Depth / Total Vertical Depth) * Hydraulic Conductivity)*
2. The maximum average area value from all SSURGO averages was used as the representative value for each STATSGO2 polygon.
3. The maximum average area was categorized into 6 groups.
4. The acres were calculated for each group in each system alternative.
5. The areas were converted into percentages and summarizd in three categories – High, Medium and Low.

This analysis provides a relative comparison of hydraulic conductivity for surface soils across the project area, with values ranging from Low to High. This analysis does not account for the fact that liquids will follow a preferred path, or other incongruities within the soil profile that would affect the movement of liquid. Additionally, the use of a composite rating is not expected to provide an accurate evaluation for any specific location, since numerous other factors may affect the movement of oil in the soil.

Groundwater (Map A-6)

Groundwater is a subsurface hydrologic resource or water that exists in the pore spaces and fractures in rock and sediment beneath the Earth's surface. This is an essential resource that is often used for potable water consumption, agricultural irrigation and industrial applications. Groundwater typically can be described in terms of its depth, aquifer and surrounding geologic composition. The depth to the water table (distance from the Earth's surface to the first occurrence of completely saturated material) varies substantially across the system alternatives.

Groundwater is obtained primarily from wells completed in unconsolidated-deposit aquifers that consist mostly of sand and gravel and from wells completed in semiconsolidated- and consolidated-rock (bedrock) aquifers.

Unconsolidated aquifers are the most wide spread and productive aquifers throughout the system alternative corridors. These aquifers consist of material deposited during multiple glacial advances that covered the area mainly during the Quaternary Period. Groundwater is typically found in the glacial outwash deposits of sand and gravel (in either layers or lenses) that may also include cobbles and boulders. This unit overlies all other bedrock aquifers, where present.

Though unconsolidated aquifers of glacial origin generally form numerous local aquifers, regional-scale unconsolidated aquifers are also found throughout the system alternative corridors. These aquifers consist of outwash, terrace or ice-contact deposits, and they mostly occupy bedrock valleys or areas of interlobe ice margins. Unconsolidated Aquifers are generally not the principle aquifers used for water supply.

The surficial aquifer systems throughout the system alternative corridors not only function as a storage reservoir for recharge from precipitation, but, in most places, water moves downward through the aquifer system to recharge underlying bedrock aquifers. Conversely, in some places, groundwater moves upward from underlying bedrock aquifers into the surficial aquifer system and then moves to streams where it is discharged.

Bedrock aquifers vary greatly in characteristics, composition and spatial occurrence. The analysis details the principal bedrock aquifers that occur throughout each system alternative.

Methodology

Groundwater aquifer extents and descriptions were obtained from Groundwater Atlas: HA 730-I (Montana, North Dakota, South Dakota and Wyoming), HA 730-J (Iowa, Michigan, Minnesota and Wisconsin), and HA 730-K (Illinois, Indiana, Kentucky, Ohio and Tennessee). Acres of principal groundwater aquifer within each system alternative were developed using spatial analysis tools in ArcGIS.

4.1.2 Ecoregions (Map A-7)

Ecoregions denote areas within which ecosystems (and the type, quality and quantity of environmental resources) are generally similar. They are identified through the analysis of the patterns and the composition of geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology that affect or reflect differences in ecosystem quality and integrity.

Ecoregions can be divided into several levels, with descending levels categorizing a smaller area of interest. Level I Ecoregions highlight major ecological areas and provide context for global or intercontinental patterns, Level II Ecoregions are useful for national and sub-continental overviews of ecological patterns, and Level III Ecoregions can be used to enhance regional environmental monitoring, assessment and reporting, and decision-making.

Each of the following Ecoregions and their associated sub-regions are crossed by at least one of the system alternatives.

Affects to herbaceous vegetation would be limited to the construction timeframe as most grassland vegetation would be able to reestablish, whereas removal of shrubs and trees would have a more long-term effect. Depending on vegetation type and removal, potential effects include fragmentation of terrestrial habitat, increased runoff and potential sedimentation of adjacent aquatic habitats, and increased susceptibility to invasion by non-native species and noxious weeds.

Descriptions of Level III Ecoregions were taken directly from the Environmental Protection Agency's Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States (2013). A description of the miles of system alternatives located within each ecoregion is provided in the discussions of the individual system alternatives.

Great Plains

The majority of all system alternatives are located within the Great Plains, which includes the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions.

The area of the West-central Semi-arid Prairies that is crossed by the system alternatives consists of a mix of Northwestern Glaciated Plains and the Northwestern Great Plains Level III Ecoregions. The Temperate Prairies region stretches across most of eastern North Dakota, the western edge of Minnesota, and most of Iowa. The region crossed by the system alternatives consists of a mix of Northern Glaciated Plains, Lake Agassiz Plain and Western Corn Belt Plains.

<u>Northwestern Glaciated Plains</u>

The Northwestern Glaciated Plains ecoregion is a transitional region between the generally more level, moister, more agricultural Northern Glaciated Plains to the east and the generally more irregular, dryer, Northwestern Great Plains to the west and southwest. The western and southwestern boundary roughly coincides with the limits of continental glaciation. Pocking this ecoregion is a moderately high concentration of semi-permanent and seasonal wetlands, locally referred to as Prairie Potholes.

Northwestern Great Plains

The Northwestern Great Plains ecoregion encompasses the Missouri Plateau section of the Great Plains that is mostly unglaciated. It is a semiarid rolling plain of shale, siltstone and sandstone punctuated by occasional buttes and badlands. Rangeland is common, but spring wheat and alfalfa farming also occur; native grasslands persist in areas of steep or broken topography. Agriculture is restricted by the erratic precipitation and limited opportunities for irrigation.

Northern Glaciated Plains

The Northern Glaciated Plains ecoregion is characterized by a flat to gently rolling landscape composed of glacial drift. The subhumid conditions foster a grassland transitional between tall and shortgrass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for waterfowl nesting and migration. Although the till soils are very fertile, agricultural success is subject to annual climatic fluctuations.

Lake Agassiz Plains

Glacial Lake Agassiz was the last in a series of proglacial lakes to fill the Red River valley in the three million years since the beginning of the Pleistocene. Thick beds of lake sediments on top of glacial till create the extremely flat floor of the Lake Agassiz Plain. The historic tallgrass prairie has been replaced by intensive row crop agriculture. The preferred crops in the northern half of the region are potatoes, beans, sugar beets and wheat; soybeans, sugar beets and corn predominate in the south.

Western Corn Belt Plains

Once mostly covered with tallgrass prairie, over 80 percent of the Western Corn Belt Plains is now used for cropland agriculture and much of the remainder is in forage for livestock. A combination of nearly level to gently rolling glaciated till plains and hilly loess plains, an average annual precipitation of 26 to 37 inches, which occurs mainly in the growing season, and fertile, warm, moist soils make this one of the most productive areas of corn and soybeans in the world. Agricultural practices have contributed to environmental issues, including surface and groundwater contamination from fertilizer and pesticide applications as well as concentrated livestock production.

Eastern Temperate Forests

All of the system alternatives cross the Eastern Temperate Forest region, which includes the Central USA Plains, Mixed Wood Plains, and Southeastern USA Plains Level II Ecoregions. The Central USA Plains region is made up of smooth plains that have been substantially changed by agricultural practices. Within the areas of the system alternatives, the Central USA Plains are crossed in the Central Corn Belt Plains Level III Ecoregion. The Southeastern USA Plains region consists of irregular plains with low hills with areas of cropland, grazing and forests. System alternatives cross the Southeastern USA Plains in the Interior River Valleys and Hills Level III Ecoregion. The Mixed Wood Plains region is mainly made up of

plains, some hills and many small lakes. This region consists entirely of North Central Hardwood Forests Level III Ecoregion in the areas of the system alternatives.

Central Corn Belt Plains

Extensive prairie communities intermixed with oak-hickory forests were native to the glaciated plains of the Central Corn Belt Plains; they were a stark contrast to the hardwood forests that grew on the drift plains of Ecoregions to the east. Ecoregions to the west were mostly treeless except along larger streams. Beginning in the nineteenth century, the natural vegetation was gradually replaced by agriculture. Farms are now extensive on the dark, fertile soils of the Central Corn Belt Plains and mainly produce corn and soybeans; cattle, sheep, poultry and hogs are also raised, but they are not as dominant as in the drier Western Corn Belt Plains to the west. Agriculture has affected stream chemistry, turbidity and habitat.

Interior River Valleys and Hills

The Interior River Lowland is made up of many wide, flat-bottomed terraced valleys, forested valley slopes and dissected glacial till plains. In contrast to the generally rolling to slightly irregular plains in adjacent ecological regions to the north, east and west, where most of the land is cultivated for corn and soybeans, a little less than half of this area is in cropland, about 30 percent is in pasture, and the remainder is in forest. Bottomland deciduous forests and swamp forests were common on wet lowland sites, with mixed oak and oak-hickory forests on uplands. Paleozoic sedimentary rock is typical and coal mining occurs in several areas.

North Central Hardwood Forests

The North Central Hardwood Forests ecoregion is transitional between the predominantly forested Northern Lakes and Forests to the north and the agricultural ecoregions to the south. Land use/land cover in this ecoregion consists of a mosaic forests, wetlands and lakes, cropland agriculture, pasture, and dairy operations. The growing season is generally longer and warmer than that of the Northern Lakes and Forests Ecoregion and the soils are more arable and fertile, contributing to the greater agricultural component of land use. Lake trophic states tend to be higher here than in the Northern Lakes and Forests, with higher percentages in eutrophic and hypereutrophic classes.

Northern Forest

The Northern Forest ecoregion is made up entirely of the Mixed Wood Shield Level II Ecoregion in the area crossed by several system alternatives in northern Minnesota. The Mixed Wood Shield region consists mainly of plains with some hills and numerous lakes and wetlands. This area of the Mixed Wood Shield is made up entirely of the Northern Lakes and Forests Level III Ecoregion.

Northern Lakes and Forests

The Northern Lakes and Forests is a region of relatively nutrient-poor glacial soils, coniferous and northern hardwood forests, undulating till plains, morainal hills, broad lacustrine basins, and extensive sandy outwash plains. Soils in this ecoregion are thicker than in those to the north and generally lack the arability of soils in adjacent ecoregions to the south. The numerous lakes that dot the landscape are clearer and less productive than those in ecoregions to the south.

Methodology

Ecoregion data was collected from the Commission for Environmental Cooperation's (CEC) Ecological Regions of North America in GIS shapefile format. Descriptions of ecoregions and distinguishing characteristics were taken from the 1997 CEC Ecological Regions of North America, with supplemental information acquired from USGS (Bryce et. al 1998), the Environmental Protection Agency's Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States (2013).

4.1.3 Land Cover (Maps A-8 and 9)

Construction and operation of a pipeline will affect the land that it crosses. In forested areas, trees and shrubs must be removed and rights-of-way kept clear of such vegetation. In agricultural areas, there would be temporary impacts during construction, but agricultural activities could resume after the pipeline construction is completed. However, construction impacts, including compaction, soiling mixing and impacts to organic farms, farms in rolling topography and prime and unique farmland, can be long-lasting and even permanent. Construction in developed areas can result in displacement of residences and other structures. And construction in wetlands can result in changes to their hydrologic and vegetative character.

All the system alternatives begin in the western portion of North Dakota where the land cover is primarily dominated by agriculture, open grasslands and prairie wetlands. There are dense concentrations of oil wells in the Bakken shale formation where all of the system alternatives begin. As the northern system alternatives extend east and near the central part of Minnesota, the land cover becomes generally an even mix of cultivated lands, wetlands and forests, with many rural residential properties. Within this area there are many small cities as well as numerous medium-sized lakes. As the southern system alternatives extend southeast, the land cover is predominantly planted or cultivated fields. The southern system alternatives also pass through many small to medium size cities. Several of the system alternatives are adjacent to large cities in the Twin Cities metropolitan area and the Chicago area. As all of the system alternatives approach their termination point, population density becomes greater.

Methodology

Land cover data was collected from the 2011 United States Geological Survey (USGS) National Land Cover Data (NLCD). The raster data were converted to polygons and number of acres of each land cover type within each system alternative was developed using spatial analysis tools in ArcGIS. The data evaluated identifies the acres and percentages of land covers for each system alternative.

4.1.4 Water Resources (Maps A-10, 11 and 12)

Water resources include water that flows, like a river or stream, waterbodies, like a lake or impoundment, and wetlands. The location and type of water resources are important to identify as a pipeline could have adverse effects on surface waters. A potential release may affect adjacent and downstream water resources. Temporary impacts to water may occur during construction activities due to soil erosion and stormwater runoff contamination. Permanent impacts from construction could include placement of fill in waterbodies or wetlands which may reduce the quality of these water resources to provide terrestrial and aquatic habitats for flora and fauna. Additionally, the removal of woody vegetation from forested/shrub wetlands during construction and maintenance of the pipeline would alter the wetland type. Figures representing surface water are displayed on Map A-10, and wetland concentrations on Maps A-11 and A-12.

The system alternatives cross four major watersheds: the Missouri, Souris-Red-Rainy, Upper Mississippi and the Great Lakes. The Missouri watershed includes all of portions of Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Iowa and Missouri. The Missouri originates in Montana and flows east for approximately 2,340 miles before entering the Mississippi River north of St Louis, Missouri. The river takes drainage from sparsely populated areas and is a semi-arid watershed. The Missouri River basin is extensively developed for irrigation, flood control and generation of hydroelectric power. All seven system alternatives originate within the Missouri River watershed.

The Souris-Red-Rainy watershed includes portions of North Dakota and Minnesota. The Souris-Red-Rainy watershed is one of the smallest watersheds in the United States and encompasses the main waterways and associated drainages of the Souris, Red and Rainy rivers. All seven system alternatives cross this watershed.

The Upper Mississippi watershed includes portions of Minnesota, Wisconsin, Iowa, Illinois, Missouri and Indiana. All seven of the system alternatives cross the Upper Mississippi watershed. This watershed runs from its headwaters in Itasca State Park to its confluence with the Missouri River in St Louis. The Mississippi River experiences a large volume of agricultural run-off, which has contributed to high levels of nitrogen and phosphorus in the river. All seven system alternatives cross the Mississippi River.

The Great Lakes watershed includes the areas adjacent to the Great Lakes and is the largest surface freshwater system on Earth (when not including the polar ice caps). This watershed includes portions of

Minnesota, Wisconsin, Illinois and numerous other states to the east. Of the large lakes in this watershed, Lake Superior is the closest lake to the system alternatives and has a land drainage area of 49,300 square miles. SA-Applicant, SA-03, SA-06 and SA-07 cross the Great Lakes watershed in far northern Minnesota, just south of Duluth.

All system alternatives cross the Laurentian Divide, which divides the direction of water flow of streams and rivers in the northern United States. North of the divide, waters flow north towards Hudson Bay; south of the divide, waters flow south towards the Mississippi River and the Gulf of Mexico or the Great Lakes and the Atlantic Ocean. Because of the location of the divide, the system alternatives cross headwaters streams (such as the Mississippi River Headwaters) and potentially narrower portions of rivers and streams in this region.

Methodology

Water Resources data included water flowage and waterbody data from the USGS National Hydrography Flowline and Waterbody Database (NHD) and U.S. National Atlas Water Feature Line dataset, impaired streams data from the U.S. Environmental Protection Agency (USEPA) Impaired Streams Database and wetlands data from the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Database. Acres of wetlands and lakes, length of streams, and count of river crossings within each system alternative were developed using spatial analysis tools in ArcGIS.

4.1.5 Special Species and Critical Habitat (Map A-13, Appendix E)

Pipeline construction in areas potentially occupied by special species or critical habitat could adversely impact the viability of the plants or animals. Terrestrial species could be temporarily displaced due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the pipeline. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

As discussed above in the ecoregions section, the system alternatives pass through many ecoregions that encompass a range of landscapes and types of vegetation. Habitat conditions in the area historically included tall and shortgrass prairies, oak-hickory forests and coniferous forests. Today, agriculture and development have widely changed the landscape, and reduced habitat for species that were once common. The majority of the area covered by the system alternatives is used for growing crops and ranging cattle, and does not provide suitable habitat for most rare species, increasing the importance of those that remain.

Federally listed species, species proposed for listing, and designated critical habitats are protected by the Endangered Species Act (ESA), which is administered by the U.S. Fish and Wildlife Service (USFWS).

Section 7 of the ESA (19 United States Code [USC] § 1536(c)), as amended, states that all Federal agencies, in consultation with the USFWS, will determine the effect of actions authorized, funded or carried out by such agencies on any federally listed species or designated critical habitats. Federal agencies must ensure that activities demonstrated to have a federal nexus do not jeopardize the continued existence of a federally-listed species, or result in the destruction or adverse modification of federally-listed designated critical habitat. Section 10 of the ESA allows for non-federal entities, i.e. private citizens and corporations, to proceed with proposed projects and activities that may affect a federally listed species through the development of a Habitat Conservation Plan (HCP), in consultation with the USFWS.

Designated Critical Habitat has been specifically identified as an area which contains the Primary Constitute Elements (PCEs) necessary for a federally protected species to complete part or all of the species' necessary life stages and functions. Appendix E provides further details on the Federal Endangered, Threatened and Candidate Species and the likelihood that they might be impacted.

Methodology

Threatened and endangered species data was collected from the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) (USFWS 2014a). Species information is provided at the county level. No specific location information is provided. An actual route or right-of-way might be able to be placed to avoid areas of concern and would be informed by state-based natural heritage information on threatened and endangered species and critical habitat. Habitat information was taken from the USFWS's Species Fact Sheets (USFWS 2014b). Critical Habitat data was acquired from USFWS in GIS shapefile format.

Critical habitat and species counts within counties crossed by each system alternative were developed using spatial analysis tools in ArcGIS.

4.1.6 Public Resource and Recreational Lands (Map A-14 and 15)

Public resource lands and recreational areas were set aside for the public's use or to protect habitat for plant or animal species. Construction of the pipeline through these areas could impact public use and access, as well as reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline right-of-way, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area. Also included in this section are tribal reservation lands.

Public lands crossed by system alternatives include areas managed by both state and federal agencies. Federally managed recreation areas include national parks, national forests, National Wildlife Refuges (NWRs), National Conservation Areas (NCAs), Wildlife Management Areas (WMAs), and Waterfowl Production Areas (WPAs). Federal recreation areas are designated by Congress and are intended to

conserve, protect and enhance natural areas for the benefit and enjoyment of present and future generations. State designated recreation areas vary by jurisdiction, but can include state parks, state forests, state designated recreation areas, scientific natural areas, trails and conservation areas. Similar to national recreation areas, state designated public lands are set aside as natural resource areas for public uses such as education, hunting and other forms of recreation.

Methodology

Public lands data was collected from natural resource and recreation agencies in the five state and from the U.S Fish and Wildlife Service (USFWS), the U.S. Forest Service and the National Park Service (NPS). Each state has different designations of natural resource and recreation lands. Similar lands were combined across states to allow for a comparison of the system alternatives. Acres and count of each type of public land within each system alternative were developed using spatial analysis tools in ArcGIS.

4.1.7 Cities and Population (Maps A-16 and 17)

As with many types of infrastructure, the concentrations of people or business may make it more difficult to develop a feasible route for the pipeline within the system alternative corridors. The system alternatives primarily cross rural areas; however, populations increase around larger cities such as those in the Twin Cities metropolitan and Chicago areas. During construction, residents in proximity to construction activities may be exposed to short-term increases in construction dust and noise, disruption to traffic patterns, and temporary competition for services during pipeline installation. Where development is most concentrated, a potential pipeline may be more difficult to route without displacing residences, other buildings and infrastructure. Potential releases related to spills or leaks may affect more people in areas of denser development.

Methodology

The 2010 U.S. Census Bureau data and estimates were accessed to gather information on existing demographics and population conditions in the states crossed by the system alternatives. Data was collected by census block group, city and census designated place. Recent Aerial photography was used to verify locations and development patterns. The density of population within each system alternative was developed using spatial analysis tools in ArcGIS.

4.1.8 Community Features (Map A-18)

Community features, such as schools, medical centers, churches, fire stations, police stations and transportation networks (airports, roads), serve the daily needs of residents in their community. These community features are scattered throughout each of the system alternatives in rural areas. Clusters of schools and fire stations are located within the 2 mile wide corridors and adjacent to the larger cities.

Construction of a pipeline may temporarily affect access to these features and the services they provide. Communities also might desire to maximize the distance of a pipeline from these features. In addition, areas with a minimal road network may make access to the pipeline in case of an emergency more difficult.

Methodology

The data used to establish baseline community features was derived from a variety of federal, state and local sources. Data for emergency services was collected from the USGS National Structures Datasets (NSD), cemeteries and church data were derived from ESRI, highway data was derived from USGS TIGER data, airports were from the FAA's National Flight Data Center and schools were acquired from the individual state databases. Counts of the features within each system alternative were developed using spatial analysis tools within ArcGIS.

4.1.9 Cultural Resources (Map A-19 and 20)

Pipeline construction and operation may adversely affect cultural resources sites that are near the pipeline route. Noise and vibration from the construction and visual impacts may affect architectural properties.

The National Historic Preservation Act (Public Law 102-575) defines the term "historic property" to include districts, sites, buildings, structures, landscapes and objects included in or eligible for the National Register of Historic Places (NRHP). The NRHP includes National Historic Landmarks, National Monuments and National Historic Sites. The data presented for each system alternative represents those properties currently listed and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted. It also does not include properties *eligible* for listing or *considered eligible*.

Analysis of state historic preservation office data, which typically includes literature and records searches pertaining to archeological and architectural surveys and sites, is not included in this review. Pre-European contact archaeological sites are often located on prominent elevations and near major water features such as lakes and rivers. Other types of cultural resources, such as historic landscapes and places of traditional religious or spiritual significance could be located anywhere within the two-mile-wide corridor.

Methodology

The NRHP, a publicly available database from the National Park Service (http://www.nps.gov/nr/research/), was accessed to gather information on known historic places. The data only includes architectural properties currently listed on the NRHP and does not include

archaeological sites as their location is not provided in the NRHP. Counts of the Architectural sites within each system alternative were developed using spatial analysis tools within ArcGIS.

4.1.10 Contaminated Areas (Map A-21 and 22)

Pipeline construction adjacent to or crossing known contaminated sites could disturb the site and cause further spread of contamination. Pipeline construction in contaminated area may also require special handling for contaminated media and pose worker-safety issues.

Contaminated sites are areas where a release of hazardous wastes or petroleum products into the surrounding environment (i.e. soil and groundwater) has occurred. The U.S. Environmental Protection Agency (USEPA) has identified uncontrolled hazardous waste sites throughout the country that pose the greatest risk to human health and the environment. These sites are placed on the National Priorities List (NPL) and the USEPA works in conjunction with state and local agencies to establish and implement appropriate clean-up plans at the identified sites. Contaminated properties identified on the NPL are often referred to as Superfund sites.

Smaller-scale contaminated sites that involve hazardous waste and petroleum products exist throughout the system alternative corridors. These sites can range from minor gasoline or diesel spills and cleanup to much larger sites that involve offsite migration of contaminants. Contamination at these sites is typically more localized and poses a lesser environmental hazard than a NPL site. The tables in each system alternative's Contaminated Areas section summarize the number of potentially contaminated properties that are located within each system alternative corridor. This table is not intended to identify all the contaminated properties present within the system alternatives. The following are definitions of the listing types used to categorize potentially contaminated properties that occur along the system alternatives:

- **Brownfields Property**
  Includes properties where expansion, redevelopment , or reuse of a site is complicated by the presence or potential presense of a hazardous substance, pollutant or contaminant.
- **Compliance Activity**
  Listings that are included in the Permit Compliance System (PCS) and Integrated Compliance Information System (ICIS) databases, as well as state equivalents.
- **Enforcement Activity/Compliance Activity**
  Listings in the ICIS Federal Enforcement and Compliance (FE&C) database and state equivalents. These listings involve inspection and enforcement actions relating to environmental laws (i.e. Clean Water Act or Toxic Substances Control Act)
- **Enforcement Action**
  Listings under this category have been subject to enforcement action relating to violation of an environmental law.

- **Leaking Underground Storage Tank-ARRA**
  This category includes leaking under ground storage tank listings that were funded by the American Recovery and Reinvestment Act (ARRA).
- **Superfund (Non-NPL)**
  This category includes sites in the USEPA Superfund program in cooperation with individual states and tribal governments. Non-NPL sites are lower priority sites (as designated by the USEPA) than those listed on the National Priorities List.

Methodology

To provide a consistent evaluation across all states, data was collected from the USEPA Facility Registration Service (FRS). This exchange network is a partnership among states, tribes, territories and the USEPA to facilitate the exchange of environmental information throughout the country. The FRS database integrates more than 80 USEPA and state databases into one database. All states crossed by the system alternatives provide state database information to the FRA database, with the exception of South Dakota. Only USEPA program data for South Dakota is included at this time.

This section focused on the nation's most contaminated properties (National Priorities List) in the area and other listings that may indicate that contamination is likely. Counts of the sites within each system alternative were developed using spatial analysis tools within ArcGIS.

4.1.11 Air Emissions

Air quality is a resource that is important to human health, as well as the natural and built environments. The United States Environmental Protection Agency (USEPA) implements the Clean Air Act to reduce air pollution levels across the country. One aspect of the Clean Air Act is the National Ambient Air Quality Standards (NAAQS) developed for the six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, ozone and lead). The NAAQS are set at levels that EPA has determined will protect human health, public welfare, plants and animals, and structures. The impact that a project will have on ambient air quality is an important consideration, especially for projects that will impact areas with an existing air quality impairment (i.e., areas that have been found to not be attaining one or more NAAQS). Areas that have ambient concentrations of a given pollutant that are less than the respective NAAQS are classified as "attainment" for that pollutant. Areas that have ambient concentrations of a given pollutant that are greater than the respective NAAQS are classified as "nonattainment" for that pollutant.

Methodology

Project-impact county air quality status (i.e., attainment/nonattainment) was collected from the USEPA's website titled "The Green Book Nonattainment Areas for Criteria Pollutants." The Green Book

website serves as a public access to the country's air quality status that is officially listed in 40 CFR Part 81.

4.1.12 High-Consequence Areas and Natural Disaster Hazard Areas (Maps A-23 through 27)

The consequences of an inadvertent release of product (natural gas, crude oil, refined products, etc.) from a pipeline can vary, depending on where the release occurs and the product involved. These releases may adversely affect human health and safety, adversely affect the environment, and damage personal property. In order to identify specific areas and features where a release may have the most significant adverse effects, federal pipeline safety regulations use the concept of "High Consequences Areas" (HCAs), to identify areas and features where a release may have the most significant adverse consequences. When these areas are identified, the operator of a pipeline is required to devote additional resources and analysis to maintaining integrity of the pipeline.[49]

Because potential consequences of natural gas and hazardous liquid pipeline release differ, criteria for HCAs are also different. HCAs for natural gas focus only on populated areas. The identification of HCAs for hazardous liquid pipelines includes:[50]

- ***Populated areas*** include both high population areas (called "urbanized areas" by the U.S. Census Bureau) and other populated areas (areas referred to by the Census Bureau as a "designated place").
- ***Drinking water sources*** include those supplied by surface water or wells and where a secondary source of water supply is not available. The land area in which spilled hazardous liquid could affect the water supply is also treated as an HCA.
- ***Unusually sensitive ecological areas*** include locations where critically imperiled species can be found, areas where multiple examples federally listed threatened and endangered species are found, and areas where migratory water birds concentrate.

In addition, U.S. Department of Transportation's (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) identifies Natural Disaster Hazard Zones as areas that present a higher risk of failure in the event of a flood or landslide. These Natural Disaster Hazard Zones are defined as being Low, Medium or High risk.

Methodology

HCA data on populated areas and flood and landslide hazard data were collected from U.S. Department of Transportation's (USDOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) National

[49] U.S. DOT, PHSMA "Fact Sheet: High Consequences Areas (HCA)."
[50] Ibid.

Pipeline Mapping System. Drinking water and ecological HCAs data were provided by Enbridge Energy as access to these data are restricted to the general public.

Counts of the areas and acres within each system alternative were developed using spatial analysis tools within ArcGIS.

4.2 SA-Applicant

System Alternative-Applicant is approximately 615 miles in length and crosses the states of North Dakota and Minnesota. This system alternative travels east out of Tioga North Dakota and parallel's Enbridge's existing pipeline. The system alternative crosses in to Minnesota south of Grand Forks to just west of Clearbrook, Minnesota (where a new terminal is being proposed). It then follows an existing pipeline corridor south to just north of Park Rapids, Minnesota. It then turns generally east following existing electric transmission lines or other linear features for much of the way before it terminates in Superior, Wisconsin. System Alternative -08 and the SA-Applicant are almost equal in length

4.2.1 Geology/Soils/Groundwater

Geology, soil types and groundwater aquifers for SA-Applicant are represented in Maps A-3, 4, 5 and 6.

Geology

The majority of SA-Applicant is underlain by glacial deposits overlying bedrock, most prominent being Precambrian in origin. The table below identifies the uppermost bedrock types crossed by SA-Applicant.

Shallow bedrock or bedrock outcrops could be impacted by pipeline construction if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Table 4-1 Bedrock Geology – SA-Applicant

Precambrian bedrock underlies the majority of SA-Applicant.			
Geologic Era	Geologic Description	Acres in the SA-Applicant	Percentage of SA-Applicant
Precambrian	Archean gneiss	115,209	14.63%
	Archean granitic rocks	119,334	15.15%
	Early Proterozoic sedimentary rocks	139,222	17.68%
	Middle Proterozoic sedimentary rocks	8,664	1.10%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	15,129	1.92%
Mesozoic	Cretaceous sedimentary rocks	253,860	32.23%
Cenozoic	Paleogene sedimentary rocks	117,730	14.95%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

Soils

SA-Applicant includes 12 Major Land Resource Areas (MLRAs), with four covering more than 10 percent of the area (Table 4-2 and Map A-4). MLRA 55A has a gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 56 is a nearly level lake plain with gravely beech ridges and dunes. Mollisols and Vertisols dominate the soil orders; both are deep and poorly drained. MLRA 57 includes a complex pattern of moraines, outwash plains, drumlins, lake plains and drainages. Lakes, ponds and marshes are common. Alfisols, Entisols and Histosols dominate the soil orders. Soils tend to be very deep and generally are sandy to loamy. MLRA 90A is gently undulating to rolling, with numerous glacial features such as moraines and drumlin fields. A number of soil orders are present from forested Spodosols to organic Histosols. Soils are shallow to deep and excessively to poorly drained.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape and soil characteristics in each MLRA (USDA 2006).

More than 12 percent of soils have limitations with regard to shallow bedrock related issues, primarily in northeast Minnesota. Soils that are shallow or have bedrock near the surface may require careful routing and alternative construction techniques. Approximately 16 percent have shrink/swell issues; these are concentrated in the Red River Valley. Soils that have shrink/swell characteristics may require alternative designs and maintenance to ensure the stability of the pipe. More than 70 percent of the soils in Applicant SA have essentially no limitations for construction.

Table 4-2 Major Land Resource Areas (MLRAs) – SA-Applicant

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-Applicant	Percentage of SA-Applicant
53B	Central Dark Brown Glaciated Plains	-	62,313	8.1
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.7
55A	Northern Black Glaciated Plains	-	232,259	30.2
55B	Central Black Glaciated Plains	-	35,584	4.6
56	Red River Valley of the North	Shrink swell	124,278	16.2
57	Northern Minnesota Gray Drift	-	129,283	16.8
88	Northern Minnesota Glacial Lake Basins	-	31,043	4.0
90A	Wisconsin and Minnesota Thin Loess and Till, Northern Part	Shallow/bedrock	79,854	10.4
91A	Central Minnesota Sandy Outwash	-	46,227	6.0
92	Superior Lake Plain	Shallow/bedrock	7,852	1.0
93A	Superior Stony and Rocky Loamy Plains and Hills, Western Part	Shallow/bedrock	1,030	0.1
102A	Rolling Till Prairie	-	13,734	1.8
Total			**769,147**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-Applicant has a mix of hydraulic conductivity rates in the surficial soils, with 78 percent rated High, and the remaining portion nearly equally divided into the Low and Moderate ranges (Table 4-3). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-3 Relative Hydraulic Conductivity Ratings – SA-Applicant

Hydraulic Conductivity Range	Percentage of Area
Low	10
Medium	12
High	78
Total	100

Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Groundwater

Groundwater for drinking water, potable water, industrial and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout the SA-Applicant. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers (that lack any or adequate glacial cover) would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

More than 65 percent of principal bedrock aquifers within SA-Applicant occur in Archean bedrock units. These aquifers typically have lower permeability than overlying unconsolidated material and other bedrock types. Table 4-4 summarizes the principal bedrock aquifers that are used as water supply sources along SA-Applicant corridor. Section 4.1 provides background information on groundwater.

Table 4-4 Principal Bedrock Aquifer Systems – SA-Applicant

More than 65 percent of principal bedrock aquifers within SA-Applicant occur in Archean bedrock units.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-Applicant by State Crossed	Bedrock Type (Associated with Principal Aquifers)	Percent Acres of Aquifer in SA-Applicant by State
Cambrian-Ordovician aquifer system	Minnesota	9,333.63	Early Proterozoic sedimentary rocks	1.19%
Lower Cretaceous aquifers	Minnesota	9,483.77	Early Proterozoic sedimentary rocks	1.20%
	North Dakota	12,766.57	Cretaceous sedimentary rocks	1.62%
Lower Tertiary aquifers	North Dakota	116,153.87	Paleogene sedimentary rocks	14.75%
Other rocks	Minnesota	364,711.18	Archean gneiss	46.31%
	North Dakota	153,989.54	Archean granitic rocks	19.55%
Paleozoic aquifers	Minnesota	45.16	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	0.01%
	North Dakota	13,466.64	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	1.71%
Upper Cretaceous aquifers	North Dakota	89,196.28	Cretaceous sedimentary rocks	11.32%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands

Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

SA-Applicant encounters the following six aquifer types represented on Map A-6:

Cambrian-Ordovician Aquifer System
The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois and portions of Minnesota. The portion of this aquifer system that extends from southeastern Minnesota up toward Duluth, Minnesota, and Superior, Wisconsin, is represented by the Precambrian Hinckley Sandstone. This unit is hydraulically connected to the younger Cambrian bedrock and is, therefore, included with this aquifer system.

Lower Cretaceous Aquifers
Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers
Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-Applicant. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks
This aquifer is present throughout a large portion of SA-Applicant corridor in Northern Minnesota and Eastern North Dakota and categorized as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Paleozoic Aquifers
In SA-Applicant, Paleozoic aquifers subcrop beneath glacial deposits in northeastern North Dakota. These aquifers are composed mostly of limestone and dolomite, which are the most productive, but Paleozoic sandstones also yield water.

Upper Cretaceous Aquifers
Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-Applicant. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is

interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

4.2.2 Ecoregions

The majority of SA-Applicant crosses the Great Plains and Northern Forests ecoregions. Most of the area has been converted to agriculture or developed, with the exception of the Mixed Wood Shield of the Northern Forests. SA-Applicant crosses four Level II and six Level III ecoregions, as shown in the Table 4-5. SA-Applicant starts in the Great Plains ecoregion, briefly crosses through the Eastern Temperate Forest, and ends in the Northern forest (Map A-7).

Table 4-5 Miles of Applicant SA by Ecoregion

The majority of SA-Applicant crosses the Great Plains and Northern Forests ecoregions.					
Level I		Level II		Ecoregion Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	354	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	304	Northern Glaciated Plains	198
				Lake Agassiz Plain	106
Eastern Temperate Forests	41	Mixed Wood Plains	41	North Central Hardwood Forests	41
Northern Forests	174	Mixed Wood Shield	174	Northern Lakes and Forests	174
Total Miles					**569**

Source: USEPA, Ecoregions of the United States, 2013

Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions. This portion of the West-central Semi-arid Prairies is made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. This portion of the Temperate Prairies consists of the Northern Glaciated Plains and the Lake Agassiz Plain. The portion of the Eastern Temperate Forest crossed by SA-Applicant is made up entirely of the North Central Hardwood Forests. Finally, the system alternative crosses the Northern Forest region within the Mixed

Wood Shield Level II Ecoregion and the Northern Lakes and Forests Level III Ecoregion. For a description of Ecoregions see Section 4.1.

4.2.3 Land Cover

SA-Applicant traverses through three states, a total of 21 counties, 14 cities and more than 600 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, mainly herbaceous vegetation to agriculture to deciduous forests from west to east along the system alternative.

Starting at the west end of the system alternative and moving east, the land cover is dominated by agriculture, open grasslands and prairie wetlands. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams County, as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses east there are higher concentrations of grassland/herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. Continuing east, the land cover becomes mainly cultivated crops. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads.

The majority of land cover in SA-Applicant is cultivated, forest or wetland as illustrated in the Table 4-6. As the system alternatives crosses the Red River into Minnesota, the land use continues to be agricultural with scattered farmsteads in Polk and Red Lake counties. As the corridor extends east and nears the central part of the state, the land cover becomes mostly forests and wetlands, with many rural residential properties. Within this area there is a heavy concentration of medium- to large-sized lakes and lake chains. As the corridor approaches the Superior Terminal in the Superior area, the land use becomes urban, where it is heavily developed with residential and industrial uses.

Table 4-6 Land Cover – SA-Applicant

The majority of land cover in SA-Applicant is cultivated, forest or wetland.		
Land Cover	Acres	Percent
Barren	424	0.06%
Developed	32,355	4.2%
Forest	144,315	18.8%
Herbaceous	86,505	11.2%
Planted/Cultivated	363,381	47.2%
Shrubland	13,717	1.8%
Water	21,081	2.7%
Wetlands	107,367	13.9%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.2.4 Water Resources

Water resources located within in the SA-Applicant corridor include rivers, streams, lakes, ponds and wetlands (Map A-10). SA-Applicant includes portions of 75 named streams, some of which are divided into several segments or cross the corridor multiple times for a total of 615 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 2,049.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east, rivers crossing SA-Applicant include the White Earth, Des Lacs, Souris, Turtle and Red Rivers in North Dakota, and the Red Lake, Mississippi, Crow Wing, Willow, Sandy, Kettle and Moose in Minnesota. Of these streams or other flowages, the largest is the Mississippi River. SA-Applicant is one of two system alternatives that cross the Mississippi River twice: once in Clearwater County and again in Aitkin County, Minnesota. The width of the Mississippi River and associated riparian wetland area where SA-Applicant crosses is approximately 30 feet and 250 feet, respectively. These are the two narrowest crossings of the river by any system alternative.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-Applicant crosses approximately 50 impaired river or stream segments.

SA-Applicant includes all or portions of 119 named lakes. The corridor also includes numerous unnamed water bodies, bringing the total of water bodies to 3,397. Water bodies include intermittent or perennial lakes and ponds, swamps and marshes. SA-Applicant crosses through areas with a high concentration of water bodies in Ward, Pierce, Benson and Ramsey counties in North Dakota, and Hubbard and Cass counties in Minnesota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant in places within SA-Applicant corridor, especially in Ramsey County, North Dakota, and Clearwater, Wadena, Morrison, Crow Wing, Aitkin and Carlton counties, Minnesota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the system alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub and pond), lacustrine (lake), riverine and other. The NWI dataset combines the forested and scrub shrub wetlands into the "forested/shrub" wetland type as

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

these wetlands are similar in that they support woody vegetation. The table below describes the acres of each type of wetland within SA-Applicant.

Table 4-7 Wetland Types – SA-Applicant

Wetlands make up over 13 percent of the SA-Applicant and forested/shrub wetlands make up 7.3 percent		
Wetland Type	Acres	Percentage of SA-Applicant
Forested/Shrub	57,769	7.3%
Emergent	47,010	6.0%
Lake[1]	10,345	1.3%
Pond[1]	3,517	<1%
Riverine	1,154	<1%
Other	4	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as waterbodies referenced in the paragraph above.

SA-Applicant crosses numerous watercourses, waterbodies and wetlands. There are several areas within the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline.

4.2.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-Applicant corridor: three endangered species, four threatened species, one candidate species, one proposed endangered, and one proposed threatened species. Table 4-8 describes these species, their current federal listing status, and counties crossed by SA-Applicant where they are known to or believed to occur. For one of the endangered species, the pallid sturgeon, the system alternative is located in the species' counties of occurrence but does not cross any of the streams where the endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-8 Endangered Species Act Listed Species Potentially within SA-Applicant

Counties crossed by SA-Applicant include 10 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Mountrail, Williams
Piping plover	*Charadrius melodus*	Threatened	Shoreline • Breeds on open, sparsely vegetated sand or gravel beaches adjacent to alkali wetlands, and on beaches, sand bars, and dredged material islands of major river systems and Great Lakes Shorelines	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward, Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward, Williams, **Minnesota:** *County level range not defined in MN*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Pierce, Ramsey, Towner, Ward, Williams **Minnesota:** Polk
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Ward, Williams

Counties crossed by SA-Applicant include 10 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Fishes				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**North Dakota:** Mountrail, Williams
Flowering Plants				
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**Minnesota:** Polk, Red Lake
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Pierce, Ward **Minnesota:** Polk
Mammals				
Canada lynx	*Lynx canadensis*	Threatened	Boreal Forests • Require high snowshoe hare densities. • Associated with moist, cool, boreal spruce-fir forests with rolling terrain.	**Minnesota:** Aitkin, Carlton, Cass, Clearwater
Northern long-eared bat	*Myotis septentrionalis*	Proposed endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Ward, Williams **Minnesota:** Aitkin, Becker, Carlton, Cass, Clearwater, Crow Wing, Hubbard,

Counties crossed by SA-Applicant include 10 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			may also roost in cooler places, like caves and mines.	Polk, Red Lake, Wadena

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

The system alternative also crosses critical habitat for one listed species and proposed critical habitat for two listed species. SA-Applicant crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover (Map A-13). Critical habitat was designated for the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638) and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, North Dakota and South Dakota. SA-Applicant crosses the piping plover critical habitat in Mountrail County, North Dakota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.2.6 Public Resource and Recreational Lands

The review of public lands and recreation areas showed that SA-Applicant crosses numerous federal and state-managed public recreation areas in North Dakota and Minnesota as noted in Table 4-9 and Maps A-14 and A-15. The majority of potential impacts occur in counties with high concentrations of public lands including Mountrail, Ward, Pierce, Ramsey and Nelson in North Dakota, and Polk, Clearwater, Hubbard, Cass, Aitkin and Carlton in Minnesota.

Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

North Dakota

East of Tioga Beaver Creek Station, SA-Applicant passes through a concentration of national WMAs, federally managed WPAs, and state-managed Working Lands Program properties in Mountrail and Ward counties. Continuing East into central Ward County, the system alternatives touches the lower portion

of the Upper Souris National Wildlife Refuge. SA-Applicant approaches another cluster of WPAs and WLPs in eastern Pierce County, and passes just north of the Lake Alice National Wildlife Refuge in Ramsey County. A mix of Private Land Open to Sportsmen (PLOTS) designated lands and several small NWRs are common throughout eastern Ramsey County and Nelson County, but most public lands in Grand Forks County are located north of the system alternatives.

Minnesota

As the system alternative traverses Minnesota, it passes near the Glacial Ridge National Wildlife Refuge and a cluster of WMAs, WPAs, and Scientific and Natural Areas in Polk County. Public lands in Clearwater County are sparse until the system alternatives reached the southern part of the county where it crosses the White Earth State Forest and the Mississippi Headwaters State Forest. In Hubbard County, SA-Applicant includes portions of Itasca State Park, Paul Bunyan State Forest, Huntersville State Forest, and Badoura State Forest. Continuing into Cass and Aitkin counties, the system alternatives crosses the Foot Hills, Land O'Lakes, Waukenabo, Hill River, and Savannah state forest. In Carlton County, SA-Applicant crosses Fond Du Lac State Forest and Jay Cooke State Park before reaching the Superior Terminal.

Table 4-9 Public Resource and Recreational Lands – SA-Applicant

SA-Applicant includes Federal Waterfowl Production Areas, North Dakota Wildlife Areas and Minnesota State Forests.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife Service-National Wildlife Refuge	2	57
	Waterfowl Production Area	12	1,691
North Dakota	State Wildlife Areas-PLOTS lands	29	3,419
Minnesota	State Park	2	2,494
	State Forest	12	39,650
	State Recreation Area	1	15
	Conservation Areas-BWSR	8	365
	Natural Areas-Scientific and Natural Area	0	0
Total		**66**	**47,691**

Sources: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish, and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

4.2.7 Cities and Population Density

The mostly rural character of SA-Applicant is evident in the relatively low population density for both North Dakota and Minnesota (see Table 4-10). The population density pattern (an indicator of the extent of development) across SA-Applicant is very light in North Dakota, and stays light as the system alternative continues eastward across north central Minnesota. There are 14 cities partially or totally within the system alternatives corridor (Maps A-16 and A-17).

Table 4-10 Population Density and Cities – SA-Applicant

SA-Applicant includes 14 cities, the majority of which are small.			
	ND	**MN**	**Corridor**
Average Persons per Sq Mile	8	11	13
Number of cities	7	7	14
Cities >1000	2	2	4

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

Seven North Dakota cities are located within SA-Applicant corridor; two of the seven cities have populations greater than 1,000 persons. The cities range in size from 98 persons (the cities of Ross and Deering) to 1,469 persons (the city of Stanley in Mountrail County). The Minot Air Force Base is a census designated place[51] (CDP) with a population of 5,521. It is located 13 miles north of Minot, and is north of and adjacent to the SA-Applicant. Portions of the military facilities are within the system alternative boundary. There are also small unincorporated towns scattered throughout the system alternative.

In general, SA-Applicant corridor is sparsely populated and primarily rural in character. The city of Grand Forks (approximately 53,000 people within the city and more than 90,000 people including the surrounding areas[52]) is the only urban area near SA-Applicant. SA-Applicant is approximately two miles south of the city, which is located on the North Dakota-Minnesota border in Grand Forks County.

[51] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

[52] "2010 Census Redistricting Data (Public Law 94-171) Summary File". *American FactFinder*. United States Census Bureau. Retrieved 2 May 2011.

Minnesota

Seven Minnesota cities are located within SA-Applicant corridor. Two of the seven cities in Minnesota have populations greater than 1,000 persons: Bagley and Crookston. Populations range from 167 (the city of Palisade) to 7,891 persons (Crookston, Polk County). The corridor crosses a small portion (approximately three acres) of the northern edge of Crookston. The corridor crosses the eastern portion of Bagley as the corridor follows an existing pipeline.

The system alternative corridor crosses counties that are large in area, but which have limited development associated with lake shorelines, highways and former rail corridors, and which contain large wooded and wetland areas with no permanent residences. Generally the SA-Applicant corridor is located away from population centers and residential areas as it traverses northern Minnesota.

4.2.8 Community Features

SA-Applicant is largely rural, with community features typically concentrated in or near cities (Map A-18). The number and types of community of features are summarized in the below (Table 4-11).

North Dakota

Two airports are within this system alternatives: Rugby Public in Pierce County and a private facility in Towner County. Scattered throughout the system alternatives there are 10 cemeteries and three churches. Three fire stations are located within the system alternatives in Berthold, Deering and Emerado. Emergency services include a hospital in Stanley and an ambulance service in Berthold. Minot Air Force base is partially located within the system alternatives and Grand Forks Air Force Base is located less than one mile north of the system alternatives. One police station, in Emerado, is located within the system alternatives. Emerado has an elementary school, and an elementary school and high school are located in Berthold.

The main highways crossed by SA-Applicant are Interstate 29, US 2, US 52, US 83 and US 81.

Minnesota

Two airports are within the system alternatives: Bagley Municipal in Clearwater County and a private airport in Hubbard County. Scattered throughout the system alternatives there are 17 cemeteries and eight churches. Five fire stations are located within the system alternatives in Mahtowa, Wrenshall, Washburn Lake, Clearbrook and Bear Creek. Four schools are located in the system alternatives: one each in Bagley and Palisade, and two in Wrenshall.

The main highways crossed by SA-Applicant are Interstate 35, US 2, 71, US 169, US 59 and US 75.

Table 4-11 Community Features – SA-Applicant

SA-Applicant is largely rural with few community features.									
	Airports	**Amtrak**	**Cemeteries**	**Churches**	**Fire stations**	**Hospitals**	**Military base**	**Police station**	**Schools**
North Dakota	2	0	10	3	3	2	1	1	3
Minnesota	2	0	17	8	5	0	0	0	4
Total	**4**	**0**	**27**	**11**	**8**	**2**	**1**	**1**	**7**

Source: USGS TNM - National Structures Dataset

4.2.9 Cultural Resources

National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are two historic properties and one historic district (Itasca State Park) listed on the NRHP within SA-Applicant (see Table 4-12).

Table 4-12 National Register of Historic Places Properties – SA-Applicant

SA-Applicant includes three listed historic properties.			
Resource Name	**State**	**County**	**NRHP ID**
Elliott Bridge	North Dakota	McHenry	97000181
Itasca State Park	Minnesota	Clearwater	73000972
Church of St. Peter	Minnesota	Polk	82002994

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Similar to other system alternatives, known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites such as rock art, rock alignments and stone circles, are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes and the Red River of the North and Mississippi River, and their tributaries.

4.2.10 Contaminated Areas

Nationally registered contaminated sites, such as those on the National Priorities List, pose the greatest environmental risk. No NPL sites were identified in SA-Applicant.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are typically concentrated near higher populated cities and where industrial and commercial activity is more prevalent.

Table 4-13 below summarizes the number of potentially contaminated properties that are located within SA-Applicant.

Table 4-13 Potentially Contaminated Properties – SA-Applicant

16 of 17 SA-Applicant listings are in North Dakota.		
Listing Type	State	Number of Sites within SA-Applicant
Compliance Activity	North Dakota	1
Enforcement/Compliance Activity	North Dakota	10
Formal Enforcement Action	North Dakota	5
Leaking Underground Storage Tank (as defined by the American Recovery and Reinvestment Act)	Minnesota	1
Total		**17**

Source: U.S. EPA, Facility Registration Service, 2014

4.2.11 Air Emissions

Construction and operation of Applicant SA would result in direct and secondary affects to air quality. The effect of the construction and operation in SA-Applicant would be expected to be insignificant.

All of the counties in North Dakota and Minnesota through which the Applicant SA would be constructed and operated are designated as attainment or unclassifiable/attainment for pollutants subject to

National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead.

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality.

Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. As represented by NDPC, the Clearwater terminal will be permitted with estimated emissions of 24 tons per year of VOC. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions.

4.2.12 High-Consequence Areas and Natural Disaster Hazard Areas

SA-Applicant largely avoids populated areas and thus crosses few areas designated as High Consequence Areas (HCAs) by the USDOT PHMSA for population or drinking water. However, SA-Applicant does cross a number of ecological HCAs as it crosses through state and federal resource lands in Minnesota.

SA-Applicant crosses 18 populated areas designated as High Consequence Areas (HCAs) by the USDOT PHMSA. SA-Applicant crosses one high population area (HPA), Duluth, covering 1,600 acres, and 17 other population areas (OPA), covering 5,219 acres (Map A-23). Approximately 46 percent of the area of OPA HCAs is located in Mahtowa, Minnesota, south of Duluth. Other OPA HCAs are scattered throughout the system alternative.

SA-Applicant crosses 26 drinking water HCAs covering approximately 1,105 acres and 65 ecological HCAs covering 22,229 acres (Maps A-24 and A-25). The drinking water HCAs are scattered throughout with no one drinking water HCA being larger than 150 acres. The ecological HCAs are concentrated, located near existing state and federal resource lands, particularly in Mountrail County in North Dakota and Hubbard, Cass, and Aitkin counties in Minnesota.

For flood hazard, Medium risk zones cover approximately 12.9 percent of the SA-Applicant, while High risk zones cover 5.5 percent (Map A-26). High flood hazard risk areas are concentrated where the system alternative crosses larger rivers such as the Red River of the North and the Mississippi River. Medium and High risk areas are concentrated in the Red River Valley and at crossings of larger rivers such as the White Earth in western North Dakota and the Mississippi and Moose rivers in Minnesota.

For landslide hazard, Medium risk zones cover approximately 28.2 percent of the SA-Applicant, while High risk covers 1.6 percent (Map A-27). Landslide hazard areas are generally west of the Red River

Valley in North Dakota. Medium risk areas are concentrated in central and eastern North Dakota, while the High risk areas are concentrated at the far western section of the system alternative.

4.3 SA-03 Viking-North Branch-Superior

System Alternative-03 is approximately 700 miles in length and crosses the states of North Dakota and Minnesota. SA-03 begins in Tioga, North Dakota, and follows SA-Applicant route east into Minnesota. Just west of Crookston, Minnesota, it turns south and follows the Viking Pipeline. In Clay County, Minnesota, it continues southeast following the Viking Pipeline toward North Branch, Minnesota. It then turns north to Superior, Wisconsin, following existing pipeline corridors.

4.3.1 Geology/Soils/Groundwater

Geology, soil types and groundwater aquifers for SA-03 are represented in Maps A-3, 4, 5 and 6.

Geology

The majority of SA-03 is made up of glacial deposits overlying bedrock, most prominent being Precambrian of origin. The table below identifies the uppermost bedrock types crossed by SA-03.

Table 4-14 Bedrock Geology – SA-03

The majority of SA-03 is underlain by Precambrian Bedrock.			
Geologic Era	Geologic Description	Acres in SA-03	Percentage of SA-03
Precambrian	Archean gneiss	207,535	23.57%
	Archean granitic rocks	51,841	5.89%
	Early Proterozoic granitic rocks	25,918	2.94%
	Early Proterozoic sedimentary rocks	60,113	6.83%
	Middle Proterozoic sedimentary rocks	58,939	6.69%
	Middle Proterozoic volcanic rocks	3,904	0.44%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	82,214	9.34%
Mesozoic	Cretaceous sedimentary rocks	253,860	28.83%
Cenozoic	Paleogene sedimentary rocks	117,730	13.37%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

Shallow bedrock or bedrock outcrops could be impacted by the pipeline if blasting or removal of the bedrock substratum were to occur.

Soils

SA-03 includes 12 Major Land Resource Areas (MLRAs), with three covering more than 10 percent of the area (Table 4-15). MLRA 55A has a gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 56 is a nearly level lake plain with gravely beech ridges and dunes. Mollisols and Vertisols dominate the soil orders; both are deep and poorly drained. MLRA 90A is gently undulating to rolling, with numerous glacial features such as moraines and drumlin fields. A number of soil orders are present, from forested Spodosols to organic Histosols. Soils are shallow to deep and excessively to very poorly drained.

Just over 20 percent of SA-03 soils, concentrated in northern Minnesota, have limitations with regard to shallow bedrock related issues. Approximately 17 percent have shrink/swell issues; these are concentrated in the Red River Valley.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape and soil characteristics in each MLRA (USDA 2006).

Table 4-15 Major Land Resource Areas (MLRAs) – SA-03

More than 60 percent of the soils in SA-03 have essentially no limitations for construction				
MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-03	Percentage of SA-03
53B	Central Dark Brown Glaciated Plains	-	62,313	7.2
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.7
55A	Northern Black Glaciated Plains	-	232,259	26.9
55B	Central Black Glaciated Plains	-	35,584	4.1
56	Red River Valley of the North	Shrink swell	144,192	16.7
57	Northern Minnesota Gray Drift	-	50,810	5.9
90A	Wisconsin and Minnesota Thin Loess and Till, Northern Part	Shallow/bedrock	116,450	13.5
90B	Wisconsin and Minnesota Thin Loess and Till, Southern Part	Shallow/bedrock	50,310	5.8
91A	Central Minnesota Sandy Outwash	-	82,806	9.6
91B	Wisconsin and Minnesota Sandy Outwash	-	40,749	4.7

More than 60 percent of the soils in SA-03 have essentially no limitations for construction				
MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-03	Percentage of SA-03
92	Superior Lake Plain	Shallow/bedrock	7,852	0.9
102A	Rolling Till Prairie	-	33,039	3.8
Total			**862,053**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-03 has a mix of hydraulic conductivity rates in the surficial soils, with 70 percent of the area rated High, followed by 18 percent rated Medium, as noted in the table below (**Error! Reference source not found.**). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-16 Relative hydraulic conductivity ratings – SA-03

Hydraulic Conductivity Range	Percentage of Area
Low	12
Medium	18
High	70
Total	100

Source: Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Groundwater

Groundwater for drinking water, potable water, industrial, and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout the System Alternative-03. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers (that lack any or adequate glacial cover) would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

A majority of SA-03 crosses Archean aquifers, which are concentrated in Northern Minnesota.

Table summarizes the uppermost principal bedrock aquifers that are used as water supply sources along the SA-03 corridor.

Table 4-17 Principal Bedrock Aquifer Systems – SA-03

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-03.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-03 by State Crossed	Bedrock Type (Associated with Principal Aquifer)	Percent Acres of Aquifer in SA-03 by State
Cambrian-Ordovician aquifer system	Minnesota	112,604.90	Early Proterozoic granitic rocks	12.79%
Lower Cretaceous aquifers	Minnesota	8,541.45	Archean gneiss	0.97%
	North Dakota	12,766.57	Archean granitic rocks	1.45%
Lower Tertiary aquifers	North Dakota	116,153.87	Paleogene sedimentary rocks	13.19%
Other rocks	Minnesota	355,287.87	Archean gneiss	40.35%
	North Dakota	153,989.54	Archean granitic rocks	17.49%
Paleozoic aquifers	Minnesota	45.16	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	0.01%
	North Dakota	13,467.29	Cretaceous sedimentary rocks	1.53%
Upper Cretaceous aquifers	North Dakota	89,196.28	Cretaceous sedimentary rocks	10.13%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands

Note: Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

SA-03 encounters the following six aquifer types represented on Map A-6.

Cambrian-Ordovician Aquifer System

The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and portions of Minnesota. The portion of this aquifer system that extends from southeastern Minnesota up towards Duluth, Minnesota and Superior, Wisconsin are Early Proterozoic granitic rocks. These rocks are hydraulically connected to the younger Cambrian bedrock and are included with this aquifer system.

Lower Cretaceous Aquifers
Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers
Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-03. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks
This aquifer is present throughout a large portion of the SA-03 corridor and is categorized as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Paleozoic Aquifers
In SA-03, Paleozoic aquifers subcrop beneath glacial deposits in primarily northeastern North Dakota. These aquifers are composed mostly of limestone and dolomite, which are the most productive, but Paleozoic sandstones also yield water.

Upper Cretaceous Aquifers
Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-03. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

4.3.2 Ecoregions

The majority of SA-03 crosses the Great Plains and Eastern Temperate Forest ecoregions. Most of area has been converted to agriculture or developed.

SA-03 starts in the Great Plains ecoregion, briefly crosses through the Eastern temperate forest, and ends in the Northern forest (Map A-7). Within the Great Plains region, the system alternative crosses

both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions. In the area of the system alternative, the West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. The Temperate Prairies consist of the Northern Glaciated Plains and the Lake Agassiz Plain regions in the area of the system alternative. Within the Eastern Temperate Forest, the system alternative crosses the Mixed Wood Plains in an area made up of the North Central Hardwood Forest. Finally, the system alternative crosses the Northern Forest region within the Mixed Wood Shield Level II Ecoregion and the Northern Lakes and Forests Level III Ecoregion. For a description of Ecoregions see Section 4.1.

Table 4-18 Miles of SA-03 by Ecoregion

The majority of SA-03 crosses the Great Plains and Eastern Temperate Forests ecoregions.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	366	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	316	Northern Glaciated Plains	198
				Lake Agassiz Plain	118
Eastern Temperate Plains	200	Mixed Wood Plains	200	North Central Hardwood Forests	200
Northern Forests	72	Mixed Wood Shield	72	Northern Lakes and Forests	72
Total Miles					**638**

Source: USEPA, Ecoregions of the United States, 2013

4.3.3 Land Cover

SA-03 traverses through three states, a total of 25 counties, 31 cities, and approximately 700 miles (Map A-8 and A-9). There are a wide variety of land covers within the corridor, mainly grassland and herbaceous vegetation to agriculture to deciduous forests from west to east along the system alternative.

Starting at the west end of the system alternative and moving east, the land cover is dominated by agriculture, open grasslands and prairie wetlands. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams, as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses east, there are higher concentrations of herbaceous or grassland cover with many scattered wetlands and lakes representing the prairie pothole region. Continuing east, the land cover becomes mainly cultivated crops to the North Dakota/Minnesota state border. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads.

The majority of land cover in SA-03 is cultivated, as illustrated in the table below. As the system alternative crosses the Red River into Minnesota, the land cover continues to be agricultural with scattered farmsteads in Polk, Norman and Clay counties. As the corridor extends east and nears the central part of the state, the land cover becomes a generally even mix of cultivated lands, wetland, and forests with many rural residential properties. Within this area there are many small cities as well as numerous medium-sized lakes.

In Chisago County, the corridor turns north and the land use continues to be mainly agriculture, wetlands and forests. The land cover becomes more heavily forested as the corridor continues north and contains a higher concentration of lakes. Along this stretch of the system alternative are many small cities paralleling Interstate 35. As the system alternative approaches the Superior terminal in Wisconsin, the land use becomes more heavily developed with residential and industrial uses.

Table 4-19 Land Cover – SA-03

The majority of land cover in SA-03 is cultivated.		
Land Cover	Acres	Percent
Barren	283	0.03%
Developed	46,875	5.4%
Forest	86,195	10.0%
Herbaceous/grasslands	90,945	10.5%
Planted/Cultivated	512,407	59.4%
Shrubland	10,341	1.2%
Open Water	24,175	2.8%
Wetlands	90,832	10.5%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.3.4 Water Resources

Water resources located within in the SA-03 corridor include rivers, streams, lakes, ponds and wetlands (Map A-10). SA-03 includes portions of 93 named streams, some of which are divided into several segments or cross the corridor multiple times for a total of 895 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 3,140.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east, rivers crossing SA-03 include the White Earth, Des Lacs, Souris, Turtle and Red in North Dakota, and the Red Lake, Sandhill, Marsh, Wild Rice, Buffalo, Pelican, Long Prairie, Mississippi, Platte, Skunk, Rum, Snake, Kettle, Moose and Willow in Minnesota. Of these streams or other flowages, the largest is the Mississippi River. SA-03 crosses the Mississippi River in Morrison County, Minnesota. The width of the Mississippi River where SA-03 crosses is approximately 1,000 feet. Construction of the pipeline at this location may require additional mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-03 crosses approximately 98 impaired river or stream segments.

SA-03 includes all or portions 103 named lakes. The corridor also includes numerous unnamed water bodies bringing the total of water bodies to 3,777. Water bodies include intermittent or perennial lakes and ponds, swamps and marshes. SA-03 crosses through areas with a high concentration of water bodies in Ward, Pierce, Benson and Ramsey counties in North Dakota, and Becker, Otter Tail, Todd, Morrison and Isanti counties in Minnesota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant within the SA-03 corridor, especially in Ramsey County, North Dakota, and Becker, Otter Tail, Todd, Morrison, Chisago, Pine and Carlton counties, Minnesota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the System Alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub and pond), lacustrine (lake) and riverine. The NWI dataset combines the forested and scrub shrub wetlands into the "forested/shrub" wetland type as these wetlands are similar in that they support woody vegetation. The table below describes the acres of each type of wetland within SA-03.

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

Table 4-20 Wetland Types – SA-03

Emergent wetlands make up 6.8 percent of SA-03 and forested/shrub 4.5 percent.		
Wetland Type	**Acres**	**Percentage of SA-03**
Emergent	60,210	6.8%
Forested/Shrub	39,415	4.5%
Lake[1]	12,539	1.4%
Pond[1]	3,632	<1%
Riverine	1,646	<1%
Other	8	<1%

U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as waterbodies referenced in the paragraph above.

SA-03 crosses numerous watercourses, waterbodies and wetlands. There are several areas with the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline.

4.3.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within the counties crossed by the SA-03 corridor: seven endangered species, three threatened species, one candidate species, one proposed threatened species, and one proposed endangered species. Table 4-21 describes these species, their current federal listing status, and counties crossed by SA-03 where they are known to or believed to occur. For four of the endangered species (snuffbox mussel, spectaclecase, winged mapleleaf, and pallid sturgeon), the system alternative is located in the species' county of occurrence but does not cross any of the streams where the three endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-21 Endangered Species Act Listed Species Potentially within SA-03

Counties crossed by SA-03 include 13 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward, Williams
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Pierce, Ramsey, Towner, Ward, Williams **Minnesota:** Clay, Polk
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	**Minnesota:** *County level range not defined in MN*
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Minnesota:** Chisago
Snuffbox mussel	*Epioblasma triquetra*	Endangered	Aquatic • Small- to medium-sized	**Minnesota:**

Counties crossed by SA-03 include 13 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			creeks, in areas with sift currents. • Requires sand, gravel, or cobble substrate.	Chisago
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Minnesota:** Chisago, Pine
Winged mapleleaf	*Quadrula fragosa*	Endangered	Aquatic • Riffles with clean gravel, sand, or rubble bottoms and in clear, high quality water.	**Minnesota:** Chisago
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**North Dakota:** Mountrail, Williams
Vascular Plants				
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**Minnesota:** Clay, Polk
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Ward **Minnesota:** Clay, Polk
Mammals				
Canada lynx	*Lynx canadensis*	Threatened	Boreal Forests • Require high snowshoe hare densities. • Associated with moist, cool,	**Minnesota:** Pine

Counties crossed by SA-03 include 13 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			boreal spruce-fir forests with rolling terrain.	
Northern long-eared bat	*Myotis septentrionalis*	Proposed endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines.	North Dakota: Benson, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Ward, Williams **Minnesota:** Becker, Benton, Carlton, Chisago, Clay, Isanti, Mille Lacs, Morrison, Norman, Otter Tail, Pine, Polk, Todd, Wadena

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

SA-03 crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover and proposed critical habitat for Dakota skipper and poweshiek skipperling (Map A-13). Critical Habitat is defined under the Endangered Species Act as the specific geographic areas that contain features essential for the conservation of threatened or endangered species. Critical habitat was designated for the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638) and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, North Dakota and South Dakota. SA-03 crosses the piping plover critical habitat in Mountrail County, North Dakota.

Critical Habitat was proposed for both the Dakota skipper and the poweshiek pkipperling on October 23, 2014 (79 FR 63672). Proposed critical habitat for these two species overlaps in North Dakota, and is crossed by the system alternative in Clay County. While critical habitat has been proposed as part of a plan to restore populations of the poweshiek skipperling, it is not currently known to occur in the Dakotas.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources

could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.3.6 Public Resource and Recreational Lands

The review of public lands and recreation areas showed that the system alternative crosses numerous federal and state-managed public recreation areas in North Dakota and Minnesota as noted in Table 4-22 and Maps A-14 and A-15. The majority of potential affects could occur in counties with high concentrations of public lands including Pierce, Ramsey and Nelson, North Dakota, and Clay, Becker and Morrison, Minnesota. Routing option through these areas may be limited by the concentration of public lands.

Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

North Dakota

State-managed recreation areas in North Dakota include state parks, forests, wildlife management areas, and a number of areas designated under the Private Lands Open to Sportsmen (PLOTS) program. PLOTS lands have been designated in cooperation with the federal government, and reward landowners for conservation practices and activities that have a positive impact on wildlife habitat in agricultural areas. While private, these areas are open to walk-in hunting through an easement with the state. PLOTS lands include areas designated under the Working Lands Program (WLP), Habitat Plot Program, Conservation Resource Program (CRP), Wildlife Food Plot Program, Wetland Reserve Program (WRP), and the Private Forest Conservation Program.

East of Tioga Beaver Creek Station, SA-03 passes through a concentration of national WMAs, federally managed WPAs, and state-managed WLPs in Mountrail and Ward counties. Continuing east into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern Pierce County, and passes just north of the Lake Alice National Wildlife Refuge in Ramsey County. A mix of PLOTS designated lands and several small NWRs are common throughout eastern Ramsey County and Nelson County, but most public lands in Grand Forks County are located north of the system alternative.

Minnesota

State-managed recreation areas in Minnesota include state parks, forests, WMAs and Scientific Natural Areas. Similar to the North Dakota PLOTS program, Minnesota has a number of easement programs that

offer hunting opportunities on private land, managed through the Board of Water and Soil Resources (BWSR) Conservation Areas. These areas include those designated by the Walk-In Access (WIA), the Reinvest in Minnesota (RIM), the Conservation Reserve Enhancement (CREB), the Permanent Wetlands Preserve (PWP), and the Army Compatible Use Buffer (ACUB) programs.

Entering Minnesota, public areas are scarce through Polk and Norman counties, but become prevalent in eastern Clay County and Becker County. Recreational areas in these counties are mostly made up of a mix of state and federal managed WPAs with a few Scientific Natural Areas. Through Otter Tail County and Todd County, the system alternative passes near a few dispersed WPAs and other privately owned lands with public easements. In Morrison County, the western side of the county is clustered with BWSR Conservation Areas, Scientific Natural Areas, and the system alternative crosses part of the Crane Meadows National Wildlife Refuge. The system alternative passes through relatively few scattered Conservation Areas, and public easements in Benton, Mille Lacs, Isanti and Chisago counties. In Pine County, the system alternative is located generally west of most public areas, but does pass near Banning State Park and through the western part of General C.C. Andrews State Forest before continuing into Carlton County where it crosses Jay Cooke State Park and Fond Du Lac State Forest.

Table 4-22 Public Resource and Recreational Lands – SA-03

SA-03 includes Federal Waterfowl Production Areas and Minnesota Board of Water and Soil Resources Conservation Areas.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife Service-National Wildlife Refuge	3	401
	Waterfowl Production Area	9	3,067
North Dakota	State Wildlife Areas-PLOTS lands	29	3,419
Minnesota	State Forest	2	914
	State Park	1	672
	Natural Areas-Scientific Natural Areas	1	1,116
	Conservation Areas-BWSR	54	2,296
Total		**148**	**11,885**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

4.3.7 Cities and Population Density

SA-03 is largely rural (Table 4-23, Maps A-16 and A-17). The highest population density within the system alternative is located near North Branch, Minnesota. The average over the entire corridor is 36 persons per square mile. There are 30 cities partially or totally within the SA-03 corridor.

In North Dakota, Stanley is the largest city with 1,467 persons; in Minnesota, North Branch is the largest city with 10,125 persons. The population density pattern across SA-03 is very light in North Dakota, becoming heavier as the system alternative continues eastward into northwest Minnesota. The heaviest density occurs at SA-03's most southern location, where North Branch is located, and the point at which the system alternative is nearest to the Twin Cities.

Table 4-23 Population Density and Cities – SA-03

SA-03 includes 30 cities, more than half of which are in Minnesota.			
	ND	**MN**	**Total**
Average Persons per Sq Mile	8	39	36
Number of cities	7	23	30
Cities >1000	2	13	15

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

In general, the SA-03 corridor is sparsely populated and primarily rural in character. Seven North Dakota cities are located within the SA-03 corridor; two of the seven cities have populations greater than 1,000 persons. The cities range in size from 98 persons (Ross and Deering) to 1,469 persons (Stanley). The Minot Air Force Base is a census designated place[53] (CDP) with a population of 5,521. It is located 13 miles north of Minot and is north of and adjacent to the SA-03. A portion of the military facilities are located within the system alternative boundary.

[53] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

The city of Grand Forks (approximately 53,000 people within the city and more than 90,000 people including the surrounding areas[54]) is the only urban area near SA-03. It is approximately two miles north of the system alternative.

Minnesota

Twenty-three Minnesota cities are located within the SA-03 corridor; 13 of the 23 cities have populations greater than 1,000 persons. Populations range from 110 persons (Borup) to 10,125 persons (North Branch). Additional larger cities in the system alternative include Cambridge (8,111), Detroit Lakes (8,659), Rush City (3,079) and Wadena (4,088). North Branch, Cambridge and Rush City have experienced substantial increases in population since the 2000 census. These cities are located on major highways extending north from the Twin Cities.

As the system alternative proceeds north toward Duluth, it generally parallels Interstate 35 (and crosses through Hinckley, Finlayson, Rutledge, Sturgeon Lake, Moose Lake and Wrenshall , with populations between 229 and 2,750). Nearby development patterns and population densities are rural, with scattered concentrations of higher density. The higher density areas surround the small towns and lakes. As the system alternative approaches Duluth, there is denser development where there is a shorter rural-urban commute. As the system alternative turns east away from Interstate 35 and approaches the Wisconsin border, denser development patterns follow lakeshore and open farmland and the development bypasses the heavily forested areas and landscapes with steep terrain.

4.3.8 Community Features

SA-03 is largely rural, with community features typically concentrated in or near cities (Map A-18). The number and types of community of features are summarized in Table 4-24 below.

North Dakota

Two airports are located in the system alternative: Rugby Public in Pierce County and a private facility in Towner County. Scattered throughout the system alternative, there are 10 cemeteries and three churches. Three fire stations are located within the system alternative in Berthold, Deering and Emerado. Emergency services include a hospital in Stanley and an ambulance service in Berthold. Minot Air Force base is partially located within the system alternative and Grand Forks Air Force Base is located less than one mile north of the system alternative. One police station (Emerado) is located within the system alternative. Emerado has an elementary school and Berthold has an elementary school and high school.

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[54] "2010 Census Redistricting Data (Public Law 94-171) Summary File". *Amecan FactFinder*. United States Census Bureau. Retrieved 2 May 2011.

The main highways crossed by SA-03 are Interstate 29, US 2, US 52, US 83 and US 81.

Minnesota

Seven airports are within the system alternative. Five are private and two are public: Rush City Regional and Perham Municipal. Twenty cemeteries and 10 churches are scattered throughout the corridor. Ten fire stations, three police stations and three hospitals (Ada, North Branch and Perham) are located in the system alternative. Thirty-three schools are scattered throughout the system alternative. Schools are located in Ada, Borup, Cambridge, Finlayson, Hinckley, Milaca, North Branch, Perham, Randall and Wrenshall.

The main highways crossed by SA-03 are Interstate 35, US 2, US 59, US 71, US 75 and US 169.

Table 4-24 Community Features – SA-03

SA-03 is largely rural with community features concentrated in or near cities.									
	Airports	**Amtrak**	**Cemeteries**	**Churches**	**Fire stations**	**Hospitals**	**Military base**	**Police station**	**Schools**
North Dakota	2	0	10	3	3	2	1	1	3
Minnesota	7	0	20	10	10	3	0	3	33
Total	**9**	**0**	**30**	**13**	**13**	**5**	**1**	**4**	**36**

Source: USGS TNM - National Structures Dataset

4.3.9 Cultural Resources

National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There is one listed property in McHenry County North Dakota and nine listed properties scattered throughout the system alternative corridor in Minnesota (see Table 4-25).

Table 4-25 National Register of Historic Places Properties – SA-03

SA-03 includes 10 listed historic properties.			
Resource Name	State	County	NRHP ID
Elliott Bridge	North Dakota	McHenry	97000181
Carlson, J. C., House	Minnesota	Chisago	80002004
Grant House	Minnesota	Chisago	80002005
Sayer House	Minnesota	Chisago	80002002
West Riverside School	Minnesota	Isanti	80002076
Our Lady of the Angels Academy	Minnesota	Morrison	05001474
Perham Village Hall and Fire Station	Minnesota	Otter Tail	86002122
Schroeder's Brewery	Minnesota	Otter Tail	84003938
Northern Pacific Depot	Minnesota	Pine	80002107
Oldenburg, John A., House	Minnesota	Pine	78001556

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites, such as rock art, rock alignments and stone circles, are often found in upland settings.

Known sensitive areas for archaeological sites in Minnesota include areas adjacent to major water features such as lakes and the Red River of the North and the Mississippi River, and their tributaries.

4.3.10 Contaminated Areas

Nationally registered contaminated sites, such as those on the National Priorities List (NPL), pose the greatest environmental risk. No NPL sites were identified in SA-03.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are scattered throughout the SA-03 near established towns and where industrial and commercial activity is more prevalent.

Table 4-26 below summarizes the number of potentially contaminated properties that are located within SA-03 (Map A-21).

Table 4-26 Potentially Contaminated Properties – SA-03

The majority of listings within SA-03 are located in Minnesota.		
Listing Type	**State**	**Number of Sites Within SA-03 By State**
Compliance Activity	Minnesota	5
	North Dakota	1
Enforcement/Compliance Activity	Minnesota	13
	North Dakota	10
Formal Enforcement Action	Minnesota	3
	North Dakota	5
Leaking Underground Storage Tank (as defined by the American Recovery and Reinvestment Act)	Minnesota	2
Total		**39**

Source: U.S. EPA, Facility Registration Service, 2014

4.3.11 Air Emissions

All of the counties in North Dakota and Minnesota through which SA-03 crosses are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead.

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality. As represented by NDPC, the additional pipeline length associated with SA-03 would result in additional construction-related emissions.

As represented by NDPC, a route through SA-03 would require one additional pump station, with four additional pumps, as compared to SA-Applicant. Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route through SA-03 would result in 50,622 metric tons per year of additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to SA-Applicant.

4.3.12 High-Consequence Areas and Natural Disaster Hazard Areas

SA-03 largely avoids High Consequence Areas (HCA) except just north of the Twin Cities where a concentration of population and state resource lands exist. High flood hazard risk areas are concentrated where the system alternative crosses larger rivers such as the Red River of the North. Landslide hazard areas are generally in west of the Red River Valley in North Dakota.

SA-03 crosses 18 populated areas designated as a High Consequence Areas (HCA) by the USDOT PHMSA. SA-03 crosses one populated area designated as high population area (HPA) in Duluth, Minnesota, covering 1,600 acres, and 34 other population areas (OPA) covering 37,120 acres (Map A-23). Almost 60 percent of the OPA HCA area is located where SA-03 skirts the northern edge of the Twin Cities. Other OPA HCAs are scattered throughout the system alternative and are related to small cities.

SA-03 crosses 40 drinking water HCAs covering approximately 1,600 acres and 164 ecological HCAs covering 26,700 acres (Map A-24 and A-25). The drinking water HCAs are scattered throughout and where SA-03 comes close to cities such as Grand Forks, North Dakota, and Cambridge, Minnesota. The ecological HCAs are also scattered throughout and located near existing state and federal resource lands, particularly in Mountrail County in North Dakota and Clay, Becker, Otter Tail, Chisago, Pine and Carlton counties in Minnesota.

For flood hazard, Medium risk Natural Disaster Flood zones cover approximately 14.2 percent of the SA-03, while High risk zones cover 6.4 percent (Map A-26). Medium and High risk areas are concentrated in the Red River Valley and at crossings of larger rivers such as the White Earth in western North Dakota and the Wild Rice, Mississippi, Rum and Kettle Rivers in Minnesota.

For landslide hazard, Medium risk Landslide Hazard Areas cover approximately 25 percent of the SA-03, while High risk covers only 1.4 percent (MapA-27). Medium risk areas are concentrated in central and eastern North Dakota; High risk areas are concentrated at the far western and far eastern section of system alternative.

4.4 SA-04 Alliance-Chicago

System Alternative-04 begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to McHenry County, North Dakota. SA-04 turns southeast and follows the Alliance Pipeline and proceeds generally southeast through Minnesota, Iowa and Illinois to its termination point in Joliet, Illinois. SA-04 is approximately 940 miles long and passes through North Dakota, Minnesota, Iowa and Illinois.

4.4.1 Geology/Soils/Groundwater

Geology, Soil types and Groundwater Aquifer locations for SA-04 are represented in Maps A-3, 4, 5 and 6.

Geology

The majority of SA-04 is made up of glacial deposits overlying bedrock, most prominent being Mesozoic or Paleozoic (Map A-3). The table below identifies the uppermost bedrock types crossed by SA-04.

Table 4-27 Bedrock Geology – SA-04

Almost the entire length of SA-04 is underlain by either Paleozoic or Mesozoic sedimentary bedrock.			
Geologic Era	**Geologic Description**	**Acres in the SA-04**	**Percentage of SA-04**
Precambrian	Archean gneiss	43,955	3.69%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	161,113	13.51%
	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	357,087	29.94%
	Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks	161	0.01%
Mesozoic	Cretaceous sedimentary rocks	512,784	42.99%
Cenozoic	Paleogene sedimentary rocks	117,730	9.87%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

Shallow bedrock or bedrock outcrops could be impacted by the pipeline construction if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Soils

SA-04 includes 13 Major Land Resource Areas (MLRAs), with three covering more than 10 percent of the area (Table 4-28 and Map A-4). MLRA 55B has a nearly level to gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 103 is nearly level to gently rolling with moraines and glacial lake plains. Mollisols, and to a lesser extent Alfisols and Inceptisols, dominate the soil orders. Soils are generally very deep, well-drained to very poorly drained and loamy. MLRA 104 is nearly level to gently rolling. Mollisols and Alfisols dominate the soil orders. Soils generally are very deep, well-drained to very poorly drained and loamy.

More than 65 percent of the soils in SA-04 have essentially no limitations for construction. Less than 5 percent have limitations with regard to shallow bedrock related issues; primarily in western Illinois and northeastern Iowa. Soils that are shallow or have bedrock near the surface may require careful routing and alternative construction techniques.

Nearly nine percent of the soils have shrink/swell issues, primarily in the Red River valley. Soils that have shrink/swell characteristics may require alternative designs and/or maintenance to ensure the stability of the pipe.

Nearly 20 percent of SA-04 traverses landscapes with known sinkholes in eastern Iowa. Landscapes that have sinkholes present may have higher potential for groundwater impacts, should a leak occur.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape, and soil characteristics in each MLRA (USDA 2006).

Table 4-28 Major Land Resource Areas (MLRAs) – SA-04

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-04	Percentage of SA-04
53B	Central Dark Brown Glaciated Plains	-	62,313	5.2
54	Rolling Soft Shale Plain	Shallow bedrock	5,690	0.5
55A	Northern Black Glaciated Plains	-	107,842	9.0
55B	Central Black Glaciated Plains	-	236,197	19.8
56	Red River Valley of the North	Shrink/swell	102,519	8.6
102A	Rolling Till Prairie	-	70,075	5.9
103	Central Iowa and Minnesota Till Prairies	-	191,058	16.0
104	Eastern Iowa and Minnesota Till Prairies	Sinkholes	236,857	19.9
105	Northern Mississippi Valley Loess Hills	Shallow bedrock, Sinkholes	13,049	1.1
108A	Illinois and Iowa Deep Loess and Drift, Eastern Part	-	65,979	5.5
108B	Illinois and Iowa Deep Loess and Drift, East-Central Part	-	32,419	2.7
110	Northern Illinois and Indiana Heavy Till Plain	-	32,100	2.7
115C	Central Mississippi Valley Wooded Slopes, Northern Part	Shallow bedrock	36,732	3.1
Total			**1,192,830**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-04 has a mix of hydraulic conductivity rates in the surficial soils, with 57 percent rated High and 25 percent rated Low (Table 4-29). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-29 Relative Hydraulic Conductivity Ratings – SA-04

Hydraulic Conductivity Range	Percent of Area
Low	25
Medium	19
High	57
Total	100

Source: Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Groundwater

Groundwater for drinking water, potable water, industrial and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout SA-04. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers (that lack any or adequate glacial cover) would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

Approximately three-quarters of SA-04 is underlain by aquifer systems in sedimentary bedrock. The majority of these are carbonate bedrock aquifers. Table 4-30 summarizes the principal bedrock aquifers that are used as water supply sources along SA-04 corridor. Section 4.1 provides background information on groundwater.

Table 4-30 Principal Bedrock Aquifer Systems – SA-04

Approximately three-quarters of SA-04 is underlain by aquifer systems in sedimentary bedrock.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-04 by State Crossed	Bedrock Type (Associated with Principal Aquifer)	Percent Acres of Aquifer in SA-04 by State
Cambrian-Ordovician aquifer system	Illinois	51,895.11	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	4.35%
	Minnesota	61,517.80	Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks	5.16%
Lower Cretaceous aquifers	Minnesota	76,242.39	Archean gneiss	6.39%
	North Dakota	7,129.46	Cretaceous sedimentary rocks	0.60%
Lower Tertiary aquifers	North Dakota	116,153.72	Paleogene sedimentary rocks	9.74%
Other rocks	Illinois	26,113.15	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	2.19%
	Iowa	165.51	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	0.01%
	Minnesota	122,863.68	Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks	10.30%
	North Dakota	266,477.87	Archean gneiss	22.34%
	South Dakota	420.69	Cretaceous sedimentary rocks	0.04%
Silurian-Devonian aquifers	Illinois	73,703.22	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	6.18%
	Iowa	193,601.99	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	16.23%
Upper Carbonate aquifer	Iowa	46,433.59	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	3.89%
	Minnesota	58,034.68	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	4.87%
Upper Cretaceous aquifers	North Dakota	92,077.12	Cretaceous sedimentary rocks	7.72%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands
Note: Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

SA-04 encounters the following seven bedrock aquifer types represented on Map A-6:

Cambrian-Ordovician Aquifer System
The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and southeastern Minnesota. The lower part of the aquifer consists of sandstone, while the upper part is a mix of sandstone and shale interbedded with limestone or dolomite.

Lower Cretaceous Aquifers
Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers
Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-04. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks
This aquifer is present throughout a large portion of the SA-04 corridor and is categorized as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Silurian-Devonian Aquifers
The Silurian-Devonian aquifers are present only in Iowa and Illinois along this system alternative corridor. These aquifers typically subcrop below Quaternary deposits; with the exception of a small portion of the corridor near the Iowa-Illinois state line, where it is overlain by younger Paleozoic rocks. These aquifers are composed of mostly limestone and dolomite, but locally contain interbedded shale and evaporate beds.

Upper Carbonate Aquifer
The Upper Carbonate aquifer is an important aquifer only to portions of southeastern Minnesota and northeastern Iowa. As the name implies, it consists of carbonate bedrock (limestone, dolomite, and dolomitic limestone). The upper part of the aquifer consists of a shale and carbonate rock sequence. Extensive fracturing and subsequent dissolution of the carbonate portion of the rock has made the

aquifer very productive. Karst features such as solution-enlarged openings, sinkholes, and caves have contributed to the porous nature of this aquifer, thus, making it very susceptible to contamination.

Upper Cretaceous Aquifers

Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-04. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings that store and transmit most of the water.

4.4.2 Ecoregions

SA-04 crosses the Great Plains and Eastern Temperate Forests ecoregions. Most of the area has been converted to agriculture or developed. SA-04 has five Level II and eight Level III ecoregions, as shown in Table 4-31. SA-04 starts in the Great Plains ecoregion and ends in the Eastern Temperate Forest (Map A-7).

Table 4-31 Miles of SA-04 by Ecoregion

The majority of SA-04 crosses the Great Plains ecoregion.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	766	West-Central Semi-Arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	716	Northern Glaciated Plains	289
				Lake Agassiz Plain	76
				Western Corn Belt Plains	351
Eastern Temperate Forest	114	Central USA Plains	97	Central Corn Belt Plains	97
		Mixed Wood Plains	3	North Central Hardwood Forests	3
		Southeastern USA Plains	14	Interior River Valleys and Hills	14
Total Miles					**880**

Source: USEPA, Ecoregions of the United States, 2013

Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions. The West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. The Temperate Prairies consist of the Northern Glaciated Plains, the Lake Agassiz Plain, and the Western Corn Belt Plains regions in the area of the system alternative. Within the Eastern Temperate Forest, the system alternative crossed the Central USA Plains, the Mixed Wood Plains, and the Southeastern Plains. In SA-04, each of these Level II Ecoregions is made up entirely of the Central Corn Belt Plains, the North Central Hardwood Forests, or the Interior River Valleys and Hills, respectively. For a description of Ecoregions, see Section 4.1.

4.4.3 Land Cover

SA-04 traverses through four states, a total of 48 counties, 44 cities and more than 940 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, mainly grassland/herbaceous vegetation to agriculture from west to east along the system alternative.

Starting at the west end and moving east, the land cover is dominated by agriculture, open grasslands and prairie wetlands. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams, as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses southeast, there are higher concentrations of grassland or herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. Continuing southeast, the land cover becomes mainly cultivated crops. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads.

The majority of land cover in SA-04 is cultivated, as illustrated in the Table 4-32. SA-04 crosses the Red River into Minnesota; the land cover continues to be agricultural with scattered farmsteads. As the corridor extends southeast and nears the southern part of the state, the land cover remains agricultural with many small depressional wetlands with associated forests. In this region, the corridor crosses the Minnesota River where there is a concentration of forests and wetlands. Additionally, within this area there many small cities, similar to the rest of the corridor located throughout the state.

SA-04 crosses the border into Iowa; land cover remains agricultural with many small rural residencies. There are many forested areas around waterways and farmsteads serving as windbreaks. There are also many small cities, similar to the rest of the corridor located throughout the state. Progressing southeast, the system alternative approaches the Mississippi River where pockets of wetlands and deciduous forests appear. The corridor passes by the urban areas of Clinton and Camanche, Iowa.

SA-04 crosses the Mississippi River into Illinois and the trend of agricultural land cover persists. There are many isolated farmsteads with forests serving as windbreaks. The agriculture land cover continues

until the system alternative approaches the Joliet refinery near Chicago. Land cover in this part of the state gradually transitions from urban bedroom communities to suburban cities to urban industrialized areas.

Table 4-32 Land Cover – SA-04

More than 75 percent of land cover in SA-04 is cultivated.		
Land Cover	Acres	Percent
Barren	1,707	0.14%
Developed	71,432	6.0%
Forest	17,458	1.5%
Herbaceous	97,458	8.2%
Planted/Cultivated	935,995	78.5%
Shrubland	554	0.05%
Water	17,226	1.44%
Wetlands	51,000	4.3%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.4.4 Water Resources

Water resources located within in the SA-04 corridor include rivers, streams, lakes, ponds and wetlands (Map A-10). SA-04 includes portions of 132 named streams, some of which are divided into several segments or cross the corridor multiple times for a total of 1,025 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 3,967.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east, rivers crossing SA-04 include White Earth, Des Lacs, Souris, Sheyenne, James, Wild Rice and Bois de Sioux in North Dakota; the Mustinka, Pomme de Terre, Chippewa, Minnesota, Le Sueur and Cedar in Minnesota; the Little Cedar, Wapsipinicon and Mississippi in Iowa; and, the Rock, Hennepin Feeder Canal, Green, Fox and Du Page in Illinois. Of these streams or flowages, the largest is the Mississippi River.

SA-04 crosses the Mississippi in Clinton County, Iowa/Rock Island County, Illinois. The width of the Mississippi River and associated riparian wetland area where SA-04 crosses is approximately 6,900 feet, making it one of the widest crossings of the river by any system alternative. In addition, SA-04 crosses the Minnesota River in Nicollet/Le Sueur County. The width of the river and associated riparian corridor is approximately 4,500 feet. Construction of the pipeline at these locations may require additional mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-04 crosses approximately 114 impaired river or stream segments.

SA-04 includes all or portions of 20 named lakes. The system alternative also includes numerous unnamed water bodies bringing the total of water bodies to 2,881. Water bodies include intermittent or perennial lakes and ponds, swamps, and marshes. SA-04 crosses through a few areas with a high concentration of water bodies in Ward and Pierce counties in North Dakota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant in places within the SA-04 corridor, particularly in McHenry, Pierce, Stutsman and Barnes counties, North Dakota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the system alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub and pond), lacustrine (lake) and riverine. The NWI dataset combines the forested and scrub shrub wetlands into the "forested/shrub" wetland type as these wetlands are similar in that they support woody vegetation. Table 4-33 describes the acres of each type of wetland within SA-04.

Table 4-33 Wetland Types – SA-04

Emergent wetlands make up 3.7 percent of the area and most of the wetlands in SA-04.		
Wetland Type	Acres	Percentage of SA-04
Emergent	44,389	3.7%
Lake[1]	6,019	<1%
Forested/Shrub	4,661	<1%
Pond[1]	2,663	<1%
Riverine	1,958	<1%
Other	7	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as waterbodies referenced in the paragraph above.

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

4.4.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-04 corridor: 10 endangered species, nine threatened species, two candidate species, and one proposed threatened species. Table 4-34 describes these species, their current federal listing status, and counties crossed by SA-04 where they are known to or believed to occur. For three of the endangered species (sheepnose mussel, spectaclecase, and pallid sturgeon) and one threatened species (decurrent false aster), the system alternative is located in the species' county of occurrence but does not cross any of the streams where the endangered or threatened species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-34 Endangered Species Act Listed Species Potentially within SA-04

Counties crossed by SA-04 include 22 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Mountrail, Williams
Piping plover	*Charadrius melodus*	All populations except Great Lakes watershed population: Threatened	Shoreline • Breeds on open, sparsely vegetated sand or gravel beaches adjacent to alkali wetlands, and on beaches, sand bars, and dredged material islands of major river systems.	**North Dakota:** Benson, Eddy, McHenry, Mountrail, Pierce, Stutsman, Ward, Wells, Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal	**North Dakota:** Benson, Eddy, Foster, McHenry, Mountrail, Pierce, Stutsman, Ward, Wells, Williams, **South Dakota:** Roberts

Counties crossed by SA-04 include 22 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			inlets, estuaries, and bays.	**Illinois:** *County level range not defined in IL*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Barnes, Benson, Eddy, McHenry, Mountrail, Pierce, Ransom, Sargent, Stutsman, Ward, Wells, Williams
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	**North Dakota:** Barnes, Benson, Cass, Eddy, Foster, McHenry, Mountrail, Pierce, Ransom, Richland, Sargent, Stutsman, Ward, Wells, Williams
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Iowa:** Clinton, Jones, Linn **Illinois:** Rock Island, Whiteside
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	Aquatic • Found in shallow areas of larger rivers and streams, with moderate to swift currents flowing over coarse sand and gravel.	**Illinois:** La Salle, Rock Island, Whiteside, Will
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Illinois:** Rock Island, Will
Fishes				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand	**North Dakota:** Mountrail, Williams

Counties crossed by SA-04 include 22 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			bars, sand flats and gravel bars.	
Vascular Plants				
Decurrent false aster	*Boltonia decurrens*	Threatened	Floodplains and wetlands • Found on moist, sandy, floodplains and prairie wetlands along the Illinois River.	**Illinois:** Bureau, La Salle
Lakeside daisy	*Hymenoxys herbacea*	Threatened	Prairie Grassland • Found in dry, rocky areas underlain by limestone. • Requires open sites with full sun.	**Illinois:** Will
Leafy prairie-clover	*Dalea foliosa*	Endangered	Prairie • Found in prairie remnant along the Des Plains River in Illinois, in thin soils over limestone substrate.	**Illinois:** La Salle, Will
Mead's milkweed	*Asclepias meadii*	Threatened	Prairie • Requires moderately wet (mesic) to moderately dry (dry mesic) upland tallgrass prairie or glad/barren habitat characterized by vegetation adapted for drought and fire.	**Illinois:** Will
Northern wild monkshood	*Aconitum noveboracense*	Threatened	Cliffs, talus slopes, or streamside sites • Typically found on shaded to partially shaded sites with cool soil conditions, cold air drainage, or cold groundwater flowage.	**Iowa:** Delaware
Prairie bush-clover	*Lespedeza leptostachya*)	Threatened	Prairie • Known only from the tallgrass prairie region of the upper Mississippi River Valley.	**Iowa:** Bremer, Buchanan, Chickasaw, Clinton, Delaware, Fayette, Howard, Jones, Linn, Mitchell
Western Prairie Fringed	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet	**North Dakota:** Ransom, Richland,

Counties crossed by SA-04 include 22 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Orchid			unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**South Dakota:** Roberts **Iowa:** Bremer, Chickasaw, Clinton, Delaware, Fayette, Howard, Jones, Linn, Mitchell
Eastern prairie fringed orchid	*Platanthera leucophaea*)	Threatened	Wet prairies and meadows • Occurs in a wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, and bogs. • Requires full sun and grassy habitat with little or no woody encroachment.	**Illinois:** Bureau, Grundy, Kendall, La Salle, Lee, Rock Island, Whiteside, Will
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Ransom, Richland, Sargent, Stutsman, Ward, Wells, **South Dakota:** Roberts **Minnesota:** Chippewa, Swift, Traverse
Hine's emerald dragonfly	*Somatochlora hineana*	Endangered	Marshes and sedge meadows • Lives in calcareous spring-fed marshes and sedge meadows overlaying dolomite bedrock.	**Illinois:** Will
Poweshiek skipperling	*Oarisma poweshiek*)	Endangered	Prairie • Lives in high quality tallgrass prairie in both upland, dry areas as well as low, moist areas.	**North Dakota:** Ransom, Richland, Sargent, **South Dakota:** Roberts **Minnesota:** Chippewa, Swift, Traverse

Counties crossed by SA-04 include 22 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
				Iowa: Howard
Rattlesnake-master borer moth	*Papaipema eryngii*	Candidate	Prairie • Mesic and wet-mesic prairies. • Associated with moderately disturbed to relatively undisturbed prairie in Illinois.	**Illinois:** Grundy, Will
Mammals				
Indiana bat	*Myotis sodalis*	Endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees.	**Illinois:** Bureau, Grundy, Kendall, La Salle, Lee, Rock Island, Whiteside

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

The system alternative also crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover and proposed critical habitat for Dakota skipper (Map A-13). Critical habitat was designated for the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638), and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, North Dakota and South Dakota. The system alternative crosses the piping plover critical habitat in Mountrail County, North Dakota.

Critical habitat was proposed for the Dakota skipper on October 23, 2014 (79 FR 63672). Proposed critical habitat for the Dakota skipper includes those areas with high-quality native remnant prairie with a high diversity of native prairie grasses and flowering forbs, and is crossed by the system alternative in McHenry County and Ransom County, North Dakota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.4.6 Public Resource and Recreational Lands

The review of public lands and recreation areas showed that the system alternative crosses federal and state-managed public recreation areas in in North Dakota, Minnesota, Iowa and Illinois as noted in Table 4-35 and Maps A-14 and A-15. The majority of potential impacts occur in counties with high concentrations of public lands in McHenry and Pierce counties in North Dakota, and Stevens and Swift counties in Minnesota.

Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

North Dakota

East of Tioga Beaver Creek Station, SA-04 passes through a concentration of national WMAs, federally managed WPAs, and state-managed Working Lands Program (WPL) properties in Mountrail and Ward counties. Continuing East into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern McHenry County and southern Pierce County. Avoiding most public lands in Wells, Foster and Stutsman counties, the system alternative continues through an area of Barnes County with several NWIs and a mix of Private Lands Open to Sportsmen (PLOTS) designated lands. In Ransom County, the system alternative crosses the southeastern portion of the Sheyenne National Grassland and then continues into Minnesota with few additional impacts to public lands.

Minnesota

As the system alternative traverses Minnesota, it crosses through dispersed WPAs, WMAs, and Board of Water and Soil Resources (BWSR) conservation lands. As the system alternative passes into Blue Earth County, it crosses over the Minnesota River State Water Trail as well as the Sakatah Singing Hills State Trail. Continuing to the southeast, the system alternative travels over the Cedar River State Water Trail before crossing the border into Iowa.

Iowa

State-managed recreation areas in Iowa include state parks, forests, preserves and WMAs, recreation areas, and bird conservation areas. Similar to North Dakota and Minnesota, Iowa has a number of easement programs that offer hunting opportunities on private land, through cooperation with the NRCS. These easement programs include the Wetlands Reserve Program (WRP), Emergency Wetlands Reserve Program (EWRP), and Emergency Watershed Protection Program (EWPP).

The system alternative passes through a number of WMAs, conservation areas, and NRCS easements in Mitchell, Howard, and Chickasaw counties, where public areas are scattered evenly across the corridor. The system alternative continues through an area with very few public lands in Beaver, Fayette, Buchanan, Delaware and Jones counties. Entering Clark County, the system alternative passes through several WMAs and NRCS easement areas, avoiding the majority of public lands in the southern part of the county. Continuing into Illinois, the system alternative crosses the Mississippi River and the Upper Mississippi River Wildlife and Fish Refuge.

Table 4-35 Public Resource and Recreational Lands – SA-04

SA-04 includes nearly 8,000 acres of North Dakota Private Lands Open to Sportsmen (PLOTS) lands.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife Service-National Wildlife Refuge	2	807
	U.S. Forest Service- National Grassland	2	902
	Waterfowl Production Area	10	4,178
North Dakota	State Wildlife Areas-PLOTS lands	56	7,972
Minnesota	Scientific Natural Areas	1	41
	Conservation Areas-BWSR	69	2,359
Iowa	State Wildlife Areas-State Recreation Area	1	14
	Conservation Areas-NRCS Easement	9	374
Illinois	State Park	2	98
	Conservation Areas	5	141
Total		**157**	**16,886**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

Illinois

State-managed recreation areas in Illinois include state parks, forests, trails and greenways, and DNR designated Conservation Areas, which include wildlife, recreation, habitat and natural areas. Illinois also has developed conservation land trusts, which provide public recreational access on private lands.

As the system alternative enters Illinois in Whiteside County, it avoids most public lands until it crosses the Hennepin Canal Parkway State Park and Access Area. In Lee County, the system alternative includes several conservation areas before continuing through an area relatively free of public areas in Bureau and western La Salle counties. The system alternative crosses the Fox River State Park in eastern La Salle County and then avoids public lands until it nears the terminus in Will County, where it includes the Illinois and Michigan Canal (a state trail and greenway), the Midewin National Tallgrass Prairie, and several conservation areas.

4.4.7 Cities and Population Density

The population density pattern (an indicator of the extent of development) across SA-04 is very light throughout North Dakota, staying light as the system alternative continues southeasterly into south central Minnesota. The heaviest density occurs in the vicinity of Mankato. SA-04 is largely rural, with the exceptions of Mankato, Minnesota, Clinton, Iowa, and the Joliet/Channahon/Minooka, Illinois, where areas of dense population occur (Table 4-36). The average over the entire corridor is 26 persons per square mile. The highest population density within the system alternative is located in Mankato, Minnesota. There are 39 cities partially or totally within the SA-04 corridor (Maps A-16 and A-17).

Table 4-36 Population Density and Cities – SA-04

SA-04 includes 39 cities, most of which are small cities.					
	ND	**MN**	**IA**	**IL**	**Total**
Average Persons per Sq Mile	6	16	15	71	26
Number of cities	9	9	13	8	39
Cities >1000	1	4	4	4	13

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

Nine North Dakota cities are located within the SA-04 corridor; one of the nine cities has a population greater than 1,000 persons. The cities range in size from 20 persons (the city of Leal) to 1,469 persons (the city of Stanley in Mountrail County). The Minot Air Force Base is a census designated place[55] (CDP) with a population of 5,521. It is located 13 miles north of Minot, and is north of and adjacent to SA-04. Portions of the military facilities are within the system alternative boundary. Six of the towns in the corridor have populations under 100 persons, and two have populations around 500 persons: Berthold with 458 persons and Wyndemere with 428 persons. The towns and their surroundings are rural in character. The system alternative is sparsely populated; census block groups indicate approximately 0 to 10 people per square mile (size is equivalent to a Public Land Survey section).

Minnesota

Nine Minnesota cities are located within the SA-04 corridor; four of the nine cities have populations greater than 1,000 persons. The city of Mankato (39,427 persons) is the largest city. Mankato is primarily located in Blue Earth County. Mankato is combined with North Mankato and other nearby communities to create a large urban region with a population over 50,000 people[56]. Residential and commercial development expands out from the two cities in all directions. The community of Eagle Lake (2,422 persons) is located southeast of Mankato and intersects the SA-04 corridor. Mankato and its surrounding area have experienced substantial population increases since the 2000 census. Mankato's population increased by 21 percent between the years 2000 and 2010.

As the corridor continues in a southeasterly direction to the Iowa border, development patterns and population density is rural with single farmsteads dispersed throughout the system alternative.

Iowa

Thirteen Iowa cities are located within the SA-04 corridor; four of the 13 cities have populations greater than 1,000 persons. The cities range in size from 111 persons (the city of Center Junction) to 26,885 persons (the city of Clinton in Clinton County). The four larger cities of Monticello (3,796), Camanche (4,448), De Witt (5,322), and Clinton are all located in the southeastern part of the system alternative, toward Iowa's eastern border.

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[55] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

[56] Micropolitan Statistical Areas and Components, Office of Management and Budget, 2007-05-11. Retrieved 2008-07-27.

Starting at the Minnesota-Iowa border the system alternative continues in a southeasterly direction. Development patterns are rural and based on the farming; population density is low with single farmsteads dispersed throughout. As the system alternative approaches the Mississippi River and Illinois, non-agricultural-related residences appear more frequently along the roadways in a denser development pattern.

Illinois

Population density in Illinois is heaviest in the cities of Minooka-Channahon. Eight cities are located within the SA-04 corridor; four of the eight have populations greater than 1,000 persons. The cities range in size from 48 persons (the village of Deer Grove) to 147,433 persons (the city of Joliet in Will County). Joliet, on the Des Plaines River, is the largest Illinois urban area affected by the SA-04 corridor. A greater length of the system alternative crosses through the cities of Channahon (12,560) and Minooka (10,924) than Joliet. Developments in these two towns consist of residential subdivisions with agriculture and open space lands located between the residential land uses. Development between the Mississippi River and Minooka consists of residences scattered throughout the corridor adjacent to the roadways and farm fields.

4.4.8 Community Features

SA-04 is largely rural, with community features typically concentrated in or near cities (Map A-18). The number and types of community of features are summarized in Table 4-37.

North Dakota

The system alternative includes 10 cemeteries and three churches. Three fire stations are located within the system alternative in Berthold, Deering and Mantador. Emergency services include a hospital in Stanley and an ambulance service in Berthold. Minot Air Force is partially located within the system alternative. Within the system alternative, Oberon has an elementary school and both Berthold and Wimbledon have an elementary school and high school.

The main highways crossed by SA-04 are Interstate 29 and 94; US 2, US 52, US 83, and US 281.

Minnesota

Three airports are located within the system alternative. One is private and two are public: Hector Municipal and Benson Municipal. Six cemeteries and five churches are in the corridor and three fire stations are in this system alternative. Police stations are located in Blomkest, Eagle Lake and Lyle.

The main highways crossed by SA-04 are Interstate 35, Interstate 90, US 14, US 59, US 71, US 75, US 169 and US 212.

Iowa

Scattered throughout the system alternative are 32 cemeteries and 16 churches. There are five fire stations, an ambulance service in Wyoming, and two schools: Midland High School in Wyoming and Grand Mound Elementary.

The main highways crossed by SA-04 are US 18, US 20, US 30, US 63 and US 151.

Illinois

Three airports are located within the system alternative, two private and one public (Morris Municipal). The Joliet Army Ammunition Plant is located southeast of the Joliet Refinery. Fifteen cemeteries and seven churches are scattered throughout the system alternative. Seven fire stations and three police stations are located in the system alternative. There are 10 schools in the system alternative: seven in Minooka and three in Channahon. In Minooka and Channahon, community features are more concentrated and may affect the placement of a pipeline ROW.

The main highways crossed by SA-04 are Interstate 80, Interstate 55, interstate 88, US 34 and US 51.

Table 4-37 Community Features – SA-04

SA-04 is largely rural with generally low concentrations of community features.

	Airports	Amtrak	Cemeteries	Churches	Fire stations	Hospitals	Military base	Police station	Schools
North Dakota	0	0	10	5	3	2	1	0	5
Minnesota	3	0	6	5	3	0	0	3	2
Iowa	0	0	32	16	5	1	0	0	2
Illinois	3	0	15	7	7	0	0	3	10
Total	**6**	**0**	**63**	**33**	**18**	**3**	**1**	**6**	**19**

Source: USGS TNM - National Structures Dataset

4.4.9 Cultural Resources

The National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are 12 architectural resources listed on the NRHP within SA-04 (Table 4-38). Two of these are historic districts in Iowa. There are five additional architectural structures in Iowa, three in Illinois and two in Minnesota.

Table 4-38 National Register of Historic Places Properties – SA-04

SA-04 includes 12 listed historic properties, the majority of which are in Iowa.			
Resource Name	State	County	NRHP ID
Mankato Holstein Farm Barn	Minnesota	Blue Earth	80001951
Alberta Teachers House	Minnesota	Stevens	83000942
Richardson-Jakway House	Iowa	Buchanan	85001382
Dugan's Saloon	Iowa	Clinton	01000908
Grand Mound Town Hall and Waterworks Historic District	Iowa	Clinton	01000910
Stoe Creek Bridge	Iowa	Fayette	98000782
Octagon Barn, Polk Township	Iowa	Howard	86001418
Caulkins, Dr. Martin H., House and Office	Iowa	Jones	82002625
Lock and Dam No. 14 Historic District	Iowa	Scott	04000174
Wood--Tellkamp House	Illinois	Bureau	94001599
First Congregational Church of LaMoille	Illinois	Bureau	96000059
Allen School	Illinois	Bureau	96000081

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites, such as rock art, rock alignments, and stone circles are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes and the Red River of the North and the Mississippi River, and their tributaries. In Iowa and Illinois, archaeological resources can be expected along major waterways and prominent hilltops and ridges.

4.4.10 Contaminated Areas

Nationally registered contaminated sites, such as those on the National Priorities List, pose the greatest environmental risk. No NPL sites were identified in SA-04.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are typically concentrated near higher populated cities and where industrial and commercial activity is more prevalent.

Table 4-39 below summarizes the number of potentially contaminated properties that are located within SA-04 (Maps A-21 and A-22)

Table 4-39 Potentially Contaminated Properties – SA-04

22 SA-04 listings are in Illinois.		
Listing Type	State	Number of Sites Within SA-04 By State
Brownfields Property	North Dakota	1
Compliance Activity	Iowa	5
	Illinois	5
	Minnesota	3
	North Dakota	3
Enforcement/Compliance Activity	Iowa	2
	Illinois	10
	Minnesota	4
	North Dakota	6
Formal Enforcement Action	Iowa	5
	Illinois	6
	Minnesota	3
	North Dakota	5
Superfund (Non-NPL)	Illinois	1
Total		**58**

Source: U.S. EPA, Facility Registration Service, 2014

4.4.11 Air Emissions

All counties in North Dakota, South Dakota, Minnesota and Iowa, and the majority of counties in Illinois in SA-04 are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns

(PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead. However, the following counties in Illinois, either in full or in part, are designated nonattainment for one or more pollutants as indicated:

- Grundy: 8-Hr ozone (part of county)
- Kendall: 8-Hr ozone and 1-Hr ozone (part of county for both)
- Will: 8-Hr ozone (whole county) and 1-Hr SO_2 (part of county)

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality.

As represented by NDPC, an additional 651 miles of pipeline would be associated with a route in SA-04. As compared to SA-Applicant, the additional pipeline length associated with a route in SA-04 would result in additional construction-related emissions.

In addition, as represented by NDPC, a route in SA-04 would require three additional pump stations with 12 additional pumps, as compared to SA-Applicant. Operational-related emissions would be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route in SA-04 would result in 163,703 metric tons per year of additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to SA-Applicant.

4.4.12 High-Consequence Areas and Natural Disaster Hazard Areas

The areas near the crossing of the Mississippi River near Clinton, Iowa, and the crossing of the Minnesota River near Mankato account for the majority of the effects on HCAs along SA-04. Flood hazard areas are concentrated where the system alternative crosses larger rivers particularly in the Red River Valley and eastern Iowa and western Illinois. Landslide hazard areas are generally west of the Red River Valley in North Dakota.

SA-04 crosses two high population areas (Mankato and Chicago) covering approximately 9,036 acres and 54 other population areas (OPA) covering 15,622 acres (Map A-23). The System Alternative crosses more than 2,800 acres (approximately 18 percent) in Channahon and Joliet near the eastern terminus and more than 2,500 acres (approximately 17 percent) in Clinton and Camanche as the System Alternative crosses the Mississippi River. Other OPA HCAs are scattered throughout the system alternative.

SA-04 crosses 32 drinking water HCAs covering approximately 8,230 acres and 153 ecological HCAs covering 37,725 acres (Map A-24 and A-25). The drinking water HCAs are scattered throughout, however

HCAs in Valley City, North Dakota, and Wyoming and Low Moor, Iowa, account for 75 percent of the drinking water HCAs in SA-04.

The ecological HCAs are concentrated at the crossing of the Mississippi River, where 136 HCAs covering more than 30,000 acres are located. These are related to the presence of existing state and federal resource lands, including the Upper Mississippi River National Wildlife and Fish Refuge.

Natural Disaster Hazard Areas are defined as being a Low/Med/High risk. For flood hazard, Medium risk zones cover approximately 12.5 percent of the SA-04, while High risk covers 7.8 percent (Map A-26). Medium and High risk areas are concentrated in the Red River Valley, along the Wapsipinicon River in eastern Iowa, and at crossings of larger rivers such as the Minnesota, Mississippi and Rock (Illinois).

For landslide hazard, Medium risk zones cover approximately 31.2 percent of the SA-03 while high risk covers only 0.4% (Map A-27). Medium Risk areas are concentrated in central and eastern North Dakota while the High risk areas are concentrated at the far western section of system alternative.

4.5 SA-05 Alliance-Enbridge-Chicago

System Alternative–05 begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to McHenry County, North Dakota, where it intersects with the Alliance Pipeline and travel southeast to Richland County, North Dakota, where it turns south and follows the I-29 corridor. In Duel County, South Dakota, SA-05 intersects with the Northern Border Pipeline and travels southeast across Minnesota and Iowa to Poweshiek County, Iowa, where it intersects with an Enbridge Pipeline and continues east through Illinois to its termination point in Joliet, Illinois. SA-05 is approximately 1,000 miles long and passes through North Dakota, South Dakota, Minnesota, Iowa and Illinois. This system alternative is the longest of the seven alternatives.

4.5.1 Geology/Soils/Groundwater

Geology, soil types and groundwater Aquifer locations for SA-05 are represented in Maps A-3, 4, 5 and 6. The section generally discusses some of the potential affects that pipeline construction could have on these resources.

Geology

The majority of the SA-05 is underlain by glacial deposits overlying mainly sedimentary rocks. More than half is sandstone bedrock from the Cretaceous Era. Table 4-40 identifies the uppermost bedrock types crossed by SA-05.

Table 4-40 Bedrock Geology – SA-05

The entire length of SA-05 is underlain by sedimentary bedrock.			
Geologic Era	**Geologic Description**	**Acres in SA-05**	**Percentage of SA-05**
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	61,101	4.74%
	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	415,790	32.27%
	Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks	9,143	0.71%
Mesozoic	Cretaceous sedimentary rocks	684,588	53.14%
Cenozoic	Paleogene sedimentary rocks	117,730	9.14%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

Shallow bedrock or bedrock outcrops could be impacted by the pipeline construction if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Soils

SA-05 includes 13 Major Land Resource Areas (MLRAs), with four covering more than 10 percent of the area (see table below). MLRA 55B has a nearly level to gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 102A is a nearly level to rolling with many prairie potholes present. Mollisols dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy. MLRA 103 is a nearly level to gently rolling with moraines and glacial lake plains. Mollisols, and to a lesser extent, Alfisols and Inceptisols dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy. MLRA 108C is mostly rolling to hilly, but some broad ridge tops are nearly level to undulating. Mollisols dominate the soil order, with lesser amounts of Alfisols, Entisols and Inceptisols. Soils generally are very deep, well drained to poorly drained, ands silty, loamy or clayey.

More than 85 percent of the soils in SA-05 have essentially no limitations for construction. Approximately 2 percent have limitations with regard to shallow bedrock related issues. Soils that are shallow or have bedrock near the surface may require careful routing and alternative construction techniques. Five percent have shrink/swell issues, primarily in the Red River Valley. Soils that have shrink swell characteristics may require alternative designs and maintenance to ensure the stability of the pipe. Just over 5 percent of SA-05 traverses landscapes with known sinkholes, located in eastern Iowa.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape, and soil characteristics in each MLRA (USDA 2006).

Table 4-41 Major Land Resource Areas (MLRAs) – SA-05

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-05	Percent of SA-05
53B	Central Dark Brown Glaciated Plains	-	62,313	4.8
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.4
55A	Northern Black Glaciated Plains	-	107,842	8.4
55B	Central Black Glaciated Plains	-	236,197	18.3
56	Red River Valley of the North	Shrink swell	63,654	4.9
102A	Rolling Till Prairie	-	220,121	17.1
103	Central Iowa and Minnesota Till Prairies	-	204,930	15.9
104	Eastern Iowa and Minnesota Till Prairies	Sinkholes	68,304	5.3
108A	Illinois and Iowa Deep Loess and Drift, Eastern Part	-	66,236	5.1
108B	Illinois and Iowa Deep Loess and Drift, East-Central Part	-	32,151	2.5
108C	Illinois and Iowa Deep Loess and Drift, West-Central Part	-	165,243	12.8
110	Northern Illinois and Indiana Heavy Till Plain	-	38,069	3.0
115C	Central Mississippi Valley Wooded Slopes, Northern Part	Shallow/bedrock	17,599	1.4
Total			**1,288,352**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-05 has a mix of hydraulic conductivity rates in the surficial soils, with 48 percent rated High, followed 33 percent rated Low (Table 4-42). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-42 Relative Hydraulic Conductivity Ratings – SA-05

Hydraulic Conductivity Range	Percent of Area
Low	33
Medium	18
High	48
Total	100

Source: Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Landscapes that have sinkholes present may have higher potential for groundwater impacts, should a leak occur. Soil permeability also influences potential for groundwater impacts; however at the scale of this analysis, permeability is so varied that no conclusions can be made based on MLRA characteristics.

Groundwater

Groundwater for drinking water, potable water, industrial, and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout SA-05. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers that lack any or adequate glacial cover would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

The entire length of SA-05 is underlain by sedimentary bedrock aquifer systems. Table 4-43 summarizes the primary bedrock aquifers that are used as water supply sources along the SA-05 corridor. Section 4.1 provides background information on groundwater.

Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

Table 4-43 Principal Bedrock Aquifer Systems – SA-05

The entire length of SA-05 is underlain by sedimentary bedrock aquifer systems.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-05 by State Crossed	Bedrock Type (Associated with Principal Aquifer)	Percent Acres of Aquifer in SA-05 by State
Cambrian-Ordovician aquifer system	Illinois	42,618.57	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	3.31%
Lower Cretaceous aquifers	Iowa	19,056.34	Cretaceous sedimentary rocks	1.48%
	Minnesota	35,631.69	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	2.77%
	North Dakota	7,129.46	Unknown	0.55%
Lower Tertiary aquifers	North Dakota	116,153.68	Paleogene sedimentary rocks	9.02%
Mississippian aquifers	Iowa	68,781.95	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	5.34%
Other rocks	Illinois	27,795.63	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	2.16%
	Iowa	62,690.25	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	4.87%
	Minnesota	129,233.09	Upper Paleozoic (Pennsylvanian and Permian) sedimentary rocks	10.03%
	North Dakota	259,246.38	Cretaceous sedimentary rocks	20.12%
	South Dakota	146,774.69	Unknown	11.39%
Silurian-Devonian aquifers	Illinois	80,864.98	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	6.28%
	Iowa	162,437.33	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	12.61%
Upper carbonate aquifer	Iowa	37,860.36	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	2.94%
Upper Cretaceous aquifers	North Dakota	92,077.21	Cretaceous sedimentary rocks	7.15%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands

SA-05 encounters the following seven bedrock aquifer types represented on Map A -6:

Cambrian-Ordovician Aquifer System
The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and southeastern Minnesota. The lower part of the aquifer consists of sandstone, while the upper part is a mix of sandstone and shale interbedded with limestone or dolomite.

Lower Cretaceous Aquifers
Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the eastern state lines of North Dakota and South Dakota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers
Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-05. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Mississippian Aquifers
The Mississippian aquifers underlie the southwestern portion of Iowa and areas slightly to the north and east. The aquifer consists of mainly limestone and dolomite. It is typically overlain by younger rocks that confine this unit and restrict groundwater circulation. In areas where this unit forms the bedrock surface, the aquifer is unconfined and hydraulically connected to the extremely permeable glacial material.

Silurian-Devonian Aquifers
The Silurian-Devonian aquifers are present only in Iowa and Illinois along this system alternative corridor. These aquifers typically subcrop below Quaternary deposits; with the exception of a small portion of the corridor near the Iowa-Illinois state line where it is overlain by younger Paleozoic rocks. These aquifers are composed of mostly limestone and dolomite, but locally contain interbedded shale and evaporate beds.

Upper Carbonate Aquifer
The Upper Carbonate aquifer is an important aquifer only to portions of southeastern Minnesota and northeastern Iowa. As the name implies, it consists of carbonate bedrock (limestone, dolomite, and dolomitic limestone). The upper part of the aquifer consists of a shale and carbonate rock sequence. Extensive fracturing and subsequent dissolution of the carbonate portion of the rock has made the

aquifer very productive. Karst features such as solution-enlarged openings, sinkholes, and caves have contributed to the porous nature of this aquifer, thus, making it very susceptible to contamination.

Upper Cretaceous Aquifers

Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-05. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

4.5.2 Ecoregions

SA-05 crosses the Great Plains and Eastern Temperate Forest ecoregions; most of the area has been converted to agriculture or developed. SA-05 crosses four Level II and seven Level III ecoregions, as shown in Table 4-44.

SA-05 starts in the Great Plains ecoregion and ends in the Eastern Temperate Forest. Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions (Map A-7). In the area of the system alternative, the West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. The Temperate Prairies consist of the Northern Glaciated Plains, the Lake Agassiz Plain, and the Western Corn Belt Plains regions in the area of the system alternative. Within the Eastern Temperate Forest, the system alternative crosses the Central USA Plains and the Southeastern Plains, which are made up entirely of the Central Corn Belt Plains and the Interior River Valleys and Hills, respectively. For a description of Ecoregions see Section 4.1.

Table 4-44 Miles of SA-05 by Ecoregion

SA-05 crosses the Great Plains and Eastern Temperate Forest ecoregions.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	834	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46

SA-05 crosses the Great Plains and Eastern Temperate Forest ecoregions.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
				Northwestern Great Plains	4
		Temperate Prairies	784	Northern Glaciated Plains	403
				Lake Agassiz Plain	49
				Western Corn Belt Plains	332
Eastern Temperate Forests	115	Central USA Plains	98	Central Corn Belt Plains	98
		Southeastern USA Plains	17	Interior River Valleys and Hills	17
Total Miles					**949**

Source: USEPA, Ecoregions of the United States, 2013

4.5.3 Land Cover

SA-05 traverses through five states, a total of 50 counties, 47 cities, and 1,000 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, mainly grassland/ herbaceous vegetation to agriculture from west to east along the system alternative.

Starting at the west end of the system alternative and moving east, the land cover is dominated by agriculture, open grasslands, and prairie wetlands similar to SA-04. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams, as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses southeast, there are higher concentrations of herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. Continuing southeast, the land cover becomes mainly cultivated crops. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads.

The majority of land cover in SA-05 is cultivated, as illustrated in the table below. As the system alternative traverses south into South Dakota, the land cover continues to be agricultural with scattered areas of grasslands and prairie pothole wetlands. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads. Near Watertown, South Dakota the system alternative turns southeast towards the Minnesota border.

As the system alternative crosses the Minnesota border, the land cover continues to be agricultural with scattered farmsteads. As the system alternative extends southeast and nears the southern part of the state, the land cover remains agricultural with many small depressional wetlands. Also within this area there are many small cities, similar to the rest of the corridor throughout the state.

As the system alternative crosses into Iowa, land cover remains agricultural with many small rural residencies. Additionally, there are many forested areas around waterways and farmsteads serving as windbreaks. As the system alternative approaches the Mississippi River, pockets of wetlands and deciduous forests appear. The corridor passes by the urban area of Davenport, Iowa, through to the border.

As the system alternative crosses the Mississippi River into Illinois, the land cover remains agricultural, with many isolated farmsteads which include windbreaks. Continuing east, the agriculture cover continues until the system alternative approaches the Joilet refinery near Chicago. Land cover in this part of the state gradually becomes exurban bedroom communities to suburban cities to urban industrialized.

Table 4-45 Land Cover – SA-05

The majority of land cover in SA-05 is cultivated.		
Land Cover	Acres	Percent
Barren	969	0.02%
Developed	81,757	6.3%
Forest	19,263	1.5%
Herbaceous	147,256	11.4%
Planted/Cultivated	970,791	75.3%
Shrubland	555	0.04%
Open Water	21,074	1.6%
Wetlands	46,686	3.6%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.5.4 Water Resources

Water resources located within in the SA-05 corridor include rivers, streams, lakes, ponds, and wetlands (Map A-10). SA-05 includes portions of 146 named streams, some of which are divided in to several segments or cross the corridor multiple times for a total of 1,157 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 5,046.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. SA-05 crosses segments of flowages approximately 5,046 times. From west to east rivers crossing SA-05 include White Earth, Des Lacs, Souris, Sheyenne, James, and Wild Rice in North Dakota, the Big Sioux in South Dakota, the Yellow Medicine, Redwood and Cottonwood in Minnesota, the Blue Earth, Iowa, Cedar, and Mississippi in Iowa and the Rock, Hennepin Feeder Canal, Green, Fox, Du Page and Des Plaines in Illinois. Of these streams or flowages, the largest is the Mississippi River.

SA-05 crosses the Mississippi River in Scott County, Iowa/Rock Island County, Illinois. The width of the Mississippi River and associated riparian wetland area where SA-05 crosses is approximately 3,000 feet, making it the third widest crossing of the River by any system alternative. Construction of the pipeline at this location would require additional impact mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-05 crosses approximately 117 impaired river or stream segments.

SA-05 crosses all or portions of 35 named lakes. The system alternative also includes numerous unnamed water bodies, bringing the total of water bodies to 3,924. Water bodies include intermittent or perennial lakes and ponds, swamps, and marshes. SA-05 crosses through areas with a high concentration of water bodies in Ward and Pierce counties in North Dakota, and Roberts and Deuel counties in South Dakota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant within the SA-05 corridor, especially in McHenry, Peirce, Stutsman, and Barnes counties, North Dakota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the system alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub, and pond), lacustrine (lake), and riverine. The NWI dataset combines the forested and scrub shrub wetlands into the "forested/shrub" wetland type as these wetlands are similar in that they support woody vegetation. The table below describes the acres of each type of wetland within SA-05.

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

Table 4-46 Wetland Types – SA-05

Emergent wetlands make up 3.6 percent of the area and over half the wetlands in SA-05.		
Wetland Type	**Acres**	**Percentage of SA-05**
Emergent	46,585	3.6%
Lake[1]	8,467	<1%
Forested/Shrub	4,529	<1%
Pond[1]	3,561	<1%
Riverine	1,714	<1%
Other	6	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as water bodies referenced in the paragraph above.

SA-05 crosses numerous watercourses, water bodies and wetlands. There are several areas with the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline including McHenry and Pierce counties in North Dakota.

4.5.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-05 corridor: 11 listed endangered species, nine threatened species, three candidate species, and one proposed threatened species. Table 4-47 describes these species, their current federal listing status, and counties crossed by SA-05 where they are known to or believed to occur. For three of the endangered species (sheepnose mussel, spectaclecase, and pallid sturgeon) and one threatened species (decurrent false aster) the system alternative is located within the species' counties of occurrence but does not cross any of the streams where the threatened or endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-47 Endangered Species Act Listed Species Potentially within SA-05

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Williams
Piping plover	*Charadrius melodus*	All populations except Great Lakes watershed: Threatened	Shoreline • Breeds on open, sparsely vegetated sand or gravel beaches adjacent to alkali wetlands, and on beaches, sand bars, and dredged material islands of major river systems.	**North Dakota:** Benson, Eddy, McHenry, Mountrail, Pierce, Stutsman, Ward, Wells, Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, Eddy, Foster, McHenry, Mountrail, Pierce, Stutsman, Ward, Wells, Williams **South Dakota:** Brookings, Codington, Deuel, Grant, Hamlin, Roberts **Iowa:** *County level range not defined in IA* **Minnesota:** *County level range not defined in MN*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Barnes, Benson, Eddy, McHenry, Mountrail, Pierce, Ransom, Sargent, Stutsman, Ward, Wells, Williams
Whooping crane	*Grus americana*	Endangered	Marsh	**North Dakota:** Barnes, Benson, Cass,

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			• Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	Eddy, Foster, McHenry, Mountrail, Pierce, Ransom, Richland, Sargent, Stutsman, Ward, Wells, Williams, **South Dakota:** Codington, Hamlin
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Iowa:** Johnson **Illinois:** Rock Island, Whiteside
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	Aquatic • Found in shallow areas of larger rivers and streams, with moderate to swift currents flowing over coarse sand and gravel.	**Illinois:** Muscatine, Grundy, La Salle, Rock Island, Whiteside, Will
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Illinois:** Rock Island, Will
Fishes				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**North Dakota:** Mountrail, Williams
Topeka Shiner	*Notropis topeka*	Endangered	Aquatic • Primarily occurs in small prairie (or former prairie) streams in pools containing clear, clean	**South Dakota:** Brookings, Codington, Deuel, Grant, Hamlin

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			water.	
Flowering Plants				
Decurrent false aster	*Boltonia decurrens*	Threatened	Floodplains and wetlands • Found on moist, sandy, floodplains and prairie wetlands along the Illinois River.	**Illinois:** Bureau, La Salle
Lakeside daisy	*Hymenoxys herbacea*	Threatened	Prairie Grassland • Found in dry, rocky areas underlain by limestone. • Requires open sites with full sun.	**Illinois:** Will
Leafy prairie-clover	*Dalea foliosa*	Endangered	Prairie • Found in prairie remnant along the Des Plains River in Illinois, in thin soils over limestone substrate.	**Illinois:** La Salle, Will
Mead's milkweed	*Asclepias meadii*	Threatened	Prairie • Requires moderately wet (mesic) to moderately dry (dry mesic) upland tallgrass prairie or glad/barren habitat characterized by vegetation adapted for drought and fire.	**Illinois:** Will
Northern wild monkshood	*Aconitum noveboracense*	Threatened	Cliffs, talus slopes, or streamside sites • Typically found on shaded to partially shaded sites with cool soil conditions, cold air drainage, or cold groundwater flowage.	**Iowa:** Hardin
Prairie bush-clover	*Lespedeza leptostachya*)	Threatened	Prairie • Known only from the tallgrass prairie region of the upper Mississippi River Valley.	**Iowa:** Cedar, Cerro Gordo, Franklin, Grundy, Hancock, Hardin, Iowa, Johnson, Kossuth, Marshall, Muscatine, Poweshiek, Scott, Tama, Winnebago **Illinois:**

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
				Lee, Cottonwood **Minnesota:** Jackson, Martin
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**North Dakota:** Ransom, Richland **South Dakota:** Brookings, Roberts **Minnesota:** Lincoln **Iowa:** Cedar, Cerro Gordo, Franklin, Grundy, Hancock, Hardin, Johnson, Kossuth, Marshall, Muscatine, Poweshiek, Scott, Tama, Winnebago
Eastern prairie fringed orchid	*Platanthera leucophaea*)	Threatened	Wet prairies and meadows • Occurs in a wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, and bogs. • Requires full sun and grassy habitat with little or no woody encroachment.	**Illinois:** Bureau, Grundy, Kendall, La Salle, Lee, Rock Island, Whiteside, Will
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** Barnes, Eddy, McHenry, Mountrail, Pierce, Ransom, Richland, Sargent, Stutsman, Ward, Wells, **South Dakota:** Brookings, Codington, Deuel, Grant, Hamlin, Roberts

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
				Minnesota: Cottonwood, Lincoln, Murray
Hine's emerald dragonfly	*Somatochlora hineana*	Endangered	Marshes and sedge meadows • Lives in calcareous spring-fed marshes and sedge meadows overlaying dolomite bedrock.	**Illinois:** Will
Poweshiek skipperling	*Oarisma poweshiek*)	Endangered	Prairie • Lives in high quality tallgrass prairie in both upland, dry areas as well as low, moist areas.	**North Dakota:** Ransom, Richland, Sargent **South Dakota:** Brookings, Codington, Deuel, Grant, Hamlin, Roberts **Minnesota:** Lincoln, Lyon, Murray **Iowa:** Cerro Gordo, Hancock, Cottonwood
Rattlesnake-master borer moth	*Papaipema eryngii*	Candidate	Prairie • Mesic and wet-mesic prairies. • Associated with moderately disturbed to relatively undisturbed prairie in Illinois.	**Illinois:** Grundy, Will
Mammals				
Indiana bat	*Myotis sodalis*	Endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees.	**Iowa:** Iowa, Johnson, Poweshiek, Scott, Tama

Potentially Counties crossed by SA-05 include 24 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Reptiles				
Eastern massauga	*Sistrurus catenatus*	Candidate	Wet areas • Live in wet prairies, marshes, and low areas along rivers and lakes. • Also use adjacent uplands during part of the year.	**Illinois:** Will **Iowa:** Scott

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

SA-05 crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover and the Topeka shiner and crosses proposed critical habitat for the Dakota skipper (Map A-13). Critical habitat was designated for the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638), and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, North Dakota, and South Dakota. The system alternative crosses the piping plover critical habitat in Mountrail County, North Dakota.

Critical habitat was designated for the Topeka shiner on July 27, 2004 (69 CFR 44736) and includes 83 stream segments in Iowa and Minnesota. The system alternative crosses several of these stream segments in Lincoln County, Minnesota.

Critical habitat was proposed for the Dakota skipper on October 23, 2014 (79 FR 63672). Proposed critical habitat for the Dakota skipper includes those areas with high-quality native remnant prairie with a high diversity of native prairie grasses and flowering forbs, and is crossed by the system alternative in McHenry County, Ransom County, North Dakota, and Roberts County, South Dakota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.5.6 Public Resource and Recreational Lands

The review of public lands and recreation areas showed that SA-05 crosses numerous federal and state-managed public recreation areas in North Dakota, South Dakota, Minnesota, Iowa and Illinois (Table 4-48 and Maps A-14 and A-15). The majority of potential affects occur in counties with high

concentrations of public lands including McHenry and Pierce, North Dakota; Roberts and Grant, South Dakota; Lincoln and Lyon, Minnesota; Hancock, Cerro Gordo and Tama, Iowa; and Grundy, Illinois .

Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

North Dakota

East of Tioga Beaver Creek Station, SA-05 passes through a concentration of national WMAs, federally managed WPAs, and state-managed WLPs in Mountrail and Ward counties. Continuing East into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern McHenry County and southern Pierce County. Avoiding most public lands in Wells, Foster, and Stutsman counties, the system alternative continues through an area of Barnes County with several NWIs and a mix of Private Lands Open to Sportsmen (PLOTS) designated lands. In Ransom County, the system alternative crosses the southeastern portion of the Sheyenne National Grassland and then continues into South Dakota with few additional impacts to public lands.

South Dakota

Public lands managed by the State of South Dakota include state parks, game production areas, recreation areas, and lakeside use areas. Similar to North Dakota and Minnesota, South Dakota has a number of easement programs that offer hunting opportunities on private land as part of the Habitat and Access Program. These easement programs include the Wildlife Partnership Program (WPP), Walk-in Area Program (WIP), Controlled Hunting Access Program (CHAP), and the Conservation Reserve Enhancement Program (CREP).

As the system alternative enters Roberts County, it passes through scattered WPAs and WMAs, especially in the northern section of County. Another cluster of WPAs and WMAs are crossed near the Grant County line, and then the system alternative continues through an area clear of public lands in Codington County, Hamlin County, and the southern part of Deuel County where it crosses into Minnesota.

Also in Roberts and Grant Counties, SA-05 goes through the jurisdictional boundaries of the Lake Traverse Indian Reservation. It is unknown whether any tribal properties are within the system alternative.

Minnesota

As the system alternative crosses through Minnesota, it crosses areas with evenly dispersed and somewhat abundant WMAs, WPAs, and Board of Water and Soil Resources (BWSR) Conservation Areas in Lincoln and Lyon Counties. The system alternative passes between Camden State Park in Lyon County and Lake Shetak State Park in Murray County, avoiding them completely. Continuing through Cottonwood, Jackson, and Martin Counties with similarly dispersed WMAs and WPAs, the system alternative enters Iowa in Kossuth County.

Table 4-48 Public Resource and Recreational Lands – SA-05

SA-05 includes North Dakota Private Lands Open to Sportsmen (PLOTS) lands and Federal waterfowl Production Areas.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife-National Wildlife Refuge	2	123
	U.S. Forest Service-National Grassland	1	893
	Waterfowl Production Area	14	3,599
North Dakota	State Wildlife Areas-PLOTS lands	56	7,972
South Dakota	X	X	
Minnesota	Natural Areas-Scientific Natural Areas	0	0
	Conservation Areas-BWSR	83	3,016
Iowa	State Wildlife Areas-State Preserves	2	41
	Conservation Areas-NRCS Easement	21	1500
Illinois	State Park	1	75
	Conservation Areas	3	138
Total		**184**	**17,357**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

Iowa

Traveling through Kossuth County, the system alternative avoids all public lands by crossing through the northeastern corner of the county. In Winnebago and Hancock Counties, the system alternative passes through a cluster of WPAs, WMAs, and NRCS easement areas before continuing into Cerro Gordo County. In Cerro Gordo County, the system alternative passes through an area with several larger WMAs and a few NRCS easements. As the system alternative travels south, public lands are scarce until the southern part of Tama County where it crosses the Iowa River Corridor WMA and associated smaller WMAs. The remainder of the corridor passes through an area of Iowa with few public lands, except

where it crosses the Iowa River in Johnson County. The Iowa River is managed by DNR as a Sovereign Water, and is surrounded by a complex of NRCS easement areas.

Illinois

The system alternative crosses through the Upper Mississippi River Wildlife and Fish Refuge and continues into Illinois in Rock Island County. In Whiteside County, the system alternative passes through a State Fish and Wildlife Area and the Hennepin Canal Parkway State Park and Access Area before entering Bureau County. The remainder of the alignment is free of public areas with the exception of the Fox River State Park in La Salle County and the terminus in Will County, where it includes the Illinois and Michigan Canal (a state trail and greenway), the Midewin National Tallgrass Prairie, and several conservation areas.

4.5.7 Cities and Population Density

The review of population distribution, density and city locations shows that SA-05 is largely rural, with the exceptions of four locations: Watertown, South Dakota; Iowa City, Iowa; Davenport, Iowa, and Joliet/Channahon/Minooka, Illinois (Table 4-49). The average over the entire corridor is 26 persons per square mile. There are 42 cities partially or totally within the SA-05 corridor (Maps A-16 and A-17).

In South Dakota, the system alternative skirts the eastern side of Watertown with 21,482 persons. In Iowa the system alternative crosses the southern portion of Iowa City (67,862 persons). The system alternative crosses north of Davenport, Iowa - a large city along the Mississippi River. In Illinois, the combined towns of Joliet/Channahon/Minooka (approximately 171,000 persons) are crossed.

Table 4-49 Population Density and Cities – SA-05

SA-05 includes 42 cities, most of which are small cities in North Dakota, Minnesota and Iowa.						
	ND	**MN**	**SD**	**IA**	**IL**	**Total**
Average Persons per Sq Mile	6	12	9	22	70	26
Number of cities	9	9	3	13	8	42
Cities >1000	1	1	1	5	4	12

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

Nine North Dakota cities are located within the SA-05 corridor; one of the seven cities in North Dakota has a population greater than 1,000 persons. The cities range in size from 20 persons (the city of Leal) to 1,469 persons (the city of Stanley in Mountrail County). The 2010 census showed that the Minot Air Force Base is a census designated place[57] (CDP) with a population of 5,521, a decrease from a population of 7,599 in 2000. The Minot Air Force base, located 13 miles north of the city of Minot, is north of and adjacent to the system alternative, with certain military facilities within the system alternative boundary. Six of the towns in the corridor have populations under 100 persons, and two are around 500 persons (Berthold, 458 persons and Wyndemere, 428 persons). The towns and their surroundings are rural in character. The system alternative is sparsely populated; census block groups indicate approximately 0 to 10 people per square mile (size is equivalent to a Public Land Survey section).

South Dakota

Three South Dakota cities are located within the SA-05 corridor. One of the three cities in South Dakota has a population greater than 1,000 persons. Watertown, which is in Codington County with a population of 21,482, is the largest city. The eastern portion of Watertown is located within the corridor.

The SA-05 corridor in South Dakota is located away from population centers and residential areas as it traverses between North Dakota and Minnesota.

Minnesota

Nine Minnesota cities are located within the SA-05 corridor; one of the nine cities has a population greater than 1,000 persons. The largest community is Fairmont in Martin County, with a population of 10,666. The corridor crosses a small portion of the southwest corner of the city.

As the corridor continues in a southeasterly direction to the Iowa border, development patterns and population density is rural with single farmsteads dispersed throughout the system alternative.

Iowa

Thirteen Iowa cities are located within the SA-05 corridor; five of the 13 cities in Iowa have populations greater than 1,000 persons (Hampton 1,187 persons; Ackley, 1,589 persons; Walcott, 1,629 persons;

[57] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

Eldridge, 5,651). Iowa City with 67,862 persons in Johnson County is the largest urban area. Populations for the 13 cities range from 176 to 67,862 people.

Starting at the Minnesota-Iowa border, the system alternative continues in a southeasterly direction. Development patterns are rural and based on farming; population density is low with single farmsteads dispersed throughout. As the system alternative approaches the Mississippi River and Illinois, non-agricultural-related residences appear more frequently along the roadways in a denser development pattern.

The corridor crosses the Mississippi River south of Princeton with dense residential development on the river.

Illinois

Eight cities are located within the SA-05 corridor, four of the eight have populations greater than 1,000 persons (Port Byron, 1,647; Minooka, 10,924; Channahon, 12,560; and Joliet). Joliet on the Des Plaines River in Will and Kendall counties with 147,433 persons is the largest Illinois urban area crossed by the system alternative. Joliet on the Des Plaines River is the largest Illinois urban area affected by the SA-04 corridor. However, a greater length of the system alternative crosses through the cities of Channahon (population 12,560) and Minooka (population 10,924) than through Joliet. Development in these two towns consist primarily of residential subdivisions, with agriculture and open space lands located between the residents.

There is no dense development within the corridor until the system alternative reaches Minooka. Two small rural towns, however, are completely within the corridor: La Moille (726 persons) and Troy Grove (250 persons). Development on the Mississippi River consists of residential development. Residences are dispersed throughout the corridor adjacent to the roadways.

4.5.8 Community Features

SA-05 is largely rural and thus community features are scattered in the system alternative, typically concentrated in or near cities (Map A-18). The number and types of community of features are summarized in the Table 4-50.

North Dakota

The system alternative includes 10 cemeteries and three churches. Three fire stations are located within the system alternative in Berthold, Deering and Mantador. Emergency services include a hospital in Stanley and an ambulance service in Berthold. Minot Air Force is partially located within the system alternative. Oberon has an elementary school and both Berthold and Wimbledon have an elementary school and high school.

The main highways crossed by SA-05 are Interstate 29 and 94; US 2, US 52, US 83 and US 281.

South Dakota

Two airports are located within the system alternative. One is private and one is public: Sisseton Municipal. Eight cemeteries and four churches are present. There are two volunteer fire departments located in Astoria and Summit.

The main highways crossed by SA-05 are Interstate 29, US 12, US 212, and US 14.

Minnesota

Two airports are located within the system alternative. One is private and one is public: Windom Municipal. Five cemeteries and one church are present. Three police and/or sheriff departments and two schools are located in Russell and Ivanhoe.

The main highways crossed by SA-05 are Interstate 90, US 14, US 59, US 71 and US 75.

Iowa

The Toledo Municipal Airport is located within the system alternative. Thirty-two cemeteries and 20 churches are scattered throughout the system alternative. Four fire stations, two hospitals and one police station are located in the system alternative. Six schools are included in the system alternative.

The main highways crossed by SA-05 are Interstate 35, Interstate 80, US 65, US 20, US 30, US 63 and US 169.

Illinois

Two airports are within the system alternative. One is private and a municipal airport is located in Morris. The Joliet Army Ammunition Plant is located southeast of the Joliet Refinery. Fourteen cemeteries and 13 churches are scattered throughout the system alternative. Eight fire stations are located within the system alternative and are concentrated around the cities of Minooka and

Channahon. Two police stations and 19 schools are in the corridor. Most of the schools are located in Minooka.

The main highways crossed by SA-05 are Interstate 80, Interstate 55, Interstate 88, US 34 and US 52.

Table 4-50 Community Features – SA-05

Concentration of community features in SA-05 is relatively low except in the area around Minooka and Channahon, Illinois.

	Airports	Amtrak	Cemeteries	Churches	Fire stations	Hospitals	Military base	Police station	Schools
North Dakota	0	0	10	5	3	2	1	0	5
Minnesota	2	0	5	1	1	0	0	4	2
South Dakota	2	0	8	4	2	0	0	0	0
Iowa	1	0	32	20	4	2	0	1	6
Illinois	2	0	14	13	8	0	0	2	19
Total	**7**	**0**	**69**	**43**	**18**	**4**	**1**	**7**	**32**

Source: USGS TNM - National Structures Dataset

4.5.9 Cultural Resources

National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are 16 total listed architectural resources listed on the NRHP within SA-05 (Table 4-51). Two of these are historic bridges in South Dakota. There is one listed property in Minnesota. Of the 10 resources listed in Iowa, one is a historic district, and the remaining are buildings, typically within cities. There are three architectural structures in Illinois, all in Bureau County.

Table 4-51 National Register of Historic Places Properties – SA-05

SA-05 includes 16 listed historic properties, the majority of which are in Iowa.			
Resource Name	State	County	NRHP ID
South Dakota Dept. of Transportation Bridge No. 15-210-136	South Dakota	Coddington	93001265
South Dakota Dept. of Transportation Bridge No. 29-279-010	South Dakota	Hamlin	93001292
Lincoln County Courthouse and Jail	Minnesota	Lincoln	80004541
Downey Savings Bank	Iowa	Cedar	76000740
Maysville Schoolhouse	Iowa	Franklin	81000237
Reeve Electric Association Plant	Iowa	Franklin	89002307
Illinois Central Combination Depot--Ackley	Iowa	Hardin	90001303
Secrest Octagon Barn	Iowa	Johnson	74000790
Polygonal Barn, Lincoln Township	Iowa	Johnson	86001452
Roberts Octagon Barn	Iowa	Johnson	86001449
First Welsh Congregational Church	Iowa	Johnson	77000528
Eldridge Turn--Halle	Iowa	Scott	87000032
Lock and Dam No. 14 Historic District	Iowa	Scott	04000174
First Congregational Church of LaMoille	Illinois	Bureau	96000059
Wood--Tellkamp House	Illinois	Bureau	94001599
Allen School	Illinois	Bureau	96000081

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Known sensitive areas for archaeological sites in South Dakota include areas adjacent to major drainage features such as the Big Stone. Non-habitation sites such as rock art, rock alignments, and stone circles are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes and tributaries to the Minnesota River. In Iowa and Illinois, archaeological resources can be expected along major waterways and prominent hilltops and ridges.

Other Cultural Resources

SA-05 passes through the Sisseton-Wahpeton Indian Reservation. Though no data is available for analysis, it is expected that there are areas of spiritual and religious importance to the Sisseton-Wahpeton people within the system alternative corridor.

4.5.10 Contaminated Areas

Nationally registered contaminated sites, such as those on the National Priorities List (NPL), pose the greatest environmental risk. No NPL sites were identified in SA-05.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are typically concentrated near higher populated cities and/or where industrial and commercial activity is more prevalent.

Table 4-52 below summarizes the number of potentially contaminated properties that are located within SA-05 (Maps A-21 and A-22).

Table 4-52 Potentially Contaminated Properties – SA-05

The majority of the listings within SA-05 are related to compliance activities.		
Listing Type	State	Number of Sites Within SA-05 By State
Brownfields Property	North Dakota	1
	South Dakota	8
Compliance Activity	Iowa	19
	Illinois	8
	North Dakota	3
	South Dakota	1
Enforcement/Compliance Activity	Iowa	4
	Illinois	10
	Minnesota	1
	North Dakota	10
	South Dakota	1
Formal Enforcement Action	Iowa	10
	Illinois	3
	Minnesota	2
	North Dakota	5
Leaking Underground Storage Tank (as defined by the American Recovery and Reinvestment Act)	South Dakota	1
Superfund (Non-NPL)	Illinois	1
Total		**88**

Source: U.S. EPA, Facility Registration Service, 2014

4.5.11 Air Emissions

The counties in North Dakota, South Dakota and Minnesota, and the majority of counties in Iowa and Illinois through which a route in SA-05 would be constructed and operated are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon

monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead. However, the following counties in Iowa and Illinois, either in full or in part, are designated nonattainment for one or more pollutants as indicated:

Iowa

Muscatine: 1-Hr SO_2 (part of county)

Illinois

Grundy: 8-Hr ozone (part of county)
Kendall: 8-Hr ozone and 1-Hr ozone (part of county for both)
Will: 8-Hr ozone (whole county) and 1-Hr SO_2 (part of county)

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality. As represented by NDPC, an additional 756 miles of pipeline would be associated with a route in SA-05. As compared to SA-Applicant, the additional pipeline length associated with a route in SA-05 would result in additional construction-related emissions.

As represented by NDPC, a route in SA-05 would require four additional pump stations with 16 additional pumps, as compared to SA-Applicant. Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route in SA-05 would result in 201,228 metric tons per year of additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to SA-Applicant.

Construction and operation of a route in SA-05 would result in direct and secondary affects to air quality, including at least one existing nonattainment area in Iowa and/or Illinois. The effects of the construction and operation of a route in SA-05 would be expected to be insignificant. However, the construction and operation of a route in SA-05 would be expected to have a higher overall affect than the construction and operation in SA-Applicant.

4.5.12 High-Consequence Areas and Natural Disaster Hazard Areas

High Consequence Areas (HCAs) and Natural Disaster Hazard Areas are defined by the USDOT PHMSA as areas that are more sensitive or hold more risk for placement of an oil pipeline. SA-05 crosses three high population areas (Davenport, Iowa City, and Chicago) covering approximately 9,170 acres and 54 other population areas (OPA) covering 16,380 acres (Map A-23). Channahon, Illinois (just west of Chicago); Eldridge, Iowa (just north of Davenport); and an area just northeast of Lake Shetak in Murray County,

Minnesota, account for almost half of the OPA HCAs in SA-05. Other OPA HCAs are scattered throughout the system alternative.

SA-05 crosses 36 drinking water HCAs covering approximately 9,100 acres and 70 ecological HCAs covering 52,000 acres (Maps A-24 and A-25). The drinking water HCAs are scattered throughout, however HCAs in Valley City, North Dakota and Fairmont, Minnesota each account for approximately 1/3 of the of the drinking water HCA acres in SA-05. The ecological HCAs are concentrated at the crossing of the Mississippi River, where 54 of the total 70 HCAs covering over 41,568 acres are located. It is related to the presence of existing state and federal resource lands and habitat areas. In addition, SA-05 crosses a grouping of HCAs with over 3,447 acres in Hancock County that may be related to critical habitat along several streams.

Natural Disaster Hazard Areas are defined as being a Low/Med/High risk. For flood hazard, medium risk covers approximately 19.2 percent of the SA-03 while high risk covers 9.9 percent (Map A-26). Medium and high risk areas are concentrated in the Red River Valley, in eastern South Dakota, crossing of smaller rivers on the Marshall and Murray counties in Minnesota and at crossings of larger rivers such as the Iowa and Cedar in Iowa, the Mississippi, and the Rock in Illinois. For landslide hazard, medium risk covers approximately 41.4 percent of the SA-05 while high risk covers only 0.4 percent (Map A-27). Medium Risk areas are concentrated in central and eastern North Dakota and in Martin County Minnesota and northern Kossuth County Iowa while the High risk areas are concentrated at the far western section of system alternative.

The areas near the crossing of the Mississippi River near Clinton, Iowa, and near Valley City, North Dakota, account for the majority of HCAs along SA-05. High flood hazard risk areas are concentrated where the system alternative crosses larger rivers particularly in eastern Iowa. Landslide hazard areas are generally in west of the Red River Valley in North Dakota and in southern Minnesota and northern Iowa.

4.6 SA-06 RR-Alliance-MinnCan-TC-Superior

System Alternative-06 begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to Grand Forks County, North Dakota, where it follows the railroad corridor southeast to Wahpeton, North Dakota. It then travels southeast along Minnesota Highway 9 until it intersects with the Alliance Pipeline and continues southeast to just southwest of Willmar. It then continues east and intersects with the Magellan Pipeline and continues southeast towards the Twin Cities Metropolitan area where it intersects with the MinnCan Pipeline and continues to the vicinity of the Flint Hills Refinery in Rosemount. It then turns north and follows existing pipelines to North Branch where it continues north following Interstate 35 to Carlton County where it turns generally east and follows SA-Applicant to the termination point in Superior, Wisconsin. SA-06 is approximately 800 miles long and passes through North Dakota and Minnesota. SA-06 and SA-07 are almost equal in length.

4.6.1 Geology/Soils/Groundwater

The following section describes the Geology, Soil types and Groundwater Aquifer locations for SA-06. The section generally discusses some of the potential affects that pipeline construction could have on these resources.

Geology

The vast majority of SA-06 is underlain by glacial deposits overlying sedimentary rocks (Map A-3). The table below identifies the uppermost bedrock types crossed by SA-06.

Table 4-53 Bedrock Geology – SA-06

Over half of SA-06 is underlain by sandstone bedrock from the Cretaceous Era.			
Geologic Era	**Geologic Description**	**Acres in SA-06**	**Percentage of SA-06**
Precambrian	Archean gneiss	55,442	5.37%
	Archean granitic rocks	1,450	0.14%
	Early Proterozoic sedimentary rocks	25,632	2.48%
	Middle Proterozoic sedimentary rocks	67,203	6.51%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	212,204	20.56%
Mesozoic	Cretaceous sedimentary rocks	533,936	51.73%
Cenozoic	Paleogene sedimentary rocks	117,730	11.41%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

The presence of shallow bedrock or bedrock outcrops would be impacted by the pipeline if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Soils

SA-06 includes 13 Major Land Resource Areas (MLRAs), with three covering more than 10 percent of the area (see table below). MLRA 55A has a gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 56 is a nearly level lake plain with gravely beech ridges and dunes. Mollisols and Vertisols dominate the soil orders; both are deep and poorly drained. MLRA 103 is a nearly level to gently rolling with moraines and glacial lake plains. Mollisols, and to a lesser extent, Alfisols and

Inceptisols dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy.

Just under 10 percent of SA-06, the majority in Northern Minnesota, have limitations with regard to shallow/bedrock related issues. Approximately 20 percent have shrink swell issues; these are concentrated in the Red River Valley.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape, and soil characteristics in each MLRA (USDA 206506).

Table 4-54 Major Land Resource Areas (MLRAs) – SA-06

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-06	Percentage of SA-06
53B	Central Dark Brown Glaciated Plains	-	62,313	6.1
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.6
55A	Northern Black Glaciated Plains	-	232,259	22.9
55B	Central Black Glaciated Plains	-	35,574	3.5
56	Red River Valley of the North	Shrink swell	219,980	21.7
90A	Wisconsin and Minnesota Thin Loess and Till, Northern Part	Shallow/bedrock	80,240	7.9
90B	Wisconsin and Minnesota Thin Loess and Till, Southern Part	-	74,705	7.4
91A	Central Minnesota Sandy Outwash	-	26,845	2.6
91B	Wisconsin and Minnesota Sandy Outwash	-	23,961	2.4
92	Superior Lake Plain	Shallow/bedrock	7,852	0.8
102A	Rolling Till Prairie	-	80,082	7.9
103	Central Iowa and Minnesota Till Prairies	-	161,157	15.9
104	Eastern Iowa and Minnesota Till Prairies	Sinkholes	2,941	0.3
Total			**1,013,598**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-06 has a mix of hydraulic conductivity rates in the surficial soils, with 56 percent rated High, with the remaining portion nearly equally divided into the Low and Moderate ranges (Table 4-55). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-55 Relative Hydraulic Conductivity Ratings – SA-06

Hydraulic Conductivity Range	Percent of Area
Low	22
Medium	21
High	56
Total	100

Source: Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Summary

Over 65 percent of the soils in SA-06 have essentially no limitations for construction. Fewer than 10 percent, concentrated in northeastern Minnesota have limitations with regard to shallow/bedrock related issues. Soils that are shallow or have bedrock near the surface may require careful routing and/or alternative construction techniques. Twenty-two percent have shrink swell issues, concentrated in the Red River Valley, Soils that have shrink swell characteristics may require alternative designs and/or maintenance to ensure the stability of the pipe. Less than 1 percent of SA-06 traverses landscapes with known sinkholes.

Groundwater

The following table summarizes the uppermost principal bedrock aquifers that are used as water supply sources along the SA-06 corridor.

Table 4-56 Principal Bedrock Aquifer Systems—SA-06

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-06. These aquifers typically have lower permeability than overlying unconsolidated material and other bedrock types.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-06 by State Crossed	Bedrock Type (Associated with Principle Aquifer)	Percent Acres of Aquifer in SA-06 by State
Cambrian-Ordovician aquifer system	Minnesota	211,772.96	Early Proterozoic sedimentary rocks	20.52%
Lower Cretaceous aquifers	Minnesota	102,575.77	Archean gneiss	9.94%
	North Dakota	8,234.87	Cretaceous sedimentary rocks	0.80%

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-06. These aquifers typically have lower permeability than overlying unconsolidated material and other bedrock types.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-06 by State Crossed	Bedrock Type (Associated with Principle Aquifer)	Percent Acres of Aquifer in SA-06 by State
Lower Tertiary aquifers	North Dakota	116,153.87	Paleogene sedimentary rocks	11.25%
Other rocks	Minnesota	191,657.65	Archean gneiss	18.57%
	North Dakota	294,006.92	Archean granitic rocks	28.49%
Silurian-Devonian aquifers	Illinois	80,864.98	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	7.84%
	Iowa	162,437.33	Middle Paleozoic (Silurian, Devonian, and Mississippian) sedimentary rocks	15.74%
Upper Cretaceous aquifers	North Dakota	89,196.28	Cretaceous sedimentary rocks	8.64%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands

Note: Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

The following summaries describe the aquifer types encountered within SA-06 (Map A-6).

Cambrian-Ordovician Aquifer System

The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and portions of Minnesota. The portion of this aquifer system that extends from southeastern Minnesota up towards Duluth, Minnesota and Superior, Wisconsin is represented by the Precambrian Hinckley Sandstone. This unit is hydraulically connected to the younger Cambrian bedrock and is, therefore, included with this aquifer system.

Lower Cretaceous Aquifers

Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers

Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-06. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks

This aquifer is present throughout a large portion of the SA-06 corridor and is categorizes as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Upper Cretaceous Aquifers

Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-06. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

Summary

Groundwater for drinking water, potable water, industrial, and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout SA-06. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers (that lack any or adequate glacial cover) would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

4.6.2 Ecoregions

The majority of SA-06 crosses the Great Plains and Eastern Temperate Forests ecoregions; most of the area has been converted to agriculture or developed. SA-06 crosses four Level II and seven Level III

ecoregions, as shown in the table below. The majority of area has been converted to agriculture or developed.

SA-06 starts in the Great Plains ecoregion, briefly crosses through the Eastern temperate forest, and ends in the Northern forest. Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions (Map A-7). In the area of the system alternative, the West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. The Temperate Prairies consist of the Northern Glaciated Plains, the Lake Agassiz Plain, and the Western Corn Belt Plains regions in the area of the system alternative. Within the Eastern Temperate Forest the Mixed Wood Plains, which is made up entirely of the North Central Hardwood Forests. Finally, the system alternative crosses the Northern Forest region within the Mixed Wood Shield Level II Ecoregion and the Northern Lakes and Forests Level III Ecoregion.

Table 4-57 Miles of SA-06 by Ecoregion

The majority of SA-06 crosses the Great Plains and Eastern Temperate Forests ecoregions.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	554	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	504	Northern Glaciated Plains	239
				Lake Agassiz Plain	163
				Western Corn Belt Plains	102
Eastern Temperate Forests	137	Mixed Wood Plains	137	North Central Hardwood Forests	137
Northern Forests	57	Mixed Wood Shield	57	Northern Lakes and Forests	57
Total Miles					**748**

Source: USEPA, Ecoregions of the United States, 2013

4.6.3 Land Cover

SA-06 traverses through three states, a total of 33 counties, 64 cities, and over 760 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, which includes grassland/herbaceous vegetation, agriculture, and deciduous forests.

Starting from the west and moving east along the system alternative, the land cover is dominated by agriculture, open grasslands, and prairie wetlands similar to SA-03. Development in the western region

of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses east there are higher concentrations of herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. Turning to the southeast, the land cover becomes more concentrated with cultivated crops. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads. As the system alternative crosses the Red River, it passes through the Wahpeton which is mainly medium- and low-density urban development.

The majority of land cover in SA-06 is cultivated, as illustrated in the table below. As the system alternative crosses the Red River into Minnesota, the land cover continues to be agricultural with scattered farmsteads. As the system alternative turns east in Kandiyohi County, cultivated agriculture still dominates the landscape. Within this area there are many small cities as well as numerous medium-sized lakes and wetlands. As the corridor curves around the Twin Cities Metropolitan area and passes over both the Minnesota and Mississippi rivers, agriculture and lakes continue to dominate the landscape with increased development in Scott and Dakota Counties. As the system alternative progresses north, the land cover becomes more heavily developed through the eastern suburbs of the St. Paul. North of the Twin Cities land cover becomes more forested and contains a higher concentration of lakes starting in northern Chisago County. There are many small cities which parallel Interstate 35. As the system alternative approaches the Superior terminal in the Superior area, the land use becomes developed, where it is heavily developed with residential and industrial uses.

Table 4-58 Land Cover – SA-06

The majority of land cover in SA-06 is cultivated.		
Land Cover	Acres	Percent
Barren	574	0.06%
Developed	78,397	7.7%
Forest	61,457	6.1 %
Herbaceous	89,692	8.8%
Planted/Cultivated	669,529	66.0%
Shrubland	8,736	0.86%
Water	29,722	2.9%
Wetlands	75,490	7.4%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.6.4 Water Resources

Water resources located within in the SA-06 corridor include rivers, streams, lakes, ponds, and wetlands (Map A-10). SA-06 includes portions of 89 named streams, some of which are divided in to several segments or cross the corridor multiple times for a total of 699 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 3,050.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east rivers crossing SA-06 include the White Earth, Des Lacs, Souris, Goose, Turtle, Maple, Sheyenne, Wild Rice and Bois de Sioux in North Dakota, and the Mustinka, Pomme de Terre, Chippewa, South Fork Crow, Minnesota, Vermillion, Mississippi, Sunrise, Snake, Kettle, Willow and Moose in Minnesota, Of these streams or other flowages, the largest is the Mississippi River. SA-06 crosses the Mississippi River in Dakota/Washington County, Minnesota. The width of the Mississippi River and associated riparian wetland area where SA-06 crosses is approximately 5,500 feet, making it the second widest crossing of the River by any system alternative. In addition, SA-06 crosses the Minnesota River in Scott/Carver County. The width of the river and associated riparian corridor is approximately 4,000 feet. Construction of the pipeline at these locations would require additional mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-06 crosses approximately 120 impaired river or stream segments.

SA-06 crosses all or portions of 123 named lakes. The system alternative also includes numerous unnamed water bodies; bring the total of water bodies to 3,767. Water bodies include intermittent or perennial lakes and ponds, swamps, and marshes. SA-06 crosses through areas with a high concentration of water bodies in Ward, Pierce, Benson, and Ramsey counties in North Dakota, and Meeker, Washington, and Chisago counties in Minnesota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant in places within the SA-06 corridor, particularly in Ramsey County, North Dakota and McLeod, Chisago, Pine, and Carlton counties, Minnesota. Maps A11 and A-12 depict the locations of high wetland concentration areas within the System Alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub, and pond), lacustrine (lake), and riverine. The NWI dataset combines the forested and scrub shrub

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

wetlands into the "forested/shrub" wetland type as these wetlands are similar in that they support woody vegetation. Table 4-59 describes the acres of each type of wetland within SA-06.

Table 4-59 Wetland Types – SA-06

SA-06 contains 6.1 percent emergent wetlands and 2.1 percent forested/shrub wetlands.		
Wetland Type	Acres	Percentage of SA-06
Emergent	63,131	6.1%
Forested/Shrub	21,230	2.1%
Lake[1]	14,802	1.4%
Pond[1]	3,607	<1%
Riverine	2,759	<1%
Other	8	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as water bodies referenced in the paragraph above.

SA-06 crosses numerous watercourses, water bodies and wetlands. There are several areas with the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline

4.6.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-06 corridor: nine endangered species, four threatened species, one candidate species, one proposed endangered species, and one proposed threatened species. Table 4-60 describes these species, their current federal listing status, and counties crossed by SA-06 where they are known to or believed to occur. For one of the endangered species, the pallid sturgeon, the system alternative is located in the species' counties of occurrence but does not cross any of the streams where the endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-60 Endangered Species Act Listed Species Potentially within SA-06

Counties crossed by SA-06 include 16 Federal Threatened and Endangered Species.

Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Mountrail, Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, McHenry, Mountrail, Ward, Williams **Illinois:** *County level range not defined for IL* **Iowa:** *County level range not defined for IA*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Pierce, Towner, Williams
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	**North Dakota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Richland, Steele, Towner, Traill, Ward, Williams
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Minnesota:** Chisago, Dakota
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	Aquatic • Found in shallow areas of larger rivers and streams, with moderate to swift currents flowing over coarse sand and gravel.	**Minnesota:** Washington
Snuffbox mussel	*Epioblasma triquetra*	Endangered	Aquatic • Small- to medium-sized creeks, in areas with sift currents.	**Minnesota:** Chisago, Washington

Counties crossed by SA-06 include 16 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			• Requires sand, gravel, or cobble substrate.	
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Minnesota:** Chisago, Pine, Washington
Winged mapleleaf	*Quadrula fragosa*	Endangered	Aquatic • Riffles with clean gravel, sand, or rubble bottoms and in clear, high quality water.	**Minnesota:** Chisago, Washington
Fishes				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**North Dakota:** Mountrail, Williams
Flowering Plants				
Prairie bush-clover	*Lespedeza leptostachya*)	Threatened	Prairie • Known only from the tallgrass prairie region of the upper Mississippi River Valley.	**Minnesota:** Dakota, Rice
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**North Dakota:** Richland
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Pierce, Richland, Ward **Minnesota:** Chippewa, Swift, Traverse

Counties crossed by SA-06 include 16 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Poweshiek skipperling	*Oarisma poweshiek*)	Endangered	Prairie • Lives in high quality tallgrass prairie in both upland, dry areas as well as low, moist areas.	**North Dakota:** Cass, Richland **Minnesota:** Chippewa, Kandiyohi, McLeod, Swift, Traverse, Wilkin
Mammals				
Canada lynx	*Lynx canadensis*	Threatened	Boreal Forests • Require high snowshoe hare densities. • Associated with moist, cool, boreal spruce-fir forests with rolling terrain.	**Minnesota:** Carlton, Pine
Northern long-eared bat	*Myotis septentrionalis*	Proposed endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines.	**Minnesota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Richland, Steele, Towner, Traill, Ward, Williams **Minnesota:** Carlton, Carver, Chippewa, Chisago, Dakota, Grant, Kandiyohi, McLeod, Meeker, Pine, Rice, Scott, Sibley, Stevens, Swift, Traverse, Washington, Wilkin

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

Critical Habitat is defined under the Endangered Species Act as the specific geographic areas that contain features essential for the conservation of threatened or endangered species. SA-06 crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover (Map A-13). Critical habitat was designated for the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638), and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, Montana, Nebraska, North Dakota, and South Dakota. The system alternative crosses the piping plover critical habitat in Mountrail County, North Dakota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential impacts to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.6.6 Public Resource and Recreational Lands

The review of public lands and recreation areas showed that the system alternative crosses numerous federal and state-managed public recreation areas in North Dakota and Minnesota (Table 4-61; Maps A-14 and A-15).

North Dakota

East of Tioga Beaver Creek Station, SA-06 passes through a concentration of national WMAs, federally managed WPAs, and state-managed WLPs in Mountrail and Ward counties. Continuing East into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern Pierce County, and passes just north of the Lake Alice national Wildlife Refuge in Ramsey County. A mix of Private Lands Open to Sportsmen (PLOTS) designated lands and several small NWRs are common throughout eastern Ramsey County and Nelson County, but become scarcer in Grand Forks, Traill, Cass, and Richland counties

Minnesota

As the system alternative traverses Minnesota, it crosses through dispersed WPAs, WMAs, and Board of Water and Soil Resources (BWSR) conservation lands, with higher concentrations in Stevens County, Kandiyohi, and Meeker County. Where the system alternative moves from Sibley County to Scott County, it crosses the Minnesota River and a number of associated state recreation areas and BWSR conservation areas. Continuing east, the system alternative passes through areas with minimal public areas in Scott and Dakota County until it turns north and crosses the Vermillion Highlands WMA and the Mississippi National River and Recreation Area. The system alternative then crosses a small number of BWSR conservation areas until it reaches Chisago County and Pine County where it includes Carlos Avery WMA, Banning State Park and General C.C. Andrews State Park. In Carlton County, the system alternative continues across Moose Lake State Park, Jay Cooke State Park, and Fond Du Lac State Park before reaching the Superior Terminal

The majority of potential impacts occur in counties with high concentrations of public lands including Pierce, Nelson and Ramsey, ND and Stevens, Swift, Kandiyohi, Meeker, Chisago and Pine, MN. Construction of the pipeline through recreation areas could temporarily impact public use and access, as

well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

Table 4-61 Public Resource and Recreational Lands – SA-06

SA-06 crosses parks, forests and conservation lands.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife-National Wildlife Refuge	2	58
	Waterfowl Production Area	12	4,011
	National Park Service-National River and Recreation Area	1	3,667
North Dakota	State Wildlife Areas-PLOTS lands	30	2,278
Minnesota	State Park	3	5,156
	State Forest	2	5,025
	State Recreation Area	1	754
	Conservation Areas - BWSR	81	2,696
	Natural Area – Scientific and Natural Area	1	48
Total		**132**	**23,693**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

4.6.7 Cities and Population Density

The review of population distribution, density, and city locations shows that SA-06 is divided between rural and urban (Table 4-62). In North Dakota locations with high population densities (greater than 5000 people per square mile) is Wahpeton, with Breckenridge –across the Red River in Minnesota having these levels of density also. Population density, greater than 5000 people per square mile in Minnesota, is heaviest in the cities of Cottage Grove and Woodbury near the Twin Cities. North Branch, Pine City and Hinckley contain areas of concentrated density. The average over the entire corridor is 81 persons per square mile. There are 59 cities partially or totally within the SA-06 corridor (Maps A-16 and A-17).

Table 4-62 Population Density and Cities – SA-06

There are 59 cities within SA-06, nearly half of which are larger cities

in Minnesota.			
	ND	**MN**	**Total**
Average Persons per Sq Mile	27	93	81
Number of cities	19	40	59
Cities >1000	5	23	28

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

The mostly rural character of SA-06 in North Dakota is evident in the relatively low population density. The population density in Minnesota is slightly higher due to the route crossing the Moorhead and Twin Cities areas.

In North Dakota, Wahpeton is the largest city (7,663 persons) crossed by the system alternative. In Minnesota, Woodbury is the largest city (61,961 persons) crossed by the system alternative. Woodbury is located on the east side of the Twin Cities Metropolitan Area. Breckenridge (3,386 persons) is the population center in northwest Minnesota (located across from Wahpeton) which the system alternative crosses. The population density pattern (an indicator of the extent of development) throughout SA-06 is very light in North Dakota until the system alternative crosses Fargo-Moorhead, density increases as the system alternative continues southeasterly toward the Twin Cities. The highest density and urban area occurs where SA-06 tracks the eastern edge of the Twin Cities.

North Dakota

Nineteen North Dakota cities are located within the SA-06 corridor; five of the 19 cities have populations greater than 1,000 persons. The populations range from 82 people in Dwight to 7,663 people in Wahpeton. Wahpeton, in Richland County, is located on the Red River (North Dakota-Minnesota border) and across from the city of Breckenridge, Minnesota. The 2010 census showed that the Minot Air Force Base is a census designated place[58] (CDP) with a population of 5,521. The Minot Air Force base, located 13 miles north of the city of Minot, is north of and adjacent to the system alternative, with certain military facilities within the system alternative boundary.

In general the system alternative is sparsely populated, primarily rural in character.

[58] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

Minnesota

Forty Minnesota cities are located within the system alternative; 23 of the 40 cities have populations greater than 1,000 persons. The largest community is the City of Woodbury in Washington County, with 61,961 persons.

Starting at the North Dakota-Minnesota border, Breckenridge [population 3,386] is the only city over 1,000 people in the system alternative for approximately 115 miles until Willmar (population 19,610). A number of smaller size towns occur within these 115 miles (e.g. Campbell [158], Herman [437], Donnelly [241]).

East of Willmar as the corridor approaches the Twin Cities Metropolitan Area, development gradually becomes denser, specifically around lakeshore and around small towns on the south and east side of the Twin Cities Metropolitan Area. After the corridor crosses the Minnesota River into Scott County, the development patterns shift from rural to suburban, and the corridor stays south of the densest development until it crosses the Mississippi River between Dakota and Washington counties. Development patterns throughout Washington County are urban to large-lot suburban. In Washington County the corridor affects nine cities with populations over 1,000 persons; Cottage Grove, Woodbury, Afton, Lake Elmo, Grant, Stillwater, Oak Park Heights, Hugo, and Forest Lake.

North of Forest Lake in Chisago County the corridor heads through rural to suburban development. The system alternative is centered on the following cities as it heads north: North Branch, Harris, Rush City, Rock Creek, Pine City, Hinckley, and Sandstone. North Branch and Rush City have experienced a substantial increase in population since the 2000 census. These cities are located on major highways extending north from the Twin Cities Metropolitan Area, providing a convenient rural-urban commute. In addition, Rock Creek, Hinckley, and Sandstone are experiencing large increases in population (31 percent, 28 percent, and 46 percent respectively).

As the system alternative proceeds north toward Duluth, a number of cities are located adjacent to or within the system alternative as it parallels the Interstate 35 corridor (Sturgeon Lake, Moose Lake, Barnum, Carlton, and Wrenshall). These cities are rural in size and are surrounded by rural tracts. As the system alternative approaches Duluth, there is denser development where there is a shorter rural-urban commute. As the corridor nears the Wisconsin border, development patterns also follow lakeshore and open farmland and are away from heavily forested areas and the hilly terrain.

4.6.8 Community Features

SA-06 is largely rural except as it goes through the city of Wahpeton and goes around the south and east sides of the Twin Cities metropolitan area, where the majority of the community features are found (Map A-18). The number and types of community of features are summarized in the Table 4-63. SA-06 travels through largely rural areas where community features are generally less concentrated and

therefore easier to avoid. However, SA-06 also passes through several areas with denser development including portions of Wahpeton, Breckenridge, and the southern and eastern suburbs of the Twin Cities. These areas all have higher concentrations of community features. Concentrations of community features may affect the placement of a pipeline ROW.

North Dakota

Seven airports are located within this system alternative. Three are private and four are public: Hamry Field in Kindred, Arthur Municipal, Larimore Municipal, and Rugby Municipal. Sixteen cemeteries and three churches are scattered throughout the system alternative. Sixteen fire stations and seven police stations are within the system alternative. Four of the seven police stations are in Wahpeton. There are nine medical response facilities within the corridor: six ambulance services and four hospitals (Stanley, Berthold, Mayville and Northwood). Minot Air Force base is partially located within the system alternative. There are 24 of four schools within the system alternative at 17 locations (for example, a middle school and high school at the same address). Six of the schools are in Wahpeton, and the remaining 11 are distributed in small towns.

The system alternative crosses downtown Wahpeton with its concentration of businesses, residences, churches, schools, including the North Dakota College of Science.

The main highways crossed by SA-06 are Interstate 29, Interstate 94, US 2, US 52, US 83 and US 281.

Minnesota

Ten airports are located within the system alternative, four of which are public: Lake Elmo Municipal, Benson Municipal, Morris Municipal, and Herman Municipal. Thirty cemeteries and 15 churches are scattered throughout the system alternative. Nineteen fire stations and five police stations are distributed throughout the corridor. Seven hospitals and/or emergency response services are located in the corridor with the majority located along the Interstate 35 segment between the Twin Cities metropolitan area and Duluth. Forty-six schools at 26 locations are in this system alternative.

The system alternative crosses downtown Breckenridge near the North Dakota border with its concentration of businesses, residences, churches, and schools. In the Twin Cities metropolitan area, the system alternative bypasses the densest development on the east side, and crosses through the more suburban cities of Cottage Grove, Woodbury, Lake Elmo, and the western edge of Stillwater.

The main highways crossed by SA-06 are Interstate 94, US 12, US 59, US 71 and US 75.

Table 4-63 Community Features – SA-06

SA-06 is largely rural but also crosses through the areas where concentrations of community features is higher.									
	Airports	**Amtrak**	**Cemeteries**	**Churches**	**Fire stations**	**Hospitals**	**Military base**	**Police station**	**Schools**
North Dakota	7	0	16	3	16	9	1	7	24
Minnesota	10	0	30	15	19	7	0	5	46
Total	**17**	**0**	**46**	**18**	**35**	**16**	**1**	**12**	**70**

Source: USGS TNM - National Structures Dataset

4.6.9 Cultural Resources

The National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are four historic districts out of 36 total historic properties listed on the NRHP within SA-06 (Table 4-64). Three of the historic districts are in North Dakota and one is in Minnesota. Of the remaining properties, 10 are within Minnesota and 22 are in North Dakota.

Table 4-64 National Register of Historic Places Properties – SA-06

SA-06 includes 36 listed historic properties, the majority of which are in North Dakota.			
Resource Name	State	County	NRHP ID
Casselton Commercial Historic District	North Dakota	Cass	82001311
Burlington Northern Depot	North Dakota	Cass	77001024
St. Stephen's Episcopal Church	North Dakota	Casselton	92001609
Funseth, Carlott, Round Barn	North Dakota	Grand Forks	86002752
Larimore City Hall	North Dakota	Grand Forks	90000600
Linwell, Martin V., House	North Dakota	Grand Forks	80002914
Elliott Bridge	North Dakota	McHenry	97000181
Leach Public Library	North Dakota	Richland	89002303
Red River Valley University	North Dakota	Richland	84002770

SA-06 includes 36 listed historic properties, the majority of which are in North Dakota.			
Resource Name	State	County	NRHP ID
Richland County Courthouse	North Dakota	Richland	80002926
Blanchard Bridge	North Dakota	Traill	97000189
Delchar Theater	North Dakota	Traill	85002831
Eielson, Carl Ben, House	North Dakota	Traill	77001031
First National Bank	North Dakota	Traill	85002906
Goose River Bank	North Dakota	Traill	85002793
Great Northern Railway Depot	North Dakota	Traill	77001033
Grinager Mercantile Building	North Dakota	Traill	85003354
Lura Building	North Dakota	Traill	85002794
Mayville Public Library	North Dakota	Traill	77001034
Ness, Andres O., House	North Dakota	Traill	77001032
Robinson, Col. William H., House	North Dakota	Traill	77001035
Stomner House	North Dakota	Traill	79003728
Union Block	North Dakota	Traill	85003353
Grandins' Mayville Farm District	North Dakota	Traill	85002905
Mayville Historic District	North Dakota	Traill	85002904
Hebeisen, Jacob, Hardware Store	Minnesota	Carver	80001975
Hebeisen, Jacob, House	Minnesota	Carver	80001976
Sayer House	Minnesota	Chisago	80002002
Christiania Lutheran Free Church	Minnesota	Dakota	10000301
Broman, Andreas, Johanna, Anna and Frank E., Farmstead	Minnesota	Kandiyohi	91000098
Northern Pacific Depot	Minnesota	Pine	73000992
Pine City Naval Militia Armory	Minnesota	Pine	80002111
Willow River Rutabaga Warehouse and Processing Plant	Minnesota	Pine	90000935
Severance, Cordenio, House	Minnesota	Washington	76001077
Furber, John P., House	Minnesota	Washington	82003074
Wilkin County Courthouse	Minnesota	Wilkin	80002182

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Similar to other system alternatives, known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites such as rock art, rock alignments, and stone circles are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes, the Red River of the North, the Mississippi River, and their tributaries.

4.6.10 Contaminated Areas

Enforcement and compliance activities listed in the USEPA FRS databases were used to identify properties most likely to be contaminated. Nationally registered contaminated sites, such as those on the National Priorities List, pose the greatest environmental risk. No NPL sites were identified in SA-06.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are scattered throughout SA-06 near or in established towns and/or where industrial and commercial activity is more prevalent. Concentrations of sites occur in Wahpeton, Willmar, on the east side of the Twin Cities and along the north –south section from the Twin Cities to Duluth.

The table below summarizes the number of potentially contaminated properties that are located within SA-06 (Maps A-21 and A-22).

Table 4-65 Potentially Contaminated Properties – SA-06

A larger number of listings were identified along SA-06 due to its proximity to more highly populated and developed areas.		
Listing Type	State	Number of Sites Within SA-06 By State
Brownfields Property	Minnesota	1
	North Dakota	1
Compliance Activity	Minnesota	17
	North Dakota	26
Enforcement/Compliance Activity	Minnesota	26
	North Dakota	29
Formal Enforcement Action	Minnesota	8
	North Dakota	11
Total		**119**

Source: U.S. EPA, Facility Registration Service, 2014

4.6.11 Air Emissions

The counties in North Dakota and the majority of counties in Minnesota through which a route in SA-06 would be constructed and operated are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead. Part of Dakota County in Minnesota is currently designated nonattainment for lead. This nonattainment area is a small

area located around an existing industrial facility that would not be anticipated to be directly impacted by a route in SA-06.

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality. As represented by NDPC, an additional 544 miles of pipeline would be associated with a route in SA-06. As compared to SA-Applicant, the additional pipeline length associated with a route in SA-06 would result in additional construction-related emissions.

As represented by NDPC, a route in SA-06 would require three additional pump stations with 12 additional pumps, as compared to SA-Applicant. Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route in SA-06 would result in 141,228 metric tons per year of additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to the SA-Applicant.

Construction and operation of a route in SA-06 would result in direct and secondary affects to air quality, potentially including an existing nonattainment area in Minnesota. The effect of the construction and operation of a route in SA-06 would be expected to be insignificant. However, the construction and operation of a route in SA-06 would be expected to have a higher overall affect than the construction and operation in SA-Applicant.

4.6.12 High-Consequence Areas and Natural Disaster Hazard Areas

High Consequence Areas (HCAs) and Natural Disaster Hazard Areas are defined by the USDOT PHMSA as areas that are more sensitive or hold more risk for placement of an oil pipeline. SA-06 crosses two high population areas, Twin Cities and Duluth covering 12,645 acres as the system alternative travels around the east side of the Twin Cities and the south edge of Duluth (Map A-23). Sixty-eight other population areas (OPA) covering 95,761 acres are included in SA-06. Approximately 41 percent of the area of OPA HCAs is located where SA-06 goes around the south and east sides of the Twin Cities. Other areas of concentrated OPA HCAs include Wahpeton, North Dakota and along I-35 north of the Twin Cities. Other OPA HCAs are scattered throughout the system alternative.

SA-06 crosses 219 drinking water HCAs covering approximately 16,100 acres and 35 ecological HCAs covering 20,735 acres (Map A-24 and A-25). The drinking water HCAs are scattered throughout, however there are concentrations near Mayville, North Dakota, Wahpeton, North Dakota, and Breckenridge, Minnesota account for approximately 58 percent of the HCAs in SA-06. The ecological

HCAs are also scatted throughout, located near existing state and federal resource lands, particularly in Mountrail County in North Dakota and Chisago, Pine and Carlton counties in Minnesota

Natural Disaster Hazard Areas are defined as being a Low/Med/High risk. For flood hazard, medium risk covers approximately 15 percent of the SA-03 while high risk covers 6.4 percent (Map A-26). Medium and high risk areas are concentrated in the Red River Valley, in Stevens County Minnesota near the crossing of the Pomme De Terre River, and at the Minnesota and Mississippi river crossings. For landslide hazard, medium risk covers approximately 36.6 percent of the SA-03 while high risk covers 1.2 percent (Map A-27). Medium Risk areas are concentrated in central and eastern North Dakota while the High risk areas are concentrated at the far western and far eastern section of system alternative.

SA-06 skirts the edges of the Twin Cities Metro area where a concentration of population exists and thus does cross HPA and OPA areas. SA-06 also crosses several larger drinking water HCAs in North Dakota and a string of ecological ESAs north of the Twin Cities. High flood hazard risk areas are concentrated where the system alternative crosses larger rivers such as the Red River of the North. Landslide hazard areas are generally in west of the Red River Valley in North Dakota.

4.7 SA-07 I-29-Magellan-MinnCan-TC-Superior

System Alternative-07 begins in Tioga, North Dakota, at the Beaver Creek Station and follows SA-Applicant route east to Grand Forks, North Dakota, where it intersects with I-29 corridor and travels south to Fargo, North Dakota. It then continues traveling southeast along the Magellan Pipeline corridor towards Alexandria, Minnesota. At Alexandria, it turns south toward Willmar, Minnesota, and then turns southeast towards the Twin Cities Metropolitan area where it intersects with the MinnCan Pipeline and continues to the vicinity of the Flint Hills Refinery in Rosemount. It then turns north and follows existing pipelines to North Branch where it continues north following Interstate 35. It then continues to Carlton County where it turns generally east and follows SA-Applicant to Superior, Wisconsin. SA-07 is approximately 810 miles long and passes through North Dakota and Minnesota. System Alternative-06 and System Alternative-07 are almost equal in length.

4.7.1 Geology/Soils/Groundwater

The following section describes the Geology, Soil types and Groundwater Aquifer locations for SA-07. The section generally discusses some of the potential affects that pipeline construction could have on these resources.

Geology

The vast majority of SA-07 is underlain by glacial deposits overlying sedimentary rocks (Map A-3). The table below identifies the uppermost bedrock types crossed by SA-07.

Table 4-66 Bedrock Geology – SA-07

The most dominant bedrock type in SA-07 is sandstone from the Cretaceous Era.			
Geologic Era	**Geologic Description**	**Acres in SA-07**	**Percentage of SA-07**
Precambrian	Archean gneiss	120,275	11.54%
	Archean granitic rocks	48,117	4.62%
	Early Proterozoic sedimentary rocks	25,632	2.46%
	Middle Proterozoic sedimentary rocks	67,203	6.45%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	226,242	21.71%
Mesozoic	Cretaceous sedimentary rocks	418,352	40.15%
Cenozoic	Paleogene sedimentary rocks	117,730	11.30%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

The presence of shallow bedrock or bedrock outcrops could be affected by the pipeline if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Soils

SA-07 includes 13 Major Land Resource Areas (MLRAs), with four covering more than 10 percent of the area (see table below). MLRA 55A has a gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 56 is a nearly level lake plain with gravely beech ridges and dunes. Mollisols and Vertisols dominate the soil orders; both are deep and poorly drained. MLRA 102A is a nearly level to rolling with many prairie potholes present. Mollisols dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy. MLRA 103 is a nearly level to gently rolling with moraines and glacial lake plains. Mollisols, and to a lesser extent Alfisols and Inceptisols, dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy.

Just over 9 percent of SA-07, the majority in Northern Minnesota, have limitations with regard to shallow/bedrock related issues. Approximately 16 percent have shrink swell issues; these are concentrated in the Red River Valley.

Map A-4 provides an overview of the Land Resource Regions and MLRAs crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape, and soil characteristics in each MLRA (USDA 2006).

Table 4-67 Major Land Resource Areas (MLRAs) – SA-07

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-07	Percentage of SA-07
53B	Central Dark Brown Glaciated Plains	-	62,313	6.1
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.6
55A	Northern Black Glaciated Plains	-	232,259	22.7
55B	Central Black Glaciated Plains	-	35,584	3.5
56	Red River Valley of the North	Shrink swell	171,707	16.8
90A	Wisconsin and Minnesota Thin Loess and Till, Northern Part	Shallow/bedrock	80,240	7.8
90B	Wisconsin and Minnesota Thin Loess and Till, Southern Part	-	74,705	7.3
91A	Central Minnesota Sandy Outwash	-	60,202	5.9
91B	Wisconsin and Minnesota Sandy Outwash	-	23,961	2.3
92	Superior Lake Plain	Shallow/bedrock	7,852	0.8
102A	Rolling Till Prairie	-	113,110	11.1
103	Central Iowa and Minnesota Till Prairies	-	152,987	14.9
104	Eastern Iowa and Minnesota Till Prairies	Sinkholes	2,941	0.3
Total			**1,023,551**	**100.0**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

SA-07 has a mix of hydraulic conductivity rates in the surficial soils, with 65 percent rated High, with the remaining portion nearly equally divided into the Low and Moderate ranges (Table 4-68). Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-68 Relative Hydraulic Conductivity Ratings – SA-07

Hydraulic Conductivity Range	Percent of Area
Low	16
Medium	18
High	65
Total	100

Source: Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Over 70 percent of the soils in SA-07 have essentially no limitations for construction. Fewer than 10 percent have limitations with regard to shallow bedrock related issues, primarily in northeast Minnesota. Soils that are shallow or have bedrock near the surface may require careful routing and alternative construction techniques. Seventeen percent have shrink/swell issues, primarily in the Red River Valley Soils that have shrink/swell characteristics may require alternative designs and maintenance to ensure the stability of the pipe. Less than 1 percent of SA-07 traverses landscapes with known sinkholes.

Analysis of soil hydraulic conductivity provides an indication of how quickly oil would move laterally and vertically through the soil profile. Conductivity ratings can vary greatly within the soil profile and across the soil surface based on soil characteristics. While hydraulic conductivity is important, other factors, such as the presence of drain tile and proximity to a sensitive resource may have greater importance when considering potential impacts. The presence of drain tile would increase the potential for oil dispersal, once the soil profile becomes saturated. From an environmental perspective, the most sensitive locations for potential spills include those areas that are proximate to surface waters, such as lakes, wetlands or streams, or where groundwater is near the surface. Once the spill moves below the soils surface (5 to 6 feet), then the surficial geology controls how quickly the oil would disperse.

Groundwater

The following table summarizes the uppermost principal bedrock aquifers that are used as water supply sources along the SA-07 corridor. Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-07. These aquifers typically have lower permeability than overlying unconsolidated material and other bedrock types.

Groundwater for drinking water, potable water, industrial, and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout the SA-07. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers (that lack any or adequate glacial cover) would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

Table 4-69 Principal Bedrock Aquifer Systems – SA-07

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-07.				
Principal Aquifer System	States Crossed	Acres of Aquifer in SA-07 by State Crossed	Bedrock Type (Associated with Principal Aquifer)	Percent Acres of Aquifer in SA-07 by State
Cambrian-Ordovician aquifer system	Minnesota	211,774.67	Early Proterozoic sedimentary rocks	20.32%
Lower Cretaceous aquifers	Minnesota	100,811.32	Archean gneiss	9.67%
	North Dakota	22,399.74	Cretaceous sedimentary rocks	2.15%
Lower Tertiary aquifers	North Dakota	116,153.78	Paleogene sedimentary rocks	11.15%
Other rocks	Minnesota	243,594.49	Archean gneiss	23.38%
	North Dakota	226,904.29	Archean granitic rocks	21.78%
Paleozoic aquifers	North Dakota	12,716.41	Cretaceous sedimentary rocks	1.22%
Upper Cretaceous aquifers	North Dakota	89,196.27	Cretaceous sedimentary rocks	8.56%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands
Note: Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

The following summaries describe the bedrock aquifer types encountered within SA-07 (Map A-6).

Cambrian-Ordovician Aquifer System

The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and portions of Minnesota. The portion of this aquifer system that extends from southeastern Minnesota up towards Duluth, Minnesota and Superior, Wisconsin is represented by the Precambrian Hinckley Sandstone. This unit is hydraulically connected to the younger Cambrian bedrock and is, therefore, included with this aquifer system.

Lower Cretaceous Aquifers

Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers

Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-07. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks

This aquifer is present throughout a large portion of the SA-07 corridor, mostly in Northern Minnesota and Eastern North Dakota and is categorized as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Paleozoic Aquifers

In SA-07, Paleozoic aquifers subcrop beneath glacial deposits in northeastern North Dakota. These aquifers are composed mostly of limestone and dolomite, which are the most productive, but Paleozoic sandstones also yield water.

Upper Cretaceous Aquifers

Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-07. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

4.7.2 Ecoregions

The majority of SA-07 crosses the Great Plains ecoregion; most of the area has been converted to agriculture or developed. SA-07 crosses three Level II and seven Level III ecoregions, as shown in the Table 4-70.

SA-07 starts in the Great Plains ecoregion, briefly crosses through the Eastern temperate forest, and ends in the Northern forest (Map A-7). Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions. In the area of the system alternative, the West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains. The Temperate Prairies consist of the Northern Glaciated Plains, the Lake Agassiz Plain, and the Western Corn Belt Plains regions in the area of the system alternative. Within the Eastern Temperate Forest the Mixed Wood Plains, which is made up entirely of

the North Central Hardwood Forests. Finally, the system alternative crosses the Northern Forest region within the Mixed Wood Shield Level II Ecoregion and the Northern Lakes and Forests Level III Ecoregion. For a description of Ecoregions see Section 4.1

Table 4-70 Miles of SA-07 by Ecoregion

The majority of SA-07 crosses the Great Plains ecoregion and most of the area has been converted to agriculture or developed.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	466	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	416	Northern Glaciated Plains	198
				Lake Agassiz Plain	134
				Western Corn Belt Plains	84
Eastern Temperate Forests	233	Mixed Wood Plains	233	North Central Hardwood Forests	233
Northern Forests	57	Mixed Wood Shield	57	Northern Lakes and Forests	57
Total Miles					**756**

Source: USEPA, Ecoregions of the United States, 2013

4.7.3 Land Cover

SA-07 traverses through three states, a total of 34 counties, 62 cities, and over 810 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, mainly grassland/herbaceous vegetation to agriculture to deciduous forests from west to east along the system alternative.

Starting from the west and moving east along the system alternative, the land cover is dominated by agriculture, open grasslands, and prairie wetlands similar to SA-06. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical of North Dakota. As the system alternative progresses east there are higher concentrations of herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. As the system alternative turns to the south, the land cover becomes more concentrated with cultivated crops. In addition, there are some areas containing deciduous forests

associated with waterways and windbreaks in fields and around farmsteads. Before the system alternative reaches the Red River, it passes through the Fargo-Moorhead metropolitan area which is mainly high- and low-density urban development.

The majority of land cover in SA-07 is cultivated, as illustrated in the table below. As the system alternative crosses the Red River into Minnesota, the land use continues to be agricultural with scattered farmsteads. As the corridor approaches Otter Tail County, cultivated agriculture still dominates the land use. Within the corridor in this area there are many urban cities as well as numerous medium-sized lakes and wetlands. As the corridor curves around the Minneapolis-St. Paul metropolitan area and passes over both the Minnesota and Mississippi rivers, the land use remains agricultural. As the system alternative progresses north, the land cover becomes more heavily forested and contains a higher concentration of lakes starting in northern Chisago County. There are many urban cities located along this stretch which parallels Interstate Highway 35. As the system alternative approaches the Superior terminal in the Superior area, the land use becomes urban, where it is heavily developed with residential and industrial uses.

Table 4-71 Land Cover – SA-07

The majority of land cover in SA-07 is cultivated.		
Land Cover	Acres	Percent
Barren	477	0.05%
Developed	89,298	8.7%
Forest	67,499	6.6%
Herbaceous	91,973	9.0%
Planted/Cultivated	651,743	63.7%
Shrubland	8,924	0.9%
Water	39,491	3.9%
Wetlands	74,145	7.2%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.7.4 Water Resources

Water resources located within in the SA-07 corridor include rivers, streams, lakes, ponds, and wetlands (Map A-10). SA-07 includes portions of 94 named streams, some of which are divided in to several segments or cross the corridor multiple times for a total of 742 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 2,991.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east rivers crossing SA-07 include the

White Earth, Des Lacs, Souris, Goose, Turtle, Maple, Sheyenne, and the Red in North Dakota, and Pelican, Pomme de Terre, East Branch Chippewa, South Fork Crow, Minnesota, Vermillion, Mississippi, Sunrise, Snake, Kettle, Willow and Moose in Minnesota, Of these streams and other flowages, the largest is the Mississippi River. SA-07 crosses the Mississippi River in Dakota/Washington County, Minnesota. The width of the Mississippi River and associated riparian wetland area where SA-07 crosses is approximately 5,500 feet, sharing second widest crossing of the River with SA-06. In addition, SA-07 crosses the Minnesota River in Scott/Carver County. The width of the river and associated riparian corridor is approximately 4,000 feet. Construction of the pipeline at this location may require additional mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-07 crosses approximately 91 impaired river or stream segments.

SA-07 crosses all or portions of 159 named lakes. The system alternative also includes numerous unnamed water bodies, bringing the total of water bodies to 4,498. Water bodies include intermittent or perennial lakes and ponds, swamps, and marshes. SA-07 crosses through areas with a high concentration of water bodies in Ward, Pierce, Benson, and Ramsey counties in North Dakota, and Otter Tail, Grant, Douglas, Pope, Meeker, Washington, and Chisago counties in Minnesota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant in places within the SA-07 corridor, particularly in Ramsey County, North Dakota and Wilkin, Grant, Douglas, Pope, McLeod, Chisago, Pine, and Carlton counties, Minnesota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the system alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub, and pond), lacustrine (lake), and riverine. The NWI dataset combines the forested and scrub shrub wetlands into the "forested/shrub" wetland type as these wetlands are similar in that they support woody vegetation. The table below describes the acres of each type of wetland within SA-07.

SA-07 crosses numerous watercourses, waterbodies and wetlands. There are several areas with the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline.

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

Table 4-72 Wetland Types – SA-07

Emergent wetlands make up 7.0 percent of SA-07.		
Wetland Type	Acres	Percentage of SA-07
Emergent	73,025	7.0%
Lake[1]	22,651	2.2%
Forested/Shrub	22,643	2.2%
Pond[1]	4,841	<1%
Riverine	2,562	<1%
Other	7	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as waterbodies referenced in the paragraph above.

4.7.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-07 corridor: nine endangered species, five threatened species, one candidate species, one proposed endangered species, and one proposed threatened species. Table 4-73 describes these species, their current federal listing status, and counties crossed by SA-07 where they are known to or believed to occur. For one of the endangered species, the pallid sturgeon, the system alternative is located within the species' counties of occurrence but does not cross any of the streams where the endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-73 Endangered Species Act Listed Species Potentially within SA-07

Counties crossed by SA-07 include 17 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly	**North Dakota:** Mountrail, ND;

Counties crossed by SA-07 include 17 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	Williams, ND
Piping plover	*Charadrius melodus*	Threatened Endangered – Great Lakes Watershed	Shoreline • Breeds on open, sparsely vegetated sand or gravel beaches adjacent to alkali wetlands, and on beaches, sand bars, and dredged material islands of major river systems and Great Lakes Shorelines	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward, Williams **Minnesota:** *County level range not defined for MN*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Pierce, Ramsey, Towner, Ward, Williams
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in winter.	**North Dakota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Traill, Ward, Williams
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Minnesota:** Carlton, Dakota, Washington
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	Aquatic • Found in shallow areas of	**Minnesota:** Washington

Counties crossed by SA-07 include 17 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			larger rivers and streams, with moderate to swift currents flowing over coarse sand and gravel.	
Snuffbox mussel	*Epioblasma triquetra*	Endangered	Aquatic • Small- to medium-sized creeks, in areas with sift currents. • Requires sand, gravel, or cobble substrate.	**Minnesota:** Chisago, Washington
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Minnesota:** Chisago, Washington
Winged mapleleaf	*Quadrula fragosa*	Endangered	Aquatic • Riffles with clean gravel, sand, or rubble bottoms and in clear, high quality water.	**Minnesota:** Chisago, Washington
Fishes				
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**Minnesota:** Mountrail, Williams
Flowering Plants				
Prairie bush-clover	*Lespedeza leptostachya*)	Threatened	Prairie • Known only from the tallgrass prairie region of the upper Mississippi River Valley.	**Minnesota:** Rice
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	**Minnesota:** Clay
Insects				

Counties crossed by SA-07 include 17 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies • Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Pierce, Ward **Minnesota:** Clay, Pope, Swift
Poweshiek skipperling	*Oarisma poweshiek*)	Endangered	Prairie • Lives in high quality tallgrass prairie in both upland, dry areas as well as low, moist areas.	**North Dakota:** McHenry, Mountrail, Pierce, Ward **Minnesota:** Douglas, Kandiyohi, McLeod, Swift, Wilkin
Mammals				
Canada lynx	*Lynx canadensis*	Threatened	Boreal Forests • Require high snowshoe hare densities. • Associated with moist, cool, boreal spruce-fir forests with rolling terrain.	**Minnesota:** Carlton, Pine
Northern long-eared bat	*Myotis septentrionalis*	Proposed endangered	Caves or tree cavities • Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. • During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines.	**North Dakota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Traill, Ward, Williams **Minnesota:** Carlton, Carver, Chisago, Clay, Dakota, Kandiyohi, McLeod, Meeker, Otter Tail, Pine, Pope, Rice, Scott, Sibley, Swift, Washington, Wilkin

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

Critical Habitat is defined under the Endangered Species Act as the specific geographic areas that contain features essential for the conservation of threatened or endangered species. SA-07 crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover and crosses proposed critical habitat for the poweshiek skipperling (Map A-13). Critical habitat was designated for

the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638) and includes prairie alkali wetlands, inland reservoir lakes, and portions of four rivers in Minnesota, North Dakota, and South Dakota. The system alternative crosses the piping plover critical habitat in Mountrail County, North Dakota.

Critical habitat was proposed for the poweshiek skipperling on October 23, 2014 (79 FR 63672). Proposed critical habitat for this species includes high-quality native remnant (untilled) tallgrass prairie containing a high diversity of native prairie grasses and flowering forbs and is crossed by the system alternative in Pope County, Minnesota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.7.6 Public Resource and Recreational Lands

Public lands crossed by SA-07 include areas managed by both state and federal agencies which are described below (Table 4-74 and Maps A-14 and A-15).

East of Tioga Beaver Creek Station, SA-07 passes through a concentration of national WMAs, federally managed WPAs, and state-managed WLPs in Mountrail and Ward counties. Continuing East into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern Pierce County, and passes just north of the Lake Alice national Wildlife Refuge in Ramsey County. A mix of Private Lands Open to Sportsmen (PLOTS) designated lands and several small NWRs are common throughout eastern Ramsey County and Nelson County, but become more scarce in Grand Forks, Traill, and Cass counties

As the system alternative traverses Minnesota, it crosses through an area dense with WPAs, WMAs, and BWSR conservation lands in Otter Tail, Grant, Douglas, Pope, Swift, and Kandiyohi counties. Continuing east, the system alternative passes through areas with minimal public areas in Scott and Dakota County until it turns north and crosses the Vermillion Highlands WMA and the Mississippi National River and Recreation Area. The system alternative then crosses a small number of Board of Water and Soil Resources (BWSR) conservation areas until it reaches Chisago County and Pine County where it includes Carlos Avery WMA, Banning State Park and General C.C. Andrews State Park. In Carlton County, the system alternative continues across Moose Lake State Park, Jay Cooke State Park, and Fond Du Lac State Park before reaching the Superior Terminal.

Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

Table 4-74 Public Resource and Recreational Lands – SA-07

SA-07 includes Federal Waterfowl Production Areas, State Park lands and other state and federal resources.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife-National Wildlife Refuge	3	74
	Waterfowl Production Area	12	8,625
	National Park Service-National River and Recreation Area	1	3,667
North Dakota	State Wildlife Areas-PLOTS lands	29	3,419
Minnesota	State Park	4	4,747
	State Forest	2	5,025
	State Recreation Area	1	758
	Conservation Area-BWSR	121	3,885
	Natural Areas-Scientific and Natural Area	1	48
Total		**174**	**30,248**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

4.7.7 Cities and Population Density

The review of population distribution, density, and city locations shows that SA-07 is divided between rural and urban (Table 4-75). The population density (an indicator of the extent of development) across SA-07 is very light in North Dakota until the system alternative crosses Fargo-Moorhead. Density increases as the system alternative continues southeasterly toward the Twin Cities. The heaviest density and urban area occurs where SA-07 tracks the eastern edge of the Twin Cities.

In North Dakota, the location with high population density (greater than 5000 people per square mile) is Fargo, with Moorhead –across the Red River in Minnesota having high levels of density also. Population density, greater than 5000 people per square mile in Minnesota, is heaviest in the cities of Cottage Grove and Woodbury near the Twin Cities. North Branch, Rush City and Hinckley contain small areas of concentrated density. The average over the entire corridor is 108 persons per square mile. There are 57 cities partially or totally within the SA-07 corridor (Maps A-16 and A-17).

Table 4-75 Population Density and Cities – SA-07

There are 57 cities within SA-07, nearly half of which are larger cities in Minnesota.			
	ND	**MN**	**Total**
Average Persons per Sq Mile	58	103	108
Number of cities	17	40	57
Cities >1000	4	24	28

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

Seventeen North Dakota cities are located within the SA-07 corridor; four of the 17 cities have populations greater than 1,000 persons. The cities range in size from 98 persons (the cities of Ross and Deering) to 105,920 people in Fargo in Cass County. The Minot Air Force Base is a census designated place[59] (CDP) with a population of 5,521. It is located 13 miles north of the city of Minot, is north of and adjacent to the system alternative. A portion of the military facilities are within the system alternative boundary. There are also small towns scattered throughout the system alternative which are not accounted for in the census data or recognized as incorporated cities.

In general the SA-07 corridor is sparsely populated, rural in character for both the east-west portion of the system alternative, as well as the north-south portion. The city of Grand Forks (approximately 53,000 people within the city and over 90,000 people including the surrounding areas[60]) is a large urban area the system alternative approaches. The SA-07 corridor is approximately two miles south of the city, which is located on the North Dakota-Minnesota border in Grand Forks County. The system alternative then turns south and continues along I-29 to Fargo.

Fargo is the second metropolitan area the system alternative crosses. It is an urban area of over 100,000 people. Fargo and the surrounding community had a 16 percent increase in population since the 2000 census. It is the largest city in North Dakota. The system alternative bisects the densest development in

[59] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

[60] "2010 Census Redistricting Data (Public Law 94-171) Summary File". *American FactFinder*. United States Census Bureau. Retrieved 2 May 2011.

the city including industrial, commercial, and residential, as well as major transportation networks of rail, interstate, and airport.

Minnesota

Forty Minnesota cities are located within the SA-07 corridor; 24 of the 40cities have populations greater than 1,000 persons. The largest community is the City of Woodbury in Washington County, with a population of 61,961 persons.

Starting at the North Dakota-Minnesota border and proceeding southwest, Moorhead is the only city over 1,000 people for approximately fifty miles until the corridor reaches the city of Fergus Falls (population 13,138). Within this fifty-mile section, development patterns and population density is light, generally with agriculture and associated single farmsteads. Fergus Falls is the edge of increased population density around the high concentration of lakes and the proximity of I-94 to the corridor.

The next developed area with higher development density surrounds the city of Alexandria (population 11,070). While the general character is rural, the lakes have dense development on the shoreline. This pattern of dense development surrounding lakes and the cities near the lakes alternates with the less-densely populated areas of farmland. The system alternative includes residential development in Willmar.

East of Willmar as the corridor approaches the Twin Cities metropolitan area, development gradually becomes denser, specifically around lakeshore and around small towns on the south and east side of the Twin Cities metropolitan area. After the corridor crosses the Minnesota River into Scott County, the development patterns shift from rural to suburban, and the corridor stays south of the densest development until it crosses the Mississippi River between Dakota and Washington counties. Development patterns throughout Washington County are urban to large-lot suburban. In Washington County, the corridor affects nine cities with populations over 1,000 persons; Cottage Grove, Woodbury, Afton, Lake Elmo, Grant, Stillwater, Oak Park Heights, Hugo, and Forest Lake.

North of Forest Lake in Chisago County the corridor heads through rural to suburban development. The system alternative is centered on the following cities as it heads north: North Branch, Harris, Rush City, Rock Creek, Pine City, Hinckley, and Sandstone. North Branch and Rush City have experienced a substantial increase in population since the 2000 census. These cities are located on major highways extending north from the Twin Cities Metropolitan Area, providing a convenient rural-urban commute. In addition, Rock Creek, Hinckley, and Sandstone are experiencing large increases in population (31 percent, 28 percent, and 46 percent respectively).

As the system alternative proceeds north toward Duluth, a number of cities are located adjacent to or within the system alternative as it parallels the Interstate 35 corridor (Sturgeon Lake, Moose Lake, Barnum, Carlton, and Wrenshall). These cities are rural in size and are surrounded by rural tracts. As the

system alternative approaches Duluth, there is denser development where there is a shorter rural-urban commute. As the corridor nears the Wisconsin border, development patterns also follow lakeshore and open farmland and are away from heavily forested areas and the hilly terrain.

4.7.8 Community Features

SA-06 is largely rural except as it goes through the city of Fargo and goes around the south and east sides of the Twin Cities Metropolitan Area, where the majority of the community features were found (Map A-18). The number and types of community of features are summarized in the Table 4-76. SA-07 travels through largely rural areas, where community features are generally less concentrated and therefore easier to avoid. Concentrations of community features may affect the placement of a pipeline ROW.

North Dakota

Eight airports are located within this system alternative. Five are private and three are public: Hector International in Fargo, Hillsboro Municipal, and Rugby Municipal. An Amtrak rail station is in Fargo. Seventeen cemeteries and four churches are scattered throughout the system alternative. Eleven fire stations and eight police stations, including sheriffs and jails, are within the system alternative. Eight hospitals and/or ambulance services are located throughout the corridor. Five of these eight medical facilities are in Fargo with another concentration located in the Interstate 35 segment between the Twin Cities and Duluth. Minot Air Force base is partially located within the system alternative. Grand Forks Air Force Base is located less than one mile north of the system alternative. Twenty-two schools are within the system alternative at 19 locations.

The system alternative crosses downtown Fargo with its concentration of businesses, residences, churches, schools, and transportation facilities. The corridor crosses at least two major railroads, including the route for the Amtrak Empire Builder. It also crosses an international airport.

The main highways crossed by SA-07 are Interstate 29, Interstate 94, US 2, US 52, US 83 and US 281.

Minnesota

Eight airports are within the system alternative. Five are private and three are public: Lake Elmo Municipal, Willmar Municipal, and Glenwood Municipal. Thirty-two cemeteries and 21 churches are scattered throughout the system alternative. There are 18 fire stations and eight police stations, including sheriffs and jails, are within the system alternative. Six hospitals and/or ambulance services are located in the system alternative, and five of the six are located between Duluth and the Twin Cities. Forty-four schools are located within the system alternative at 29 locations.

The system alternative crosses downtown Moorhead with its concentration of businesses, residences, churches, schools, and transportation facilities. The system alternative passes to the east of the densest development in the Twin Cities metropolitan area, through the more suburban cities of Cottage Grove, Woodbury, Lake Elmo, and the western edge of Stillwater.

The main highways crossed by SA-07 are Interstate 94, Interstate 35, US 12, US 52, US 8, US 59, US 71, US 75, US 212, and US 169.

Table 4-76 Community Features – SA-07

SA-07 is largely rural but also crosses through the areas of Fargo-Moorhead and the Twin Cities metropolitan area where the concentration of community features is higher.									
	Airports	**Amtrak**	**Cemeteries**	**Churches**	**Fire stations**	**Hospitals**	**Military base**	**Police station**	**Schools**
North Dakota	8	1	17	4	11	8	1	8	22
Minnesota	8	0	32	21	18	6	0	3	44
Total	**16**	**1**	**49**	**25**	**29**	**14**	**1**	**11**	**66**

Source: USGS TNM - National Structures Dataset

4.7.9 Cultural Resources

The National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are seven historic districts and 41 other historic properties listed on the NRHP within SA-07 (Table 4-77). Five of the historic districts are in the Fargo, North Dakota area, and two are in Minnesota. Of the remaining properties, 16 are within Minnesota and 25 are in North Dakota. Most of these resources are in the Fargo-Moorhead metropolitan area.

Table 4-77 National Register of Historic Places Properties – SA-07

SA-07 includes 48 listed historic properties.			
Resource Name	State	County	NRHP ID
North Dakota State University District	North Dakota	Cass	86003261
North Side Fargo High Style Residential Historic District	North Dakota	Cass	86003739
St. Mary's Cathedral Historic District	North Dakota	Cass	87002635
Downtown Fargo District	North Dakota	Cass	87002635
Fargo South Residential District	North Dakota	Cass	83001929
Barrington Apartments	North Dakota	Cass	88000982
Cass County Courthouse	North Dakota	Cass	83004062
Cole Hotel	North Dakota	Cass	83001928
DeLendrecie's Department Store	North Dakota	Cass	79003725
Dibley House	North Dakota	Cass	80004282
Elliot--Powers House and Garage	North Dakota	Cass	87002634
Fargo and Southern Depot	North Dakota	Cass	75001303
Fargo Theatre Building	North Dakota	Cass	82001312
Gethsemane Episcopal Cathedral	North Dakota	Cass	80002909
Grand Lodge of North Dakota, Ancient Order of United Workmen	North Dakota	Cass	79001770
Great Northern Freight Warehouse	North Dakota	Cass	90001749
Kennedy House	North Dakota	Cass	86003742
Knerr Block, Floyd Block, McHench Building and Webster and Cole Building	North Dakota	Cass	83001930
Lewis House	North Dakota	Cass	79003726
Masonic Block	North Dakota	Cass	79001771
Monticello--Mount Vernon--Arlington Apartments	North Dakota	Cass	87002633
Northern Pacific Railway Depot	North Dakota	Cass	75001304
Pence Automobile Company Warehouse	North Dakota	Cass	93001478
Powers Hotel	North Dakota	Cass	83001931
Union Storage & Transfer Cold Storage Warehouse and Armour Creamery Building	North Dakota	Cass	7000016
Wilson, Woodrow, School	North Dakota	Cass	12000881
First State Bank of Buxton	North Dakota	Traill	78001995
Plummer, Amos and Lillie, House	North Dakota	Traill	95001488
Sarles, O. C., House	North Dakota	Traill	85000562
Traill County Courthouse	North Dakota	Traill	80002928
Hebeisen, Jacob, Hardware Store	Minnesota	Carver	80001975
Hebeisen, Jacob, House	Minnesota	Carver	80001976
Northern Pacific Depot	Minnesota	Cass	75001304
Sayer House	Minnesota	Chisago	80002002

SA-07 includes 48 listed historic properties.			
Resource Name	State	County	NRHP ID
Burnham Building	Minnesota	Clay	80002013
Comstock, Solomon Gilman, House	Minnesota	Clay	74001011
Huntoon, Lew A., House	Minnesota	Clay	80002016
Main Building, Concordia College	Minnesota	Clay	80002017
Park Elementary School	Minnesota	Clay	88003013
Christiania Lutheran Free Church	Minnesota	Dakota	10000301
Broman, Andreas, Johanna, Anna and Frank E., Farmstead	Minnesota	Kandiyohi	91000098
Park Region Luther College	Minnesota	Otter Tail	84000241
Willow River Rutabaga Warehouse and Processing Plant	Minnesota	Pine	90000935
Pine City Naval Militia Armory	Minnesota	Pine	80002111
Iverson, Urjans, House	Minnesota	Pope	82003001
Monson Lake State Park CCC/WPA/Rustic Style Historic Resources	Minnesota	Swift	89001666
Furber, John P., House	Minnesota	Washington	82003074
Severance, Cordenio, House	Minnesota	Washington	76001077

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Similar to other system alternatives, known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites such as rock art, rock alignments, and stone circles are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes and the Red River of the North, the Minnesota River and the Mississippi River, and their tributaries.

4.7.10 Contaminated Areas

Enforcement and compliance activities listed in the USEPA FRS databases were used to identify properties most likely to be contaminated. Nationally registered contaminated sites, such as those on the National Priorities List, pose the greatest environmental risk. No NPL sites were identified in SA-07.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are scattered throughout SA-07 near or in established towns and/or where industrial and commercial activity is more prevalent. Concentrations of sites occur in Fargo/Moorhead area, Willmar, on the east side of the Twin Cities and along the north–south section from the Twin Cities to Duluth.

The table below summarizes the number of potentially contaminated properties that are located within SA-06 (Maps A-21 and A-22).

Table 4-78 Potentially Contaminated Properties – SA-07

A larger number of listings were identified along SA-07 due to its proximity to more highly populated and developed areas.		
Listing Type	**State**	**Number of Sites Within SA-07 By State**
Brownfields Property	Minnesota	11
Compliance Activity	Minnesota	16
	North Dakota	37
Enforcement/Compliance Activity	Minnesota	23
	North Dakota	65
Formal Enforcement Action	Minnesota	10
	North Dakota	20
Total		**182**

Source: U.S. EPA, Facility Registration Service, 2014

4.7.11 Air Emissions

The counties in North Dakota and the majority of counties in Minnesota through which a route in SA-07 would be constructed and operated are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead. Part of Dakota County in Minnesota is currently designated nonattainment for lead. This nonattainment area is a small area located around an existing industrial facility that would not be anticipated to be directly impacted by a route in SA-07.

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality. As represented by NDPC, an additional 526 miles of pipeline would be associated with a route in SA-07. As compared to SA-Applicant, the additional pipeline length associated with a route in SA-07 would result in additional construction-related emissions.

As represented by NDPC, a route in SA-07 would require three additional pump stations with 12 additional pumps, as compared to SA-Applicant. Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks.

Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route in SA-07 would result in 134,236 metric tons per yearof additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to SA-Applicant.

Construction and operation of a route in SA-07 would result in direct and secondary affects to air quality, potentially including an existing nonattainment area in Minnesota. The effect of the construction and operation of a route in SA-07 would be expected to be insignificant. However, the construction and operation of a route in SA-07 would be expected to have higher overall affects than the construction and operation in SA-Applicant.

4.7.12 High-Consequence Areas and Natural Disaster Hazard Areas

High Consequence Areas (HCAs) and Natural Disaster Hazard Areas are defined by the USDOT PHMSA as areas that are more sensitive or hold more risk for placement of an oil pipeline. SA-07 crosses three high population areas, Fargo-Moorhead, Twin Cities and Duluth covering 21,323 acres as the system alternative travels through the Fargo-Moorhead area, around the east side of the Twin Cities and the south edge of Duluth (Map A-23). Sixty-five other population areas (OPA) covering 95,805 acres are included in SA-07. Approximately 42 percent of the area of OPA HCAs is located where SA-07 goes around the south and east sides of the Twin Cities. Other areas of concentrated OPA HCAs include Fargo-Moorhead, Fergus Falls, Minnesota, Alexandria, Minnesota, and Willmar, Minnesota and along I-35 north of the Twin Cities. Other OPA HCAs are scattered throughout the system alternative.

SA-06 crosses 160 drinking water HCAs covering approximately 10,986 acres and 42 ecological HCAs covering 25,980 acres (Maps A-24 and A-25). The drinking water HCAs are scattered throughout, however concentrations near Fargo-Moorhead account for approximately 43 percent of the HCAs in SA-07. The ecological HCAs are also scatted throughout, located near existing state and federal resource lands and known critical habitat, particularly in Mountrail County in North Dakota and Ottertail, Grant, Chisago, Pine and Carlton counties in Minnesota.

Natural Disaster Hazard Areas are defined as being a Low/Med/High risk. For flood hazard, medium risk covers approximately 12.9 percent of the SA-07 while high risk covers 5.4 percent (Map A-26). Medium and high risk areas are concentrated in the Red River Valley, in Otter Tail County Minnesota near the crossing of the Pelican River, and at the Minnesota and Mississippi river crossings. For landslide hazard, medium risk covers approximately 21.8 percent of the SA-07 while high risk covers 1.2 percent (Map A-27). Medium Risk areas are concentrated in central and eastern North Dakota while the High risk areas are concentrated at the far western and far eastern section of system alternative.

SA-07 skirts the edges of the Twin Cities Metro area and goes through the Fargo-Moorhead area where a concentration of population exists and thus does cross HPA and OPA areas. SA-07 also crosses several

larger drinking water HCAs in North Dakota and a string of ecological ESAs in western Minnesota and north of the Twin Cities. High flood hazard risk areas are concentrated where the system alternative crosses larger rivers such as the Red River of the North. Landslide hazard areas are generally in west of the Red River Valley in North Dakota.

4.8 SA-08 I-29-I-94-TC

System Alternative-08 begins in Tioga, North Dakota and follows SA-Applicant route east to Grand Forks, North Dakota, where it intersects with Interstate 29 corridor and travels south to Fargo, North Dakota. It continues traveling southeast along the Interstate 94 corridor towards the Twin Cities Metropolitan area. Just northwest of Maple Grove, it turns east and follows an existing pipeline generally east across the north suburbs before turning south and following another existing pipeline across the east suburbs before terminating in Rosemount, Minnesota. System SA-08 is approximately 635 miles in length and crosses the states of North Dakota and Minnesota. SA-08 and the SA-Applicant are almost equal in length.

4.8.1 Geology/Soils/Groundwater

The following section describes the Geology, Soil types and Groundwater Aquifer locations for SA-08. The section generally discusses some of the potential affects that pipeline construction could have on these resources.

Geology

The vast majority of SA-08 is underlain by glacial deposits overlying sedimentary rocks (Map A-3). The table below identifies the uppermost bedrock types crossed by SA-08.

Table 4-79 Bedrock Geology – SA-08

Sandstone from the Cretaceous Era makes up the uppermost bedrock in over 40 percent of SA-08.			
Geologic Era	**Geologic Description**	**Acres in SA-08**	**Percentage of SA-08**
Precambrian	Archean gneiss	138,505	17.16%
	Archean granitic rocks	50,955	6.31%
	Early Proterozoic granitic rocks	38,247	4.74%
	Early Proterozoic sedimentary rocks	12,272	1.52%
Paleozoic	Lower Paleozoic (Cambrian and Ordovician) sedimentary rocks	109,899	13.62%
Mesozoic	Cretaceous sedimentary rocks	339,517	42.07%
Cenozoic	Paleogene sedimentary rocks	117,730	14.59%

Source: U.S. Geological Survey, Digital version of the Geologic Map of the United States, originally published at a scale of 1:2,500,000 in 1974.

A review of the geology within the system alternative indicates that the majority of the area is made up of glacial deposits overlying bedrock. The presence of shallow bedrock or bedrock outcrops would be impacted by the pipeline if blasting or removal of the bedrock substratum were to occur. Impacts to bedrock are likely in areas where bedrock is less than 10 feet from the surface.

Soils

SA-08 includes 11 Major Land Resource Areas (MLRAs), with three covering more than 10 percent of the area (Table 4-80). MLRA 55A has a gently rolling surface dominated by Mollisols, which are fertile, deep soils of the prairie. MLRA 56 is a nearly level lake plain with gravely beech ridges and dunes. Mollisols and Vertisols dominate the soil orders; both are deep and poorly drained. MLRA 102A is a nearly level to rolling with many prairie potholes present. Mollisols dominate the soil orders. Soils are generally very deep, well drained to very poorly drained and loamy.

Just over 20 percent of SA-08 have shrink swell issues; these are concentrated in the Red River Valley. More than 75 percent of the soils in SA-08 have essentially no limitations for construction. Less than 1

Table 4-80 Major Land Resource Areas (MLRAs) – SA-08

MLRA ID	Major Land Resource Area Name	Construction Considerations*	Acres in SA-08	Percent of SA-08
53B	Central Dark Brown Glaciated Plains	-	62,313	7.7
54	Rolling Soft Shale Plain	Shallow/bedrock	5,690	0.7
55A	Northern Black Glaciated Plains	-	232,259	28.8
55B	Central Black Glaciated Plains	-	35,584	4.4
56	Red River Valley of the North	Shrink swell	166,421	20.6
57	Northern Minnesota Gray Drift	-	31,958	4.0
90B	Wisconsin and Minnesota Thin Loess and Till, Southern Part	-	36,767	4.7
91A	Central Minnesota Sandy Outwash	-	77,687	9.6
91B	Wisconsin and Minnesota Sandy Outwash	-	2,010	0.2
102A	Rolling Till Prairie	-	128,050	15.9
103	Central Iowa and Minnesota Till Prairies	-	28,386	3.5
Total			**807,124**	**100**

Source: Natural Resources Conservation Service, National Coordinated Major Land Resource Area (MLRA) Version 4.2

*Note: MLRAs that have "-" in the construction considerations column do not have limitations.

percent have limitations with regard to shallow bedrock related issues. Twenty-one percent have shrink/swell issues, primarily in the Red River Valley. Soils that have shrink/swell characteristics may require alternative designs and maintenance to ensure the stability of the pipe.

Map A-4 provides an overview of the Land Resource Regions and Major Land Resource Areas crossed by the system alternatives. Appendix D includes a brief description of the location, extent, landscape, and soil characteristics in each MLRA (USDA 2006).

SA-08 has a mix of hydraulic conductivity rates in the surficial soils, with 68 percent rated High, followed by 18 percent rated Low. Map A-5 provides an overview of relative hydraulic conductivity for surface soils crossed by the system alternatives.

Table 4-81 Relative Hydraulic Conductivity Ratings – SA-08

Hydraulic Conductivity Range	Percent of Area
Low	18
Medium	14
High	68
Total	100

Source: Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey.

Groundwater

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-08. These aquifers typically have lower permeability than overlying unconsolidated material and other bedrock types. Table 4-82 summarizes the primary aquifers that are used as water supply sources along the SA-08 corridor. Section 4.1 provides background information on groundwater.

Groundwater for drinking water, potable water, industrial, and irrigational uses are obtained from aquifers in unconsolidated materials and bedrock units throughout SA-08. Construction of the pipeline is most likely to impact the uppermost aquifer in an area (most likely an unconsolidated aquifer), if a release were to occur. Unconsolidated aquifers or shallow bedrock aquifers that lack any or adequate glacial cover would be more susceptible to contamination. Shorter contaminant travel times from the surface to the underlying aquifer are expected for these aquifers if confining layers or thicker sequences of glacial materials are not present.

Table 4-82 Principal Bedrock Aquifer Systems – SA-08

Aquifer systems in Archean bedrock units make up the majority of principal bedrock aquifers in SA-08.				
Principle Aquifer System	States Crossed	Acres of Aquifer in SA-08 by State Crossed	Bedrock Type (Associated with Principle Aquifers)	Percent Acres of Aquifer in SA-08 by State
Cambrian-Ordovician aquifer system	Minnesota	75,604.23	Early Proterozoic granitic rocks	9.37%
Lower Cretaceous aquifers	Minnesota	30,023.85	Archean gneiss	3.72%
	North Dakota	22,399.80	Cretaceous sedimentary rocks	2.78%
Lower Tertiary aquifers	North Dakota	116,153.87	Paleogene sedimentary rocks	14.39%
Other rocks	Minnesota	234,122.99	Archean gneiss	29.01%
	North Dakota	226,906.34	Archean granitic rocks	28.11%
Paleozoic aquifers	North Dakota	12,716.41	Cretaceous sedimentary rocks	1.58%
Upper Cretaceous aquifers	North Dakota	89,196.28	Cretaceous sedimentary rocks	11.05%

Source: Principal Aquifers of the 48 Conterminous United States, Hawaii, Puerto Rico, and the U.S. Virgin Islands
Note: Aquifer systems are generally defined by hydraulically connected bedrock units of similar geologic age. The bedrock type describes the rock in which the aquifer occurs.

The following summaries describe the aquifer types encountered within SA-08.

Cambrian-Ordovician Aquifer System

The Cambrian-Ordovician aquifer system is a complex multi-aquifer system with individual aquifers separated by leaky confining units. The aquifers are capped by the Maquoketa confining unit, which confines them as an aquifer system. This aquifer system extends throughout Iowa, Illinois, and portions of Minnesota. The portion of this aquifer system that extends from southeastern Minnesota up towards Duluth, Minnesota and Superior, Wisconsin are Early Proterozoic granitic rocks. These rocks are hydraulically connected to the younger Cambrian bedrock and are included with this aquifer system.

Lower Cretaceous Aquifers

Lower Cretaceous aquifers occur in a narrow, discontinuous band that parallels the state line of North Dakota-Minnesota. The aquifer subcrops beneath glacial deposits in this area. Formations of

consolidated sandstone compose the lower Cretaceous aquifers. This aquifer may receive some upward leakage from deeper aquifers; therefore, the water may be under high artesian pressure.

Lower Tertiary Aquifers

Lower Tertiary aquifers extend throughout much of the western North Dakota portion of SA-08. These aquifers are made up of semi-consolidated to consolidated sedimentary rock. Sandstone units compose most of the water-bearing beds of the aquifer.

Other Rocks - Archean Granitic/Gneiss Rocks

This aquifer is present throughout a large portion of the SA-08 corridor, mainly in Northern Minnesota and Eastern North Dakota and is categorized as “Other rocks” in the table above. Crystalline rocks normally are considered a barrier to groundwater movement because their permeability is at least an order of magnitude less than that of most sediments that overlie them. Where no other aquifers are available, however, crystalline rocks are an important source of water, especially for domestic and farm wells.

Paleozoic Aquifers

In SA-08, Paleozoic aquifers subcrop beneath glacial deposits in northeastern North Dakota. These aquifers are composed mostly of limestone and dolomite, which are the most productive, but Paleozoic sandstones also yield water.

Upper Cretaceous Aquifers

Upper Cretaceous aquifers occur in the western half of the North Dakota portion of SA-08. This aquifer is mostly deeply buried, but is exposed locally in narrow bands with Lower Tertiary bedrock. Beds of consolidated sandstone compose most of the Upper Cretaceous aquifers. The sandstone is interbedded with shale, siltstone, and occasional thin, lenticular beds of coal. Most of the water in the sandstone aquifers is in pore spaces between individual grains of sand, but some of the aquifers contain fractures, bedding planes, and joints that provide large-scale openings which store and transmit most of the water.

4.8.2 Ecoregions

The majority of SA-08 crosses the Great Plains ecoregion; most of the area has been converted to agriculture or developed. The review of ecoregion data show that the SA-08 crosses three Level II and six Level III ecoregions, as shown in the table below. The majority of area has been converted from its historic classification to agricultural uses or developed.

SA-08 starts in the Great Plains ecoregion and ends in the Eastern Temperate Forest. Within the Great Plains region, the system alternative crosses both the West-central Semi-arid Prairies and the Temperate Prairies Level II Ecoregions (Map A-7). In the area of the system alternative, the West-central Semi-arid Prairies are made up of the Northwestern Glaciated Plains and the Northwestern Great Plains.

The Temperate Prairies consist of the Northern Glaciated Plains, the Lake Agassiz Plain, and the Western Corn Belt Plains regions in the area of the system alternative. Within the Eastern Temperate Forest the Mixed Wood Plains, which is made up entirely of the North Central Hardwood Forests. See the table below for estimated miles within each level of Ecoregion. For a description of Ecoregions see Section 4.1.

Table 4-83 Miles of SA-08 by Ecoregion

The majority of SA-08 crosses the Great Plains ecoregion.					
Level I		Level II		Level III	
Ecoregion	**Miles**	**Ecoregion**	**Miles**	**Ecoregion**	**Miles**
Great Plains	380	West-central Semi-arid Prairies	50	Northwestern Glaciated Plains	46
				Northwestern Great Plains	4
		Temperate Prairies	330	Northern Glaciated Plains	198
				Lake Agassiz Plain	131
				Western Corn Belt Plains	1
Eastern Temperate Forests	217	Mixed Wood Plains	217	North Central Hardwood Forests	217
Total Miles					**597**

Source: USEPA, Ecoregions of the United States, 2013

4.8.3 Land Cover

SA-08 traverses through two states, a total of 27 counties, 81 cities, and over 635 miles (Maps A-8 and A-9). There are a wide variety of land covers within the corridor, mainly grassland/herbaceous vegetation to agriculture to deciduous forests from west to east along the system alternative. SA-08 has the largest percentage of developed land cover among the system alternatives.

Starting from the west and moving east along the system alternative, the land cover is dominated by agriculture, open grasslands, and prairie wetlands similar to SA-07. Development in the western region of the corridor includes dense concentrations of oil wells in the Bakken shale formation. The oil extraction infrastructure is largely found near the Tioga Beaver Creek Station in Williams as well as Mountrail County. Other development in this area is primarily low-density cities and rural residencies, which is typical North Dakota. As the system alternative progresses east, there are higher

concentrations of herbaceous cover with many scattered wetlands and lakes, representing the prairie pothole region. As the system alternative turns to the south, the land cover becomes more concentrated with cultivated crops. Additionally, there are some areas containing deciduous forests associated with waterways and windbreaks in fields and around farmsteads. Before the system alternative reaches the Red River, it passes through the Fargo-Moorhead metropolitan area which consists of high- and low-density urban development.

The majority of land cover in SA-08 is cultivated or developed, as illustrated in the table below. As the system alternative crosses the Red River into Minnesota, the land use continues to be agricultural with scattered farmsteads as the system alternative heads southeast. Cultivated agriculture still dominates the land cover as the system alternative approaches Otter Tail County. Within this area there are many urban cities as well as numerous medium-sized lakes and wetlands. As the corridor continues towards the Twin Cities metropolitan area, the land use remains agricultural with lakes scattered throughout. As the system alternative enters the Twin Cities metropolitan area, the land cover changes to medium- and high-intensity urban development with many commercial and industrial areas. As the system alternative approaches the Flint Hills Refinery, it passes through many urban bedroom communities and suburban cities.

Table 4-84 Land Cover – SA-08

The majority of land cover in SA-08 is cultivated or developed.		
Land Cover	Acres	Percent
Barren	506	0.06%
Developed	125,951	15.6%
Forest	30,873	3.8%
Herbaceous	87,842	10.9%
Planted/Cultivated	484,707	60.0%
Shrubland	2,381	0.3%
Open Water	30,303	3.7%
Wetlands	44,560	5.5%

Source: USGS, National Land Cover Database, 2011 (NLCD2011)

4.8.4 Water Resources

Water resources located within in the SA-08 corridor include rivers, streams, lakes, ponds, and wetlands (Map A-10). SA-08 includes portions of 65 named streams, some of which are divided in to several segments or cross the corridor multiple times for a total of 620 segments. The corridor also includes numerous unnamed streams or other flowages, bringing the total number of stream segments in the system alternative to 2,649.

None of the streams or flowages within the system alternative are federally designated or protected as Wild and Scenic River under 16 U.S.C. 1271 et seq. From west to east crossing SA-08 include the White Earth, Des Lacs, Souris, Turtle and Red in North Dakota, and the Pelican, Pomme de Terre, Chippewa, Sauk and Mississippi in Minnesota. SA-08 is one of two system alternatives that cross the Mississippi River twice: once in Hennepin County and again in Dakota/Washington County, Minnesota. The width of the Mississippi River and associated riparian wetland area where SA-08 crosses is approximately 700 feet and 2,300 feet (respectively). Construction of the pipeline at these locations would require additional mitigation measures to reduce erosion and runoff into the river.

The U.S. Environmental Protection Agency (USEPA) and state agencies designate some rivers and streams as impaired if "pollution controls are not sufficient to attain or maintain applicable water quality standards."[1] SA-08 crosses approximately 85 impaired river or stream segments.

SA-08 includes all or portions of 137 named lakes. The system alternative also includes numerous unnamed water bodies, bringing the total of water bodies to 4,064. Water bodies include intermittent or perennial lakes and ponds, swamps, and marshes. SA-08 crosses through areas with a high concentration of water bodies in Ward, Pierce, Benson, and Ramsey counties in North Dakota, and Otter Tail, Douglas, Stearns, Wright, and Washington counties in Minnesota, which may affect ability to route a potential pipeline through these areas.

Wetlands are abundant in places within the SA-08 corridor, particularly in Ramsey County, North Dakota and Wilkin, Grant, Douglas, Pope, McLeod, Chisago, Pine, and Carlton counties, Minnesota. Maps A-11 and A-12 depict the locations of high wetland concentration areas within the system alternatives. The National Wetland Inventory (NWI) wetland types crossed by this alternative include palustrine wetlands (emergent, forested, scrub shrub, and pond), lacustrine (lake), and riverine. The table below describes the acres of each type of wetland within SA-08.

[1] USEPA. 2012. Clean Water Act: Total Maximum Daily Loads (303d). Accessed October 2014. Web. <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm>.

Table 4-85 Wetland Types – SA-08

Emergent wetlands make up 6.8 percent and lacustrine wetlands 1.8 percent of SA-08.		
Wetland Type	Acres	Percentage of SA-08
Emergent	54,596	6.8%
Lake[1]	14,642	1.8%
Forested/Shrub	5,610	<1%
Pond[1]	4,438	<1%
Riverine	3,390	<1%
Other	8	<1%

Source: U.S. Fish and Wildlife Service, National Wetlands Inventory – Wetlands, 2014

[1] Wetlands classified as "Lake" or "Pond" may include open water areas identified as waterbodies referenced in the paragraph above.

SA-08 crosses numerous watercourses, waterbodies and wetlands. There are several areas with the system alternative where the concentration of water is greater and may affect the ability to route a potential pipeline.

4.8.5 Special Species and Critical Habitat

The USFWS has identified the following threatened and endangered species as potentially occurring within counties crossed by the SA-08 corridor: nine endangered species, four threatened species, one candidate species, one endangered species, and one proposed threatened species. Table 4-86 describes these species, their current federal listing status, and counties crossed by SA-08 where they are known to or believed to occur. For one of the endangered species, the pallid sturgeon, the system alternative is located in the species' counties of occurrence but does not cross any of the streams where the endangered species are known to occur.

Appendix E provides additional clarification on the potential impacts of proposed system alternatives to Federal Endangered, Threatened and Candidate species at the county level and the likelihood of occurrence.

Table 4-86 Endangered Species Act Listed Species Potentially within SA-08

Counties crossed by SA-08 include 16 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
Birds				
Least tern	*Sterna antillarum*	Endangered	Shoreline • Breeds on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	**North Dakota:** Mountrail, Williams
Piping plover	*Charadrius melodus*	Threatened	Shoreline • Breeds on open, sparsely vegetated sand or gravel beaches adjacent to alkali wetlands, and on beaches, sand bars, and dredged material islands of major river systems.	**North Dakota:** North Benson, McHenry, Mountrail, Pierce, Ward, Williams
Red knot	*Calidris canutus rufa*	Proposed threatened	Shoreline • Breeds in drier tundra areas, such as sparsely vegetated hillsides. • Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays.	**North Dakota:** Benson, McHenry, Mountrail, Pierce, Ward, Williams **Minnesota:** *County level range not defined in MN*
Sprague's pipit	*Anthus spragueii*	Candidate	Grassland • Breeds and winters in open grassland with good drainage and no shrubs or trees.	**North Dakota:** Benson, Grand Forks, McHenry, Mountrail, Pierce, Ramsey, Towner, Ward, Williams **Minnesota:** Clay
Whooping crane	*Grus americana*	Endangered	Marsh • Breeds in freshwater marshes and prairies. • Uses grain fields, shallow lakes and lagoons, and saltwater marshes on migration and in	**North Dakota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Trail, Ward,

Counties crossed by SA-08 include 16 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
			winter.	Williams
Clams				
Higgins eye	*Lampsilis higginsii*	Endangered	Aquatic • Deep water with moderate currents. • Require sand and gravel river bottoms.	**Minnesota:** Dakota, Hennepin, Ramsey, Washington
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	Aquatic • Found in shallow areas of larger rivers and streams, with moderate to swift currents flowing over coarse sand and gravel.	**Minnesota:** Washington, Ramsey, Washington
Snuffbox mussel	*Epioblasma triquetra*	Endangered	Aquatic • Small- to medium-sized creeks, in areas with sift currents. • Requires sand, gravel, or cobble substrate.	**Minnesota:** Hennepin
Spectaclecase (mussel)	*Cumberlandia monodonta*	Endangered	Aquatic • Large rivers, in areas sheltered from the force of the current. • Clusters in firm mud, beneath rock slabs, between boulders, and under tree roots.	**Minnesota:** Washington
Winged mapleleaf	*Quadrula fragosa*	Endangered	Aquatic • Riffles with clean gravel, sand, or rubble bottoms and in clear, high quality water.	**Minnesota:** Ramsey, Washington
Pallid sturgeon	*Scaphirhynchus albus*	Endangered	Aquatic • Prefer habitats with a diversity of depths and velocities formed by braided channels, sand bars, sand flats and gravel bars.	**North Dakota:** Mountrail, Williams
Prairie bush-clover	*Lespedeza leptostachya*)	Threatened	Prairie • Known only from the tallgrass prairie region of the upper Mississippi River Valley.	**Minnesota:** Dakota
Western prairie fringed	*Platanthera praeclara*	Threatened	Wet prairies and meadows • Typically mesic to wet	**Minnesota:** Clay

Counties crossed by SA-08 include 16 Federal Threatened and Endangered Species.				
Common Name	Scientific Name	Federal Status	Habitat	Counties of Occurrence by State
orchid			unplowed tallgrass prairies and meadows but have been found in old fields and roadside ditches.	
Insects				
Dakota Skipper	*Hesperia dacotae*	Threatened	Native prairies ● Moist bluestem prairies or upland prairie that is relatively dry and often found on ridges and hillsides.	**North Dakota:** McHenry, Mountrail, Pierce, Ward **Minnesota:** Clay
Poweshiek skipperling	*Oarisma poweshiek*)	Endangered	Prairie ● Lives in high quality tallgrass prairie in both upland, dry areas as well as low, moist areas.	North Dakota: Cass **Minnesota:** Clay, Douglas, Stearns, Wilkin
Mammals				
Northern long-eared bat	*Myotis septentrionalis*	Proposed endangered	Caves or tree cavities ● Winter hibernation in large caves or mines with large passages and entrances, constant temperatures, and high humidity with no air currents. ● During summer, bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines.	**North Dakota:** Benson, Cass, Grand Forks, McHenry, Mountrail, Nelson, Pierce, Ramsey, Towner, Traill, Ward, Williams **Minnesota:** Anoka, Clay, Dakota, Douglas, Grant, Hennepin, Otter Tail, Ramsey, Sherburne, Stearns, Todd, Washington, Wilkin, Wright

Source: U.S. Fish and Wildlife Service, FWS Critical Habitat for Threatened & Endangered Species

Critical Habitat is defined under the Endangered Species Act as the specific geographic areas that contain features essential for the conservation of threatened or endangered species. SA-08 crosses USFWS designated critical habitat for the Northern Great Plains populations of piping plover and crosses proposed critical habitat for the poweshiek skipperling (Map A-13). Critical habitat was designated for

the Northern Great Plains piping plover on September 11, 2002 (67 FR 57638) and includes prairie alkali wetlands, inland reservoir lakes, and portions of 4 rivers in Minnesota, North Dakota, and South Dakota. The system alternative crosses the piping plover critical habitat in Mountrail County, North Dakota.

Critical habitat was proposed for the poweshiek skipperling on October 23, 2014 (79 FR 63672). Proposed critical habitat for this species includes high-quality native remnant (untilled) tallgrass prairie containing a high diversity of native prairie grasses and flowering forbs and is crossed by the system alternative in Wilkin County, North Dakota.

Pipeline construction in areas potentially occupied by terrestrial species could cause temporary displacement due to noise and visual disturbance. Short-term and long-term habitat removal could also result from construction of the Project. For aquatic species, construction in and near water resources could result in sediment runoff and potential contamination from equipment. Potential affects to critical habitat would be similar to those for listed species, but could also decrease the likelihood of repopulation in the vicinity of the pipeline.

4.8.6 Public Resource and Recreational Lands

Public lands crossed by SA-08 include areas managed by both state and federal agencies which are described below (Maps A-14 and A-15).

North Dakota

East of Tioga Beaver Creek Station, SA-08 passes through a concentration of national WMAs, federally managed WPAs, and state-managed WLPs in Mountrail and Ward counties. Continuing East into central Ward County, the system alternative touches the lower portion of the Upper Souris National Wildlife Refuge. The system alternative approaches another cluster of WPAs and WLPs in eastern Pierce County, and passes just north of the Lake Alice national Wildlife Refuge in Ramsey County. A mix of Private Lands Open to Sportsmen (PLOTS) designated lands and several small NWRs are common throughout eastern Ramsey County and Nelson County, but are scarcer in Grand Forks, Traill, and Cass counties

Minnesota

As the system alternative traverses Minnesota, it crosses through an area dense with WPAs, WMAs, and Board of Water and Soil Resources (BWSR) conservation lands in Otter Tail, Grant, Douglas, Pope, Swift, and Douglas counties. Public lands are more dispersed but still relatively frequent throughout Stearns and Wright County, where the system alternative avoids most WPAs, Scientific Natural Areas, and State Parks. Through Hennepin County, public lands are scarce, until the system alternative crosses the Mississippi National River and Recreation Area. From there the system alternative winds through Anoka, Ramsey, and Washington counties and crosses no public lands until it again crosses the Mississippi National River and Recreation Area and terminates in the Twin Cities area.

The review of public lands and recreation areas showed that the system alternative crosses federal and state-managed public recreation areas in North Dakota and Minnesota (see table below). The majority of potential impacts occur in counties with high concentrations of public lands including Mountrail, Ward, Pierce, Ramsey and Nelson, North Dakota, and Otter Tail, Grant, Douglas, Pope, Swift and Douglas, Minnesota. Construction of the pipeline through recreation areas could temporarily impact public use and access, as well as temporarily reduce the overall value of the area by disturbing natural areas and limiting wildlife and waterfowl habitat. Long term impacts would be limited to the pipeline corridor, where removal of trees and continued maintenance could reduce or fragment habitat, and potentially affect the overall recreational value of the area.

Table 4-87 Public Resource and Recreational Lands – SA-08

SA-08 crosses more than 13,000 acres of Federal land.			
Ownership	Land Type	Total Crossed by SA	Area Within by SA (Acres)
Federal	U.S. Fish and Wildlife Service-National Wildlife Refuge	3	74
	National Park Service-National River and Recreation Area	1	6,397
	Waterfowl Production Area	12	7,408
North Dakota	State Wildlife Areas-PLOTS lands	29	3,419
Minnesota	Conservation Areas-BWSR	27	690
	Natural Areas-Scientific and Natural Area	6	486
Total		**78**	**18,474**

Source: NRCS, NCED Easements, 2014; State Resource Lands: Illinois DNR, Iowa DNR, Minnesota DNR, North Dakota Game and Fish and Parks and Recreation, South Dakota DNR; USFWS Waterfowl Production Areas and National Wildlife Refuges; National Park Service.

4.8.7 Cities and Population Density

The review of population distribution, density, and city locations shows that SA-08 is divided between rural and urban (Table 4-88). In North Dakota the location with high population density (greater than 5000 people per square mile) is Fargo, with Moorhead – across the Red River in Minnesota having high concentrations of density also. In Minnesota population densities, greater than 5000 people per square mile in small concentrations, are located along the I94 corridor; Sauk Centre, Melrose, Avon, and St. Michael. From Maple Grove to through the Twin Cities density continues at high levels. The average over the entire corridor is 306 persons per square mile. There are 76 cities partially or totally within the SA-08 corridor (Maps A-16 and A-17).

Table 4-88 Population Density and Cities – SA-08

SA-08 includes 76 cities, nearly half of which are larger cities in Minnesota.			
	ND	**MN**	**Total**
Average Persons per Sq Mile	58	457	306
Number of cities	17	59	76
Cities >1000	4	49	53

Source: US Census: http://www.census.gov/2010census/data/ Retrieved August 2014.

North Dakota

Seventeen North Dakota cities are located within the SA-08 corridor; four of the 17 cities have populations greater than 1,000 persons. The cities range in size from 98 persons (the cities of Ross and Deering) to 105,920 people in Fargo in Cass County. The Minot Air Force Base is a census designated place[61] (CDP) with a population of 5,521. It is located 13 miles north of the city of Minot, is north of and adjacent to SA-08. Portions of the military facilities are within the SA-08 boundary..

In general, the SA-08 corridor is sparsely populated, rural in character for both the east-west portion of the system alternative, as well as the north-south portion. The city of Grand Forks (approximately 53,000 people within the city and over 90,000 people including the surrounding areas[62]) is the first urban area the system alternative comes close to. The SA-08 corridor is approximately two miles south of the city, which is located on the North Dakota-Minnesota border in Grand Forks County. The system alternative then turns and continues south along I-29 to Fargo.

Fargo is the second metropolitan area the system alternative crosses. It is an urban area of over 100,000 people. Fargo and the surrounding community had a 16 percent increase in population since the 2000 census. It is the largest city in North Dakota. The system alternative bisects the densest development in the city including industrial, commercial, and residential, as well as major transportation networks of rail, interstate, and airport.

Minnesota

[61] Census Designated Place: a concentration of population identified by the U.S. Census Bureau for statistical purposes. They are the statistical equivalent to places such as cities or towns.

[62] "2010 Census Redistricting Data (Public Law 94-171) Summary File". *American FactFinder*. United States Census Bureau. Retrieved 2 May 2011.

Fifty-nine Minnesota cities are located within the SA-08 corridor; forty-nine of the fifty-nine have populations greater than 1,000 persons. The SA-08 corridor has the largest percentage of towns with populations over 1,000 of all the system alternatives being considered. The largest community is the city of Minneapolis in Hennepin County with a population of 382,578.

Starting at the North Dakota-Minnesota border and proceeding southwest, Moorhead is the only city over 1,000 people for the first 50 miles. The corridor generally parallels Interstate 94 and travels in a southeast direction where it crosses the city of Fergus Falls with a population of 13,138. Within the fifty-mile stretch between the two cities, the development patterns and population density is rural, generally with agriculture and associated single farmsteads as the predominant land use. Fergus Falls is located on the edge of increased population density around the many lakes and the cities adjacent to I-94.

Increased development occurs in the city of Alexandria (population 11,070) and its surrounding area. While the general character is rural, the lakes have dense development on the shoreline. This pattern of dense development surrounding lakes and the cities near the lakes alternates with the less-densely populated areas of farmland along the I-94 highway corridor. As the system alternative heads toward St. Cloud it crosses through nine small towns. St. Cloud is the largest population center in central Minnesota, an urban city with a population of 65,842 within the city, and approximately 190,000 persons in the surrounding areas. As the pipeline corridor follows I-94, it does not cross the most intensely developed areas of St. Cloud, but is situated in the suburban, less-densely populated part of the city.

East of St. Cloud, and as the system alternative approaches the Twin Cities metropolitan area, development gradually becomes denser. After the corridor crosses into Hennepin County, the development patterns shift from rural to suburban. Development patterns throughout western Hennepin County are large-lot suburban, transitioning quickly to dense urban development throughout the rest of the corridor to the terminus in Rosemount in Dakota County.

The mostly rural character of SA-08 in North Dakota is evident in the relatively low population density. The population density in Minnesota is relatively high due to the route crossing the Twin Cities metropolitan area.

In North Dakota, Fargo is the largest city (105,920 persons) crossed by the system alternative. In Minnesota, Brooklyn Park (75,781 persons) is the largest city which any of the system alternative's cross. Minneapolis is the largest city (382,578 persons) affected by the system alternative (a small portion of the system alternative crosses the city). Woodbury is located on the east side of the Twin Cities Metropolitan Area. Moorhead (38,065 persons) is the population center in northwest Minnesota (located across from Fargo). The population density pattern (an indicator of the extent of development) across SA-08 is very light in North Dakota until the system alternative crosses Fargo-Moorhead, density

increases as the system alternative continues southeasterly toward the Twin Cities. The density concentration is at its peak as SA-08 approaches and then continues through the Twin Cities.

4.8.8 Community Features

SA-08 is largely rural except as it goes through the city of Fargo and goes around the north and east sides of the Twin Cities Metropolitan Area, where the majority of the community features were found (Maps A-18).

North Dakota

Eight airports are within this system alternative. Five are private and three are public: Hector International in Fargo, Hillsboro Municipal, and Rugby Municipal. An Amtrak rail station is located within the corridor in Fargo. Seventeen cemeteries and four churches are scattered throughout the system alternative. Eleven fire stations and eight police stations, including sheriffs and jails, are within the system alternative. Eight hospitals and/or ambulance services are distributed within the system alternative. Five of the eight medical facilities are in Fargo. Minot Air Force base is partially located within the system alternative. Grand Forks Air Force Base is located less than one mile north of the system alternative. Twenty-two schools occur within the system alternative at 19 locations.

The system alternative crosses downtown Fargo with its concentration of businesses, residences, churches, schools, and transportation facilities. The corridor crosses at least two major railroads, including the route for the Amtrak Empire Builder. It also crosses an international airport.

The main highways crossed by SA-08 are Interstate 29, Interstate 94; US 2, US 52, US 83, and US 281.

Minnesota

Seven airports are within the system alternative. Five are private and two are public: Moorhead Municipal and Sauk Centre Municipal. Thirty-six cemeteries and seven churches are scattered throughout the system alternative. Twenty-nine fire stations and ten police stations are located in the system alternative. The majority of these are located in Hennepin or Ramsey counties. Seven hospitals and/or ambulance services are in the system alternative. Ninety-six schools are within this system alternative at 81 locations. The majority of the schools are located in Hennepin, Ramsey, and Washington counties.

The main highways crossed by SA-08 are Interstate 94 (which is used by this system alternative as an existed developed corridor), Interstate 694, Interstate 494, Interstate 35W, and Interstate 35E. Starting at the western portion of the system alternative in Minnesota, the rural road network is more dispersed, development is sparse, and major highways are connected by county and township roads. As the system

alternative proceeds southeast and approaches the Twin Cities metropolitan area, the transportation network becomes very dense and many city streets providing connections between major highways.

The number and types of community of features are summarized in the table below. SA-08 travels through largely rural areas, where community features are generally less concentrated and therefore easier to avoid. However, SA-08 also passes through several areas with denser development. SA-08 travels through Fargo/Moorhead, and the northern and eastern suburbs of the Twin Cities, both areas which have higher concentrations of community features. Concentrations of community features may affect the placement of a pipeline ROW. Construction and operation of a pipeline may affect the delivery of services to the community and areas with a minimal road network may make access to the pipeline in case of an emergency more difficult.

Table 4-89 Community Features – SA-08

SA-08 is largely rural but also crosses through the areas of Fargo-Moorhead and the Twin Cities metropolitan area where the concentration of community features is higher. Schools are the most commonly encountered feature, followed by fire stations and cemeteries.

	Airports	Amtrak	Cemeteries	Churches	Fire stations	Hospitals	Military base	Police station	Schools
North Dakota	8	1	17	4	11	8	1	8	22
Minnesota	7	0	36	7	29	7	0	10	96
Total	**15**	**1**	**53**	**11**	**40**	**15**	**1**	**18**	**118**

Source: USGS TNM - National Structures Dataset

4.8.9 Cultural Resources

The National Register of Historic Places (NRHP) Architectural Resources within the system alternative are shown on Maps A-19 and A-20. The data presented represents those architectural resources (historic standing structures) currently listed on the NRHP and does not include archaeological sites, since they are considered sensitive in nature and locational information is restricted.

Architectural Resources

There are seven historic districts and 48 other historic properties listed on the NRHP within SA-08 (Table 4-90). Five of the historic districts are in the Fargo, North Dakota area, and two are in Stearns County, Minnesota. There are 48 additional individually listed properties in SA-08. Of these properties, 22 are within Minnesota and 26 are in North Dakota. Most of these resources are in the Fargo-Moorhead metropolitan area (Clay County, Minnesota and Cass County, North Dakota).

Table 4-90 National Register of Historic Places Properties – SA-08

SA-08 includes 55 listed historic properties. The majority of these listings, including five historic districts, are in the Fargo-Moorhead area.			
Resource Name	State	County	NRHP ID
North Dakota State University District	North Dakota	Cass	86003261
North Side Fargo High Style Residential Historic District	North Dakota	Cass	86003739
St. Mary's Cathedral Historic District	North Dakota	Cass	87002635
Downtown Fargo District	North Dakota	Cass	87002635
Fargo South Residential District	North Dakota	Cass	83001929
Fargo and Southern Depot	North Dakota	Cass	75001303
Fargo Theatre Building	North Dakota	Cass	82001312
Gethsemane Episcopal Cathedral	North Dakota	Cass	80002909
Grand Lodge of North Dakota, Ancient Order of United Workmen	North Dakota	Cass	79001770
Great Northern Freight Warehouse	North Dakota	Cass	90001749
Kennedy House	North Dakota	Cass	86003742
Knerr Block, Floyd Block, McHench Building and Webster and Cole Building	North Dakota	Cass	83001930
Lewis House	North Dakota	Cass	79003726
Masonic Block	North Dakota	Cass	79001771
Monticello--Mount Vernon--Arlington Apartments	North Dakota	Cass	87002633
Northern Pacific Railway Depot	North Dakota	Cass	75001304
Pence Automobile Company Warehouse	North Dakota	Cass	93001478
Powers Hotel	North Dakota	Cass	83001931
Union Storage & Transfer Cold Storage Warehouse and Armour Creamery Building	North Dakota	Cass	7000016
Wilson, Woodrow, School	North Dakota	Cass	12000881
Barrington Apartments	North Dakota	Cass	88000982
Cass County Courthouse	North Dakota	Cass	83004062
Cole Hotel	North Dakota	Cass	83001928
DeLendrecie's Department Store	North Dakota	Cass	79003725
Dibley House	North Dakota	Cass	80004282
Elliot--Powers House and Garage	North Dakota	Cass	87002634
Elliott Bridge	North Dakota	McHenry	97000181
First State Bank of Buxton	North Dakota	Traill	78001995
Plummer, Amos and Lillie, House	North Dakota	Traill	95001488
Sarles, O. C., House	North Dakota	Traill	85000562
Traill County Courthouse	North Dakota	Traill	80002928
Banfill Tavern	Minnesota	Anoka	76001044

SA-08 includes 55 listed historic properties. The majority of these listings, including five historic districts, are in the Fargo-Moorhead area.			
Resource Name	State	County	NRHP ID
Barnesville City Hall and Jail	Minnesota	Clay	80002009
Burnham Building	Minnesota	Clay	80002013
Comstock, Solomon Gilman, House	Minnesota	Clay	74001011
Huntoon, Lew A., House	Minnesota	Clay	80002016
Main Building, Concordia College	Minnesota	Clay	80002017
Park Elementary School	Minnesota	Clay	88003013
Foss House	Minnesota	Ramsey	83000931
Church of St. Boniface	Minnesota	Stearns	93001234
Church of St. Mary Help of Christians--Catholic	Minnesota	Stearns	82003049
Church of the Sacred Heart (Catholic)	Minnesota	Stearns	91000906
First Congregational Church of Clearwater	Minnesota	Stearns	79001260
Freeport Roller Mill and Miller's House	Minnesota	Stearns	82003043
Lewis, Sinclair, Boyhood Home	Minnesota	Stearns	68000027
Original Main Street Historic District	Minnesota	Stearns	94000758
St. Benedict's Convent and College Historic District	Minnesota	Stearns	89000160
IOOF Hall	Minnesota	Wilkin	80002185
Johnson, J. A., Blacksmith Shop	Minnesota	Wilkin	96000174
Albertville Roller Mill	Minnesota	Wright	79001258
Clearwater Masonic Lodge-Grand Army of the Republic Hall	Minnesota	Wright	79001259
Nicherson-Tarbox House, Shed and Barn	Minnesota	Wright	79001274
Rand, Rufus, Summer House and Carriage Barn	Minnesota	Wright	79001275
Simpson Methodist Episcopal Church	Minnesota	Wright	79001276
Webster, William W., House	Minnesota	Wright	79001261

Source: National Register of Historic Places (www.nps.gov/nr)

Archaeological Resources Potential

Similar to other system alternatives, known sensitive areas for archaeological sites in North Dakota include areas adjacent to major drainage features such as the Souris River and the Red River of the North. Non-habitation sites such as rock art, rock alignments, and stone circles are often found in upland settings. In Minnesota, known sensitive areas for archaeological sites include areas adjacent to major water features such as lakes, the Red River of the North, the Minnesota River, the Mississippi River, and their tributaries.

4.8.10 Contaminated Areas

Enforcement and compliance activities listed in the USEPA FRS databases were used to identify properties most likely to be contaminated. Nationally registered contaminated sites, such as those on

the National Priorities List (NPL), pose the greatest environmental risk. No NPL sites were identified in SA-08.

Extensive subsurface excavation is required for the installation of the pipeline. Contaminated soil and groundwater may be encountered if sited in close proximity to contaminated properties. Contaminated properties are scattered throughout SA-08 near or in established towns and/or where industrial and commercial activity is more prevalent. Concentrations of sites occur in Fargo/Moorhead area, on the north and east side of the Twin Cities and along the north–south section from the Twin Cities to Duluth.

Table 4-91 below summarizes the number of potentially contaminated properties that are located within SA-08 (Maps A-21 and A-22).

Table 4-91 Potentially Contaminated Properties – SA-08

SA-08 has the greatest number of listings of potentially contaminated properties in comparison to the other SAs.		
Listing Type	State	Number of Sites Within SA-08 By State
Brownfields Property	Minnesota	25
Compliance Activity	Minnesota	47
	North Dakota	37
Enforcement/Compliance Activity	Minnesota	55
	North Dakota	65
Formal Enforcement Action	Minnesota	36
	North Dakota	20
Leaking Underground Storage Tank (as defined by the American Recovery and Reinvestment Act)	Minnesota	1
Superfund (non-NPL)	Minnesota	2
Total		**288**

Source: U.S. EPA, Facility Registration Service, 2014

4.8.11 Air Emissions

The counties in North Dakota and the majority of counties in Minnesota through which a route in SA-08 would be constructed and operated are designated as attainment or unclassifiable/attainment for pollutants subject to National Ambient Air Quality Standards (NAAQS). The pollutants subject to NAAQS include ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and lead. Part of Dakota County in Minnesota is currently designated nonattainment for lead. This nonattainment area is a small

area located around an existing industrial facility that would not be anticipated to be directly impacted by a route in SA-08.

Construction-related emissions will be limited to fugitive dust and mobile-source combustion emissions including both criteria pollutants and greenhouse gases. Given the temporary and localized nature of these dust emissions, as well as the ability to mitigate them as needed, these activities are not expected to significantly affect air quality. As represented by NDPC, an additional 474 miles of pipeline would be associated with a route in SA-08. As compared to SA-Applicant, the additional pipeline length associated with a route in SA-08 would result in additional construction-related emissions.

As represented by NDPC, a route in SA-08 would require three additional pump stations with ten additional pumps, as compared to SA-Applicant. Operational-related emissions will be limited to insignificant amounts of volatile organic compounds (VOC), an ozone precursor, from valve leaks. Although the pipeline itself is not a significant source of greenhouse gas emissions, the power required to operate pumps and equipment does result in increased secondary greenhouse gas emissions. As represented by NDPC, a route in SA-08 would result in 120,636 metric tons per year of additional secondary carbon dioxide equivalent (CO_2e) emissions as compared to SA-Applicant.

Construction and operation of a route in SA-08 would result in direct and secondary affects to air quality, potentially including an existing nonattainment area in Minnesota. The effect of the construction and operation of a route in SA-08 would be expected to be insignificant.

4.8.12 High-Consequence Areas and Natural Disaster Hazard Areas

High Consequence Areas (HCAs) and Natural Disaster Hazard Areas are defined by the USDOT PHMSA as areas that are more sensitive or hold more risk for placement of an oil pipeline. SA-08 follows the I-94 corridor from Fargo to the Twin Cities, crossing numerous populated areas. Many of those populated areas are also drinking water HCAs. SA-08 also crosses a string of ecological ESAs in western Minnesota and along the Mississippi River in the northern suburbs of the Twin Cities. High flood hazard risk areas are concentrated where the system alternative crosses larger rivers such as the Red River of the North and as it parallels the Mississippi River northwest of the Twin Cities. Landslide hazard areas are generally west of the Red River Valley in North Dakota.

SA-08 crosses three high population areas, Fargo-Moorhead, Twin Cities and Duluth covering 72,986 acres as the System Alternative travels through the Fargo-Moorhead area, around the north and east sides of the Twin Cities and the south edge of Duluth (Map A-23). Fifty-seven other population areas (OPA) covering 61,584 acres are included in SA-08. The OPA HCAs on SA-08 are scattered along the I-94 corridor from Fargo to the Twin Cities, including Fergus Falls, Alexandria, St Cloud, Monticello, Dayton, and Maple Grove and along the east side of the Twin Cities including Inver Grove Heights, Rosemount and Woodbury. Other OPA HCAs are scattered throughout the system alternative.

SA-08 crosses 249 drinking water HCAs covering approximately 21,880 acres and 16 ecological HCAs covering 10,728 acres (Maps A-24 and A-25). The drinking water HCAs are scattered throughout, however concentrations match where cities are located along the I-94 corridor and the east side of the Twin Cities. The ecological HCAs are also scatted throughout, located near existing state and federal resource lands and known critical habitat, particularly in Mountrail County in North Dakota and Ottertail, Grant, Chisago, Pine and Carlton counties in Minnesota. In addition, ecological HCAs are located within SA-08 where the system alternative crosses or is near the Mississippi River.

Natural Disaster Hazard Areas are defined as being a Low/Med/High risk. For flood hazard, medium risk covers approximately 15.7 percent of the SA-08 while high risk covers 7.6 percent (Map A-26). Medium and high risk areas are concentrated in the Red River Valley, in Otter Tail County Minnesota near the crossing of the Pelican River, in Stearns County near the crossing of the Sauk River, in Wright County along the Mississippi River and at the Mississippi River crossing in Washington County. For landslide hazard, medium risk covers approximately 27.2 percent of the SA-08 while high risk covers 0.25 percent (Map A-27). Medium Risk areas are concentrated in central and eastern North Dakota while the High risk areas are concentrated at the far western section of system alternative.

4.9 Sandpiper Route Alternatives in Wisconsin

Of the seven system alternatives under review, four terminate in Superior, Wisconsin (SA-Applicant, SA-03, SA-6 and SA-07). All four follow NDPC's proposal, SA-Applicant, from the Minnesota border to the terminus. In Wisconsin, the Sandpiper project is proposed to be located entirely in Douglas County for approximately 14 miles, where it will terminate at the Superior Terminal (see **Error! Reference source not found.**).

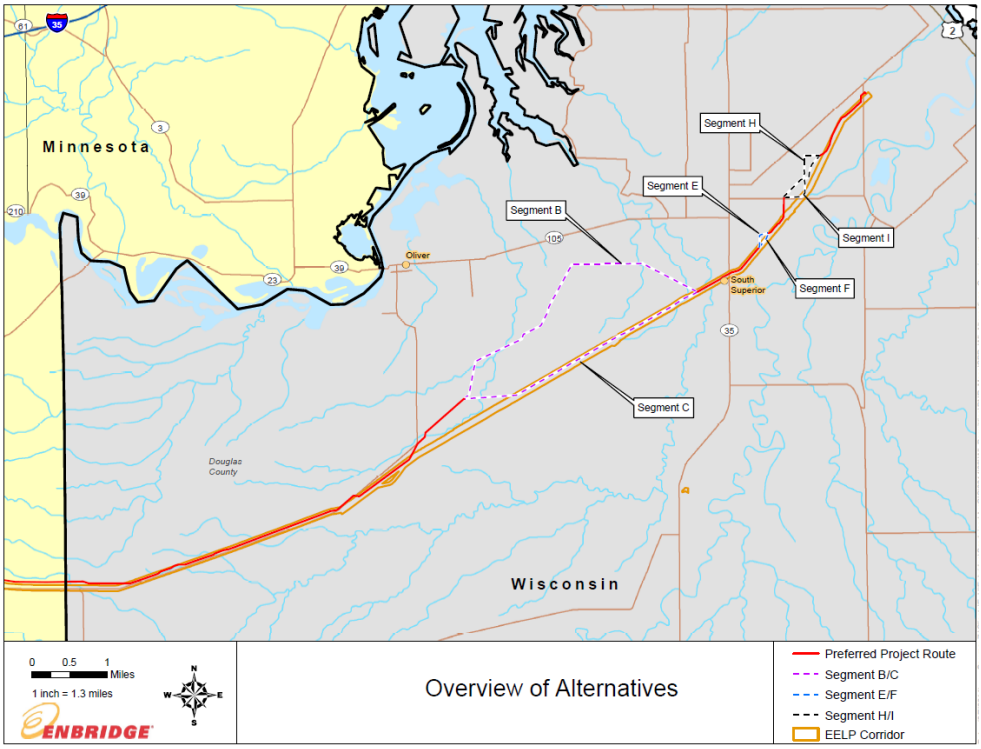
A Public Interest Determination[63] was submitted by North Dakota Pipeline Company, LLC (NDPL) and Enbridge Energy Limited Partnership (EELP) to the Wisconsin Public Service Commission (WPSC) in March of 2014. Information on the proposed pipeline project in Wisconsin is summarized from the application for Public Interest Determination. Following receipt of necessary permits, including a public interest determination by the WPSC, segments of the proposed pipeline (where easement options have been obtained from landowners) may be constructed in early 2015. The targeted in-service date is the end of first quarter of 2016.

The proposed route in Wisconsin includes construction of the Sandpiper pipeline (30 inch diameter pipe) and replacement of approximately 18 miles of its existing Line 3 pipeline with new 36-inch OD pipe

[63] A determination by the Wisconsin Public Service Commission (WPSC) is required for construction. The application is available through WPSC's electronic record http://psc.wi.gov/apps35/ERF_view/viewdoc.aspx?docid=200350

beginning at the Wrenshall valve near milepost (MP) 1079.9 in Carlton County, Minnesota, extending to the southeast and ending at the existing Superior Terminal near MP 1098.1. Approximately 14 of the total 18 miles of the Line 3 Replacement – Phase 2 Project are located in Douglas County, Wisconsin. To minimize impacts to landowners and the environment, the applicant proposes to co-construct the Line 3 Replacement with the Sandpiper Pipeline utilizing the same route. The map below shows the route alternatives under consideration.

Figure 4-1 Overview of Route Alternatives



Land Requirements and Easements

While the system alternatives analyzed in this document used two-mile-wide corridors around the general location of the identified system alternatives, the route corridor and associated alternatives identified in the Public Interest Determination Application for the Wisconsin portion of the project considered a right-of-way (ROW) of 110 feet. Table 4-92 lists the ROW anticipated for the project.

Table 4-92 Wisconsin - Land

Easement		Sandpiper Pipeline Project (Wisconsin)	Line 3 Replacement – Phase 2 Project	Total Combined ROW
Permanent ROW (ft)	**Co-Located Portions**	20	20	40
	Greenfield Portions	50	20	70
Temporary Easements (ft)	**Co-Located Portions**	15	20	35
	Greenfield Portions	20	20	40
Total Land Requirements (ft)	**Co-Located Portions**	35	40	75
	Greenfield Portions	90	20	110

[a] A portion of the permanent ROW may include portions of existing EELP permanent easements, which are used for the operation and maintenance of other pipelines.

Source: Public Interest Determination Application for Sandpiper Pipeline and Line 3 Replacement

Permanent and temporary easements will be needed for the projects to accommodate the new pipelines and provide sufficient space for a buffer zone from any existing pipeline or utility for safety on either side of the pipeline. Additional temporary workspaces (ATWS) include construction areas outside of the typical 110-foot-wide construction ROW necessary for construction staging. ATWS are also necessary where the projects cross features such as waterbodies, wetlands, roads, railroads, foreign pipelines and utilities, horizontal directional drill (HDD) sites, and other special circumstances. A new 40-foot-wide permanent easement would be retained where co-located.

Route Alternatives

NDPL, EELP, and its affiliates currently own and operate existing pipeline ROWs in Wisconsin and intend to use such ROWs where possible. However, in some locations it may not be feasible to use the existing ROW due to congestion, poor crossing conditions or other constraints[64]. Alternative routes were developed for these areas, as depicted in Figure 4.9.1. As noted in the Public Interest Determination Application, only the route segments that deviate from previously permitted projects (Alberta Clipper and Southern Lights pipelines) were evaluated. That evaluation is summarized below.

[64] Ibid.

Segments B and C

Segments B and C between approximate MPs 607.0 and 611.2 (Figure 4-2) were developed due to proximity to residences and the Pokegama-Carnegie State Natural Area (SNA). Table 4.9.2 provides a comparison of the prominent land use features of these alternatives. NDPL and EELP prefer Segment C to avoid the SNA; however, final routing is subject to WDNR and U.S. Army Corps of Engineers (USACE) review.

Figure 4-2 Segment Alternatives B and C

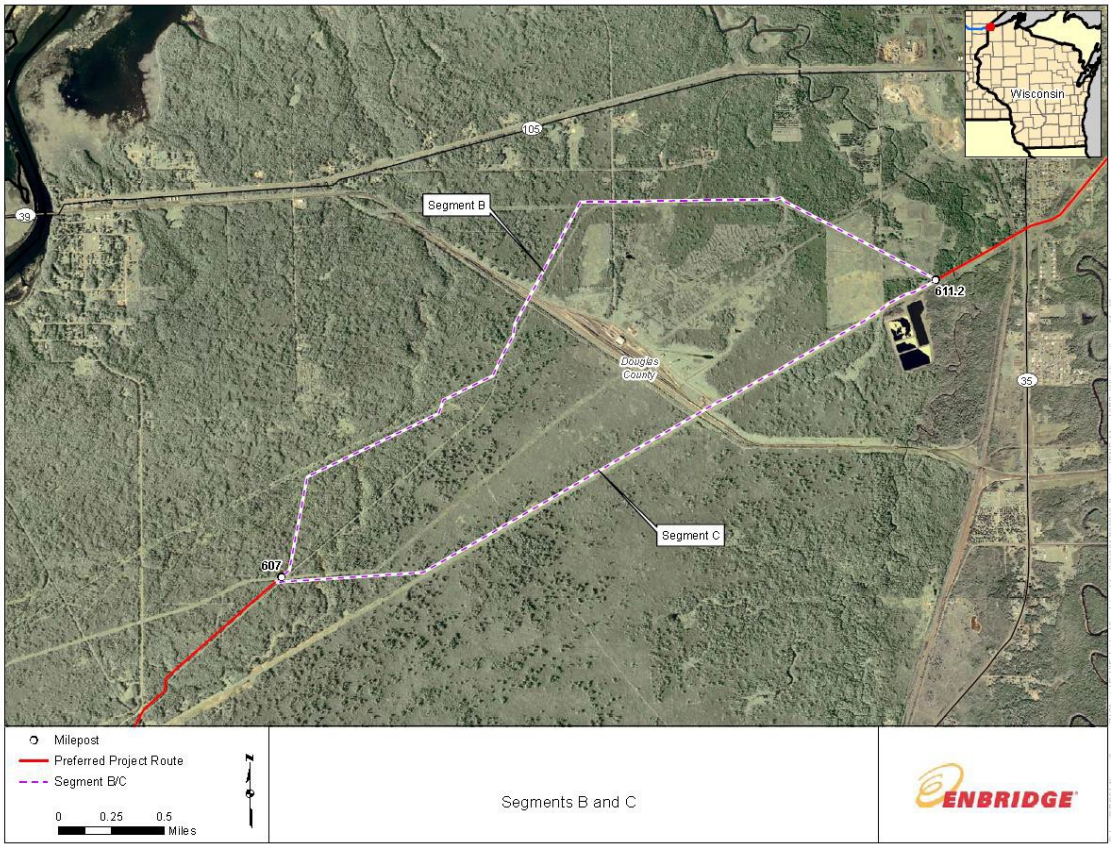


Table 4-93 Wisconsin - Environmental Features Comparison –Segments B and C

Environmental Features	Unit	Segment B	Segment C
Length	miles	4.3	3.5
Adjacent to Existing ROW	miles	0.0	2.8
Greenfield Route [a]	miles	0.5	0.0
Wetland Crossing Length [b, c]	miles	2.6	2.8
Wetland Impact - Construction [b, d]			
PEM	acres	4.2	8.6
PSS	acres	22.9	26.3
PFO	acres	10.8	5.0
Wetland Impact - Operation [b, e]			
PEM	acres	0.0	0.0
PSS	acres	14.3	10.7
PFO	acres	6.4	2.1
Rare Plant Occurrences [b]	number	161	267
Hydric Soils	acres	51.4	48.3
Highly Wind Erodible Soils	acres	0.0	0.0
Agricultural Land	acres	0.0	0.0
Herbaceous Land	acres	0.3	0.3
Forest	acres	23.4	12.5
Prime Farmland Soils	acres	0.0	0.0
Intermittent Waterbodies Crossed [b]	number	0	0
Ephemeral Waterbodies Crossed [b]	number	8	0
Perennial Waterbodies Crossed [b]	number	7	2
Lake Superior National Estuarine Research Reserve Properties	number	0	0
Priority Wetlands [f]	miles	1.4	0.0
Priority Navigable Waterways Crossed	number	4	2
Areas of Special Natural Resource Interest	miles	1.4	0.0
Wild Rice Production Area Drainages [g]	miles	0.0	0.0

Table 4-93
Environmental Features Comparison –Segments B and C

Environmental Features	Unit	Segment B	Segment C
DNR Managed Lands	miles	0.0	0.0
State, County or Municipal Forest Land	miles	1.6	2.6
Railroads Crossed	number	1	1
Roads Crossed	number	2	1
Residences within 300 feet	number	0	1

[a] Greenfield locations include, for purposes of the alternatives analysis, areas where the route is not within 200 feet of an existing ROW.

[b] Based on field delineated data from Fall 2013 surveys. Where 2013 survey was not completed, Enbridge utilized recent (2008 / 2009) wetland and waterbody field data from a previous project and WWI data.

[c] Crossing length of proposed pipeline centerline across wetlands.

[d] Area of wetland impact within the construction workspace based typically on a 110-foot-wide workspace, including temporary dredge and fill areas, travel lanes, and staging areas.

[e] Permanent conversion impacts include the area within the new permanent easement where the pipeline corridor will be maintained by periodic clearing activities.

[f] Identified by the March 2000 Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes, Pub. ## ER-002-00.

[g] Identified by the WDNR and Great Lakes Indian Fish and Wildlife Commission.

Source: Public Interest Determination Application for Sandpiper Pipeline and Line 3 Replacement

Segments E and F

Route Segments E and F between MPs 612.2 and 612.5 (Figure 4-3) were developed to address ongoing litigation pending before the Circuit Court of Douglas County, which could impact future construction projects on several parcels of property. NDPL and EELP prefer Route Alternative E. Table 4-94 provides a comparison of the prominent land use features of these alternatives.

Figure 4-3 Segment Alternatives E and F

Source: Public Interest Determination Application for Sandpiper Pipeline and Line 3 Replacement

Table 4-94 Wisconsin - Environmental Features Comparison –Segments E and F

Environmental Features	Unit	Route Alternative E	Route Alternative F
Length	miles	0.3	0.2
Adjacent to Existing ROW	miles	0.0	0.2
Greenfield Route [a]	miles	0.2	0.0
Wetland Crossing Length [b, c]	miles	0.3	0.2
Wetland Impact - Construction [b, d]			
PEM	acres	1.0	0.8
PSS	acres	2.7	1.8
PFO	acres	0.7	0.0
Wetland Impact - Operation [b, e]			
PEM	acres	0.0	0.0
PSS	acres	0.0	0.9
PFO	acres	0.5	0.0
Rare Plant Occurrences [b]	number	0	0
Hydric Soils	acres	4.4	2.6
Highly Wind Erodible Soils	acres	0.0	0.0
Agricultural Land	acres	0.0	0.0
Herbaceous Land	acres	0.0	0.0
Forest	acres	2.9	2.6
Prime Farmland Soils	acres	0.0	0.0
Intermittent Waterbodies Crossed [b]	number	0	0
Ephemeral Waterbodies Crossed [b]	number	0	0
Perennial Waterbodies Crossed [b]	number	0	0
Lake Superior National Estuarine Research Reserve Properties	number	0	0
Priority Wetlands [e]	miles	0.0	0.0
Priority Navigable Waterway	number	0	0
Areas of Special Natural Resource Interest	miles	0.0	0.0
Wild Rice Production Area Drainages [f]	miles	0.0	0.0
DNR Managed Lands	miles	0.0	0.0
State, County or Municipal Forest Land	miles	0.0	0.0
Railroads Crossed	number	0	0
Roads Crossed	number	0	0
Residences within 300 feet	number	0	0

[a] Greenfield locations include, for purposes of the alternatives analysis, areas where the route is not within 200 feet of an existing ROW.

[b] Based on field delineated data from Fall 2013 surveys. Where 2013 survey was not completed, Enbridge utilized recent (2008 / 2009) wetland and waterbody field data from a previous project and WWI data.

[c] Crossing length of proposed pipeline centerline across wetlands.

[d] Area of wetland impact within the construction workspace based typically on a 110-foot-wide workspace, including temporary dredge and fill areas, travel lanes, and staging areas.

[e] Permanent conversion impacts include the area within the new permanent easement where the pipeline corridor will be maintained by periodic clearing activities.

[f] Identified by the March 2000 Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes, Pub. ## ER-002-00.

[g] Identified by the WDNR and Great Lakes Indian Fish and Wildlife Commission.

Segments H and I

Segments H and I located at approximately MPs 613.1 to 614.0 (Figure 4-4) were developed to avoid the Nemadji Golf Course. Table 4-95 provides a comparison of the prominent land use features of these alternatives. NDPL and EELP prefer Alternative I to avoid disrupting the operation of the Nemadji Golf Course; however, final routing is subject to WDNR and USACE review.

Figure 4-4 Segment Alternatives H and I

Source: Public Interest Determination Application for Sandpiper Pipeline and Line 3 Replacement

Table 4-95 Wisconsin - Environmental Features Comparison –Segments H and I

Environmental Features	Unit	Segment H	Segment I
Length	miles	0.9	0.9
Adjacent to Existing ROW	miles	0.0	0.4
Greenfield Route [a]	miles	0.4	0.0
Wetland Crossing Length [b, c]	miles	0.8	0.3
Wetland Impact - Construction [b, d]			
PEM	acres	3.5	2.9
PSS	acres	8.0	2.4
PFO	acres	0.6	0.0
Wetland Impact - Operation [b, e]			
PEM	acres	0.0	0.0
PSS	acres	6.0	0.0
PFO	acres	0.6	0.0
Rare Plant Occurrences [b]	number	56	20
Hydric Soils	acres	13.2	11.9
Highly Wind Erodible Soils	acres	0.0	0.0
Agricultural Land	acres	0.0	0.0
Herbaceous Land	acres	1.2	0.5
Upland Forest	acres	7.5	0.4
Prime Farmland Soils	acres	0.0	0.0
Intermittent Waterbodies Crossed [b]	number	7	4
Ephemeral Waterbodies Crossed [b]	number	0	0
Perennial Waterbodies Crossed [b]	number	0	0
Lake Superior National Estuarine Research Reserve Properties	number	0	0
Priority Wetlands [e]	miles	0.0	0.0
Priority Navigable Waterway	number	0	0
Areas of Special Natural Resource Interest	miles	0.0	0.0
Wild Rice Production Area Drainages [f]	miles		
DNR Managed Lands	miles	0.0	0.0
State, County or Municipal Forest Land	miles	0.0	0.0
Railroads Crossed	number	1	1
Roads Crossed	number	0	0
Residences within 300 feet	number	0	0

[a] Greenfield locations include, for purposes of the alternatives analysis, areas where the route is not within 200 feet of an existing ROW.

[b] Based on field delineated data from Fall 2013 surveys. Where 2013 survey was not completed, Enbridge utilized recent (2008 / 2009) wetland and waterbody field data from a previous project and WWI data.

[c] Crossing length of proposed pipeline centerline across wetlands.

[d] Area of wetland impact within the construction workspace based typically on a 110-foot-wide workspace, including temporary dredge and fill areas, travel lanes, and staging areas.

[e] Permanent conversion impacts include the area within the new permanent easement where the pipeline corridor will be maintained by periodic clearing activities.

[f] Identified by the March 2000 Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes, Pub. ## ER-002-00.

[g] Identified by the WDNR and Great Lakes Indian Fish and Wildlife Commission.

Permits and Approvals

Table 4-96 details the federal, state and local government permits and approvals required for the projects in Wisconsin.

Table 4-96 Agency Permits/Approvals in Wisconsin

Name of Agency	Title of Permit/Approval	Date of Application [a]	Date of Decision [b]	Status
United States Army Corps of Engineers – St. Paul District	Clean Water Act Section 404	February 2014	January 2015	Application submitted
United States Fish and Wildlife Service (Section 7)	Section 7 Endangered Species Act Consultation	December 2013	January 2015	Initial consultation in December 2013.
Wisconsin Public Utilities Commission	Public Interest Determination	March 2014	December 2014	Application Submitted
Wisconsin Department of Natural Resources	Chapter 30 Permit and NR 103 Water Quality Certification	February 2014	January 2015	Application submitted
	State Endangered Resources Review	March 2014	January 2015	Application submitted
	Temporary Water Use Permit	August 2015	September 2015	Pending submittal
	Superior Terminal Air Permit	May 2014	March 2015	Pending submittal
	Hydrostatic Test Discharge Permit	August 2015	September 2015	Pending submittal
Wisconsin Department of Natural Resources	WPDES Construction Stormwater General Permit – Pipeyards and Contractor Yards	April 2014	June 2014	Pending submittal
	WPDES Individual Construction Stormwater Permit – Pipeline Construction	June 2014	September 2014	Pending submittal
Wisconsin State Historic Preservation Office (Section 106)	Cultural Resources Consultation, NHPA Section 106 Clearance	November 2013	November 2014	Initial consultation with COE November 2013.
Wisconsin Department of Agriculture	Agricultural Protection Plan	April 2013	September 2014	Consultation initiated
Wisconsin Department of Transportation	Road Crossing Permits	TBD	TBD	Pending submittal
City of Superior	Erosion Control/Grading Permit	December 2014	February 2015	Pending submittal

[a] Actual date of initial consultation/anticipated dates for submission.
[b] Projected dates of action.

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5 Mitigation and Incident Response

Environmental impacts will result from the construction and operation of pipelines. Impacts can be:

(1) Direct, caused by the action and occurring at the same time and place.

(2) Indirect, caused by the action but occurring later in time or those that are farther removed in distance, but are still reasonably foreseeable.

(3) Cumulative. While much more difficult to quantify, these impacts result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7). The extent of impacts is generally analyzed once a system alternative has been identified.

Efforts to avoid, minimize and mitigate impacts of a proposed project occur throughout the application, permitting, construction and operations processes. Project proposers generally screened potential routes at a high level prior to permit application, eliminating alternatives that either do not meet the need for the proposed project, or those that have “fatal flaws” and are not considered viable.

Many potential impacts can be addressed through selection of the route for a pipeline, specific placement of the right-of-way and specific construction and operational techniques. Detailed impact evaluations are completed once a route has been selected for a project. The extent of direct, indirect and cumulative impacts to the natural and the built environment will determine the types and extent of mitigation required by the jurisdictional authority. Options for avoiding, minimizing and mitigating potential impacts can occur through:

- Routing and permit decision-making processes
- Construction and environmental control plans
- Release and incident response plans

The routing and permitting of a pipeline, as well as its long-term operation and maintenance must meet numerous state and federal regulations. State permitting authorities are responsible for routing and siting and determining how impacts associated with the routing and permitting will be mitigated. Federal regulations for pipelines include oversight of pipeline construction, operation, maintenance and safety requirements. All pipelines must meet state and federal statutory and regulatory requirements.

Routing and Permitting

The routing and permitting may occur at the federal, state or local level. Alternatives are often screened to determine if they meet the project purpose and need and are further evaluated for broad environmental impacts. At the macro level, routing can be used to avoid impacts to a resource or population, or to minimize impacts. If impacts cannot be avoided or minimized, mitigation for the impact must be determined.

- The Federal Energy Regulatory Commission (FERC) regulates transportation rates for natural gas and oil pipelines. The U.S. Department of Transportation's Pipeline and Hazardous Material Safety Administration (DOT/PHSMA), through the Office of Pipeline Safety (OPS), regulates the safety of natural gas, oil, and hazardous materials pipelines. FERC regulates oil transportation rates but does not regulate the location, construction or pipeline safety.

- Crude oil pipelines are highly regulated and numerous permits are required for the life of the pipeline. Permits fall into three primary classifications: federal, state local (county, township and city). The necessary federal permits typically pre-empt state permitting authority, unless state agencies are acting on behalf of the federal government. Table 5-1 shows state regulatory agencies and general requirements for permitting for the Sandpiper pipeline project.

Table 5-1 State Pipeline Permitting Authorities for Sandpiper Pipeline Alternatives

STATE	Regulatory AGENCY	General Requirements
North Dakota	North Dakota Public Service Commission[65] Authority: N.D. Century Code 49-22 and 69-06-08 of N.D. Admin. Code.	Requires applicant to file application for a Certificate of Corridor Compatibility and Route Permit with a environmental report; considered by Commission at one time with a combined set of public hearings. Timeline 6 to 9 months and ability to extend timeline for cause. Commission Certificate to construct and grant eminent domain.
South Dakota	South Dakota Public Service Commission[66]	Requires applicant to file application for a construction permit with an environmental report. Timeline up to 1 year and ability to extend timeline for cause. Requires pipeline routing permit and

[65] http://www.psc.nd.gov/jurisdiction/pipelines/index.php

[66] https://puc.sd.gov/

STATE	Regulatory AGENCY	General Requirements
	Authority: S.D. Codified Laws Chap. 49-41B and S.D. Admin Rules Chapter 20:10:22.	state associate environmental assessment.
Iowa	Iowa Utilities Board[67] Authority: Iowa Code Chapter 479B.	Companies typically file Route/Siting application with environmental report (pursuant Iowa Code chapter 479B). Typical timeframe 12 to 15 months and ability to extend time for cause. Requires Commission Certificate to grant eminent domain.
Illinois	Illinois Commerce Commission[68] Authority: Common Carrier by Pipeline Law (220 ILCS 5/15-401 (a)) and Section 8-503 (220 ILCS 5/8 503) of the Public Utilities Act.	Applicant files Certificate of Good Standing application with list of all other applicable federal, state and local permits. Timeline approximately 12 months and ability to extend for cause. Routing approval is done at county level.
Wisconsin	Wisconsin Public Service Commission[69] Authority: Wis. Stat. Section 32.02 (13) and Wis. Admin. Code Sec. PSC 2.07	Applicant files Public Interest Determination with environmental report for eminent domain authority. Timeline of approximately 12 to 15 months and ability to extend for cause. Route evaluated through permit approvals of state environmental agency.
Minnesota	Minnesota Public Utilities Commission Authority: Minn. Stat. 216B and 216G	Applicant files Certificate of Need and Route Permit applications. Timeline of approximately 12 months with ability to extend for cause. Includes alternative routes evaluation and environmental review.

[67] http://www.state.ia.us/government/com/util/energy/pipeline_permits.html
[68] http://www.icc.illinois.gov/
[69] http://psc.wi.gov/

STATE	Regulatory AGENCY	General Requirements

The statutory authority and scope of regulation for oil pipelines varies from state to state. A complete examination of the permits required for any particular oil pipeline project, and the means by which they are required, is not examined in this document.

Minnesota Permits and Approvals

In Minnesota, a pipeline route permit from the Minnesota Public Utilities Commission (MPUC) is the only state permit required for the routing of a pipeline, i.e., the MPUC's permit determines where the pipeline will be located. The process includes environmental review and a contested case hearing. The environmental review process for pipelines includes the environmental assessment supplement as part of the pipeline route permit application, a scoping process to identify alternative routes and preparation of a comparative environmental analysis (CEA).[70] The CEA evaluates the natural and socioeconomic impacts of the routes and route segments authorized by the MPUC for consideration at hearing.

With respect to location, the MPUC's permit binds state agencies. Accordingly, state agencies are required to participate in the pipeline permitting process and to aid the MPUC by indicating routes that are not permittable and route permit conditions that are appropriate for mitigating impacts of the pipeline.

The MPUC's route permit does not preempt other state or federal permits for the project. All state and federal permits subsequent to the MPUC's route permit and necessary for the construction and operation of the project (commonly referred to as "downstream permits") must be obtained by a permittee. State agencies are required to attend the public information/scoping meetings for the project and explain the permits that each respective agency must issue and how persons can participate in these permitting decisions[71] . Downstream permits that are commonly required for a pipeline project are noted in Table 5-2.

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[70] Minnesota Rule 7852.1500.
[71] Minnesota Statute 216G.05

The MPUC's pipeline route permit supersedes local planning and land use regulations and ordinances.[72] As with state agencies, the MPUC's permit binds local governments (LGUs) with respect to the location of the pipeline. However, permittees must obtain all local approvals for a pipeline to ensure proper local government functioning (e.g., inclusion of pipeline infrastructure on LGU maps). LGUs cannot deny local approvals for a permitted pipeline but may place conditions on such approvals. Typical LGU approvals include pipeline road crossing permits and utility permits.

Table 5-2 Downstream Approvals Commonly Required for a Pipeline Project

Responsible Agency	Permit and Approvals
Federal Permits and Approvals	
U.S. Army Corps of Engineers	Clean Water Act Section 404 Permit (Wetlands)
	Navigable Water Crossing Permit
U.S. Fish and Wildlife Service	Section 7 Consultation (Endangered Species)
Minnesota Permits and Approvals	
Minnesota Pollution Control Agency	Section 401 Water Quality Certification
	National Pollutant Discharge Elimination System (NPDES/SDS) Construction Stormwater Permit and Construction Dewatering
	NPDES/SDS Hydrostatic Test Water Discharge Permit
	NPDES/SDS Spill Response Plan
	Stormwater Pollution Prevention Plan (SWPPP)
Minnesota Department of Natural Resources	License to Cross Public Waters / Public Lands
	Water Appropriations Permit
	State Protected Species Consultation
Minnesota Department of Transportation	Road Crossing Permit
	Oversize/Overweight Load Permits
Minnesota Department of Agriculture	Agricultural Impact Mitigation Plan
State Historic Preservation Office	Minnesota Historic Sites / Minnesota Field Archaeology

[72] Minnesota Statute 216G.02, Subd. 4.

Construction Environmental Control Plans

Another method for avoiding, minimizing and mitigating human and environmental impacts is through the developing and implementation of control plans.

In Minnesota, the MPUC is charged with issuing a pipeline route permit that minimizes human and environmental impacts.[73] In addition to selecting a route that avoids impacts to the extent practicable, pipeline route permits contain measures to mitigate pipeline impacts. These measures address such topics as agricultural mitigation, environmental mitigation, construction practices, and compliance with federal, state and local permits.[74] Mitigation plans that are commonly required for a pipeline project are noted in Table 5-3. Additionally, all pipeline projects must comply with the conditions for right-of-way preparation, construction, cleanup and restoration found in Minnesota Rule 7852.3600.

MPUC permits may also contain special permit conditions. These special conditions are conditions that flow from the record into the permit and reflect project specific measures to avoid, minimize, and mitigate potential pipeline impacts. Though special permit conditions are project specific, there are several common types of special permit conditions:[75]

1. **Avoidance of impacts**. Permits commonly contain special conditions describing areas of the project where the permitted route avoids certain features or is narrowed to avoid certain features. The features can be manmade features (e.g., homes, infrastructure) or natural features (e.g., areas of outstanding biodiversity).
2. **Environmental Monitors.** Permittees use environmental monitors to ensure proper construction of their pipeline. MPUC route permits commonly require independent, third-party environmental monitors that report to specific state agencies (e.g., DNR, MDA). These monitors review and report on the implementation of mitigation measures called for in the MPUC's route permit and in agency approvals. Monitors are paid for by the permittee. Related to the use of environmental monitors is the use of electronic communications to share monitoring and construction information. It is now common for a pipeline project to have a project specific environmental monitoring website where all agencies can view monitoring reports, photographs and construction plans in near real time. This "electronic monitoring" allows agencies to quickly

[73] Minnesota Rule 7852.1900, subp. 2

[74] See, e.g., Pipeline Routing Permit for Construction of the Alberta Clipper Pipeline, December 29, 2008, PL-9/PPL-07-361, eDockets Number 5679213.

[75] The common types of special permit conditions listed here are examples; they may or may not be included in a specific MPUC pipeline route permit. Whether a special permit condition, or any permit condition, appears in a MPUC route permit depends on the record developed during the permitting process. Conditions flow from the record into the permit.

review and respond to monitoring data and to share data among agency staff that have expertise regarding the resource(s) at issue but who are geographically distant from the project.

3. **Agricultural Impact Mitigation Plan**. Permittees must develop and implement an agricultural impact mitigation plan (AIMP) that is approved by the Minnesota Department of Agriculture.[76] The AIMP commonly addresses top soil separation and management, soil compaction, tile line avoidance and repair, and organic agriculture. The AIMP is typically included as a special permit condition as a means for administering and enforcing the plan. Developed on a project-by-project basis, recent AIMPs have included provisions for organic farms, including erosion control, prevention of contamination of organic lands with prohibited substances, and soil restoration measures consistent with organic management plans.
4. **Construction Environmental Control Plan**. Permittees are commonly required to prepare a construction environmental control plan (CECP) for their projects. The CECP requires permittees to provide, for the MPUC's review and approval, all mitigation plans imposed by permits or approvals issued by state and federal agencies for the project, and the processes by which the permittee will monitor and report against these plans. The requirement for a CECP imposes a discipline on permittees to organize their environmental controls and processes and provide a means for the MPUC and agencies to more easily review compliance with their permits.

Permit conditions in a MPUC pipeline route permit are administered and enforced through the MPUC's permit. Downstream permits and approvals (

Table **5-2**) are not part of the MPUC's permit and are administered and enforced by the responsible agencies. However, there is overlap and coordination between the MPUC's permit and downstream agency permits. For example, the AIMP is an MDA approval that is administered and enforced through the MPUC's permit. Likewise, environmental monitors required under the MPUC's permit monitor for compliance with the MPUC's permit and downstream agency permits.

In sum, the aim of the MPUC's pipeline route permitting process is to ensure that the avoidance and mitigation measures supported by record are reflected in the MPUC's route permit, cognizant of the downstream agency permits that will be required for the project and their interplay with the MPUC's permit.

[76] Minnesota Statute 216E.10, Subd. 3(b).

Restoration and Certification

After the completion of pipeline construction and all restoration measures, permittees must file with the MPUC a certification that the pipeline has been constructed in compliance with all pipeline route permit conditions.[77] The MPUC reviews the certification and informs the permittee of any deficiencies which, if corrected, would allow the certification to be accepted. Once the certification is accepted by the MPUC, the MPUC's jurisdiction over the pipeline route permit is terminated.

Table 5-3 Mitigation Plans Commonly Required for a Pipeline Project

Mitigation Plans
Spill Prevention, Containment, and Control Plan
Pipeline Integrity and Emergency Response Plan
Petroleum Contaminated Soil Management Plan
Plan for the Discovery of Cultural or Historic Resources During Construction
Drilling Mud Containment, Response, and Notification Plan
Agricultural Impact Mitigation Plan
Stormwater Pollution Prevention Plan
Spill Response Plan
Construction Environmental Control Plan
Environmental Mitigation Plan
Protected Species Plan
Noxious Weeds and Invasive Weed Plan
Revegetation and Restoration Monitoring Plans
Environmental Clearance Plan for Access Roads
Anthrax Mitigation Plan
Botrychium Avoidance and Monitoring Plan
Complaint Receipt and Response Procedures

[77] Minnesota Rule 7852.3900

Release and Incident Response Plans

The U.S. Department of Transportation (DOT) is the federal agency authorized to regulate pipeline safety under Title 49 United States Code (USC) Parts 190 through 199. The DOT administers the national regulatory program to ensure the safe transportation of hazardous liquids by pipeline, including crude oil and petroleum products, under DOT's Pipeline and Hazardous Materials Administration (PHMSA). It develops safety regulations and approaches to risk management for pipeline systems that mandate safety in the design, construction, testing, operation and maintenance, and for emergency responses. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to select the appropriate methods to protect people and the environment.

The DOT regulates the construction and operation of both oil and natural gas pipelines primarily as a result of two federal statutes: the Natural Gas Pipeline Safety Act (1978) and the Hazardous Liquid Pipeline Safety Act (1979). PHSMA is responsible for establishing and enforcing proper design, construction and maintenance of both oil and natural gas pipelines. The operating regulations for hazardous liquids are set forth the Code of Federal Regulations (CFR) at 49 CFR Part 195. The following is a brief summary of the more important parts of Title 49 USC that any liquid pipeline operator would be required to comply with in designing, constructing, operating and maintaining a liquid pipeline:

- Part 190 describes the procedures used by PHSMA in carrying out its regulatory duties, including inspection of pipelines and enforcement of the regulations;
- Part 194 contains requirements for oil spill response plans intended to reduce the environmental impact of oil discharged from onshore oil pipelines;
- Part 195 prescribes the safety standards and reporting requirements for hazardous liquid pipelines, including detailed requirements on a broad spectrum of areas related to the safety and environmental protection of hazardous liquid pipelines;
- Part 198 prescribes regulations governing grants-in-aid for state pipeline safety compliance programs; and
- Part 199 requires operators of gas and hazardous liquid pipelines to establish programs for preventing alcohol misuse and to test employees for the presence of alcohol and prohibited drugs; it also provides the procedures and conditions for this testing.

As specified in Parts 194 and 195, a pipeline operator is required to develop a comprehensive Emergency Response Plan, referred to as Integrated Contingency Plan (ICP) for a Project for review and approval by PHSMA prior to initiation of pipeline operation. The ICP establishes the protocol to be used by the pipeline operator in the event of an incident.

An Integrated Contingency Plan applying to all Enbridge liquids pipelines in the United States was approved by PHSMA in July 2013 and remains in effect until July 2018.[78] The ICP would be amended to incorporate the Sandpiper Project and submitted to PHSMA for review and approval as required by 49 CFR 194.

An ICP may consist of two parts. Part 1 of the ICP serves as the primary response tool to an incident. Part 2 provides more detailed supporting information based on geographical response zones or regions. The ICP format is based on the Incident Command System (ICS). ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries.[79]

ICP's are intended to provide for an effective and comprehensive response to all types of incidents by preventing injury or damage to the public and mitigate impacts on the environment.

The PHSMA approved ICP will be reviewed by Enbridge on an annual basis and may be revised due to changes in regulation or operational changes that require reporting. In its ICP, Enbridge has identified four regional annexes and each contains an Emergency Response Action Plan (ERAP), specific to a region, representing a condensed version of the ICP. This document is distributed to Enbridge personnel within the region and to the appropriate response agencies. This document is available to the public at: www.emergencyresponderinfo.com.[80]

Reporting Requirements

In addition to ICP requirements, CFR Part 195 establishes a number of reporting requirements for pipeline operators. The Minnesota Department of Public Safety, Office of Pipeline Safety (MOPS) summarizes the "Hazardous Liquid Pipeline Operator Regulatory Reporting Requirements" in Table 5.4.

[79] Integrated Contingency Plan ("One Plan") Guidance, US EPA, April 1998.
[79] Integrated Contingency Plan ("One Plan") Guidance, US EPA, April 1998.
[80] Ibid.

Table 5-4 Hazardous Liquid Pipeline Operator Regulatory Reporting Requirements

Reporting Requirement	Purpose	Frequency
PHMSA Annual Report	Pipe Inventory (Size, Mileage, Material, & Vintage) Leaks (By Cause, Hazardous, & Non-Hazardous) Integrity Inspections conducted in the year Repairs made due to integrity inspections in the year	Annually (Due June 15 Each Year)
Telephonic Notice To National Response Center	Release resulting in one or more of the following: -Release of 5 gallons (19 liters) or more of hazardous liquid or carbon dioxide, except that no report is required for a release of less than 5 barrels (0.8 cubic meters) resulting from a pipeline maintenance activity if the release is: (1) Not otherwise reportable under this section; (2) Not one described in § 195.52(a)(4); (3) Confined to company property or pipeline right-of-way; and (4) Cleaned up promptly; -Caused a death or a personal injury requiring hospitalization -Resulted in either a fire or explosion not intentionally set by the operator -Caused estimated property damage, including cost of cleanup and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding $50,000 -Resulted in pollution of any stream, river, lake, reservoir, or other similar body of water that violated	Soon as practicable (within 1 hour)

	applicable water quality standards, caused a discoloration of the surface of the water or adjoining shoreline, or deposited a sludge or emulsion beneath the surface of the water or upon adjoining shorelines -In the judgment of the operator was significant even though it did not meet the criteria of any other paragraph of this section	
PHMSA Accident Report	Formal written report in follow up to an incident meeting the requirements for telephonic notice The report describes incident details such as: Pipe Parameters involved in the incident Incident Cause as determined by the operator	Within 30 days of the incident
Safety Related Condition Report	Reporting of: (1) General corrosion that has reduced the wall thickness to less than that required for the maximum operating pressure, and localized corrosion pitting to a degree where leakage might result. (2) Unintended movement or abnormal loading of a pipeline by environmental causes, such as an earthquake, landslide, or flood that impairs its serviceability. (3) Any material defect or physical damage that impairs the serviceability of a pipeline. (4) Any malfunction or operating error that causes the pressure of a pipeline to rise above 110 percent of its maximum operating pressure. (5) A leak in a pipeline that constitutes an emergency. (6) Any safety-related condition that could lead to an imminent hazard and causes (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent or more reduction in operating pressure or shutdown of operation of a pipeline.	Within 5 working days of determination No more than 10 working days after discovery

General Notification	(1) An operator must notify PHMSA of any of the following events not later than 60 days before the event occurs: (i) Construction or any planned rehabilitation, replacement, modification, upgrade, uprate, or update of a facility, other than a section of line pipe that costs $10 million or more. If 60 day notice is not feasible because of an emergency, an operator must notify PHMSA as soon as practicable; (ii) Construction of 10 or more miles of a new hazardous liquid pipeline; or (iii) Construction of a new pipeline facility. (2) An operator must notify PHMSA of any following event not later than 60 days after the event occurs: (i) A change in the primary entity responsible (i.e., with an assigned OPID) for managing or administering a safety program required by this part covering pipeline facilities operated under multiple OPIDs. (ii) A change in the name of the operator; (iii) A change in the entity (e.g., company, municipality) responsible for operating an existing pipeline, pipeline segment, or pipeline facility; (iv) The acquisition or divestiture of 50 or more miles of pipeline or pipeline system subject to this part; or (v) The acquisition or divestiture of an existing pipeline facility subject to this part.	Within 60 Days

Reference Title 49 CFR Part 195

Safety Requirements

In addition to reporting requirements, the Pipeline Safety Regulations (Title 49 CFR Part 195) includes regulations that address pipeline:

- Design
- Construction
- Pressure Testing
- Operations and Maintenance
- Qualification of pipeline personnel, and
- Corrosion control

The federal pipeline regulations represent the minimum safety standards and operators may elect to go beyond the regulatory requirements.

Pipelines are also actively monitored in a centralized office by a supervisory control and data acquisition (SCADA) system that allows for the gathering of data from remote locations in order to control equipment and conditions. SCADA is commonly used in power plants as well as in oil and gas refining, telecommunications, transportation, and water and waste control.

SCADA systems include hardware and software components. The hardware gathers and feeds data into a computer that has SCADA software installed. The computer then processes this data and presents it in a timely manner. SCADA also records and logs all events into a file stored on a hard disk or sends them to a printer. SCADA warns when conditions become hazardous by sounding alarms.

Besides SCADA systems monitoring pipeline operations, operators also carry other inspection requirements required by Title 49 CFR Part 195. Table 5-5, provided by the Minnesota Office of Pipeline Safety, summarizes other operation and maintenance functions.

Table 5-5 Typical Pipeline Operations and Maintenance Functions

Inspection of pipeline rights-of-way	26 times per year (intervals not exceeding three weeks)
Inspection of navigable water pipeline crossings	Every five years
Maintenance of valves used for safe operation	Two times per year (intervals not exceeding 7 ½ months)
Inspection of breakout tanks	One time per calendar year (intervals not exceeding 15 months)
Monitoring of pipeline corrosion protection levels (cathodic protection)	One time per calendar year (intervals not exceeding 15 months)
Monitoring of corrosion protection equipment	Six times per year (intervals not exceeding 2 ½ months)

(rectifiers)	
Inspection of buried pipelines for corrosion	Any time the pipeline is exposed
Inspection of aboveground pipelines for corrosion	One time every three calendar years (intervals not exceeding 39 months)

Reference Title 49 CFR Part 195

Integrity Management Plan

All new pipelines are required to have an Integrity Management Program (IMP) in accordance with Part 195.452 within 1 year after the start of operation; PHSMA has the authority to review and approve the IMP. This program includes the results of baseline assessments for the pipeline system and must identify and address High Consequences Areas (HCA). HCAs are defined as follows:

- A high population area, which means an urbanized area – as defined and delineated by the Census Bureau – that contains 50,000 or more people and has a population density of at least 1,000 people per square mile
- Another populated area, which means a place – as defined and delineated by the Census Bureau – that contains a concentrated population, such as an incorporated or unincorporated city, town, village, or other designated residential or commercial area
- An unusually sensitive area – explicitly defined in 49 CFR Part 195.6 as drinking water or ecological resource areas that are unusually sensitive to environmental damage from hazardous liquid pipeline releases
- A commercially navigable waterway, which means a waterway where a substantial likelihood of commercial navigation exists

Enbridge would have to implement preventive and mitigating measures to protect any HCA along the proposed route, from the consequences of a pipeline failure, with the actions taken dependent on the findings of the baseline assessment included in the Integrity Management Program. This would include conducting a risk analysis of the pipeline segment specific to the HCA to identify additional actions to enhance public safety or for environmental protection.

Additionally, federal pipeline regulations require a procedural manual for operations, maintenance and emergencies (CFR 195.402) as well as continuous training for pipeline emergency-response personnel (CFR 195.403).

There are also requirements for pipeline public awareness programs (CFR 195.440) and damage prevention programs (CFR 195.442). These requirements and programs are intended to educate the public, government agencies, contractors and responders to a pipeline incident. In Minnesota, the Gopher State “One Call” system is a tool to prevent damage by third party excavators.

State Standards and Regulations

PHSMA is responsible for oversight and inspections of interstate pipelines, such as those of the proposed Sandpiper Project. PHSMA regulates, inspects, and enforces interstate liquid pipeline safety requirements in North Dakota, South Dakota, Iowa, Illinois and Wisconsin. Minnesota's Office of Pipeline Safety has been authorized by PHSMA has inspector of interstate pipelines (liquids and gas). Therefore, the Minnesota Office of Pipeline Safety regulates and enforces interstate liquid pipeline safety requirements, and inspects interstate liquid pipeline safety requirements.

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6 Comparison of Alternatives

This chapter provides a high level comparison among the seven system alternatives across the 12 resource categories reviewed. While some of the resources noted could potentially be avoided through selection of an alignment or right-of-way within a system alternative corridor, these high level comparisons do offer useful information to distinguish among alternatives.

The analysis in Chapter 4 indicates few differences among system alternatives and potential impacts to some resource categories. All system alternatives would have similar effects on several resource categories including: geology/soils/groundwater, ecoregions, community features, cultural resources, and air emissions. Notable differences in effects among the system alternatives are described in this section and include land cover, water resources, public lands, cities and population density, and high consequence areas. Appendix B provides additional details on Minnesota specific resources crossed by the system alternatives.

6.1 Land Cover

Land cover in most of the states crossed by the proposed system alternatives is largely cultivated agricultural land and grasslands. One route alternative, SA-Applicant, crosses forests and forested wetlands in northern Minnesota. SA-04 and SA-05, which travel through Iowa and Illinois, have the greatest percentage of cultivated land at 78.5 percent and 75.3 percent and the least amount of forested land at 1.5 percent. SA-Applicant and SA-03 have significantly more forest cover, at 18.8 percent and 10 percent respectively, than the other system alternatives, while having the least amount of cultivated land. SA-Applicant and SA-03 also have the most wetlands at 13.9 percent and 10.5 percent respectively. SA-06, SA-07 and SA-08 all travel through or end in the Twin Cities and thus have the largest percentage of developed land at 7.7, 8.7 and 15.6 percent respectively. Table 6.1 compares land cover among system alternatives.

Table 6-1 Land Cover Comparison Table within each System Alternative (percent)

System Alternative	Cultivated Land	Forested Land	Developed Land	Water	Wetlands	Barren	Herbaceous/ Grasslands	Shrubland
SA-Applicant	47.2	18.8	4.2	2.7	13.9	0.06	11.2	1.8
SA-03	59.4	10.0	5.4	2.8	10.5	0.03	10.5	1.2
SA-04	78.5	1.5	6.0	1.44	4.3	0.14	8.2	0.05
SA-05	75.3	1.5	6.3	1.6	3.6	0.02	11.4	0.04
SA-06	66.0	6.1	7.7	2.9	7.4	0.06	8.8	0.06
SA-07	63.7	6.6	8.7	3.9	7.2	0.05	9.0	0.9
SA-08	60.0	3.8	15.6	3.7	5.5	0.06	10.9	0.3

6.2 Water Resources

Water resources vary considerably by type and extent across system alternatives. Stream crossings range from 1,157 in SA-05 to 615 in SA-Applicant, while the numbers of named lakes crossed range from 159 in SA-07 to 20 in SA-04. Generally, stream crossings are greater in the southern system alternatives while waterbody crossings tend to be higher in the northern system alternatives.

All of the system alternatives cross the Mississippi River at least once, with SA-08 and SA-Applicant crossing twice. System Alternatives 04, 05, 06 and 07 cross at wide parts of the river – ranging from 3,000 to 6,900 feet. SA-04 (6,900 feet) and SA-05 (3,000 feet) cross just north of Davenport, Iowa, while SA-06 and SA-07 cross at a wide spot (5,500 feet) southeast of the Twin Cities. SA-Applicant and SA-03 have significantly shorter crossings as they cross the Mississippi river farther upstream.

System Alternatives 04 and 05 have the lowest percentages of wetlands within the two-mile corridor. Less than 5 percent of these system alternatives are classified as wetlands, with vast majority of them being emergent wetlands.

SA-Applicant and SA-03 have the largest percentage of wetlands and highest ratio of forested versus emergent wetlands. Wetlands cover 14.6 percent of the corridor in SA-Applicant, with half being forested, while 12.7 percent of SA-03 is wetlands, with about one third being forested.

Table 6-2A Wetland Type in percentage within each System Alternative

System Alternative	Forested/Shrub	Emergent	Lake	Pond	Riverine	Other	TOTAL
SA-Applicant	7.3	6.0	1.3	<1	<1	<1	14.6
SA-03	6.8	4.5	1.4	<1	<1	<1	12.7
SA-04	3.7	<1	<1	<1	<1	<1	3.7
SA-05	3.6	<1	<1	<1	<1	<1	3.6
SA-06	6.1	2.1	1.4	<1	<1	<1	9.6
SA-07	7.0	2.2	2.2	<1	<1	<1	11.4
SA-08	6.8	1.8	<1	<1	<1	<1	8.6

Table 6-2B Named Streams and Lakes

System Alternative	Number of Named Streams	Number of Named Stream Crossings	Number of Named Lakes
SA-Applicant	75	615	119
SA-03	93	895	103
SA-04	132	1,025	20
SA-05	146	1,157	35
SA-06	89	699	123
SA-07	94	742	159
SA-08	65	620	137

6.3 Public Resource and Recreation Lands

The amount and type of public resources and recreation lands varies significantly between the number of occurrences (types of lands crossed) and the total number of acres of each public land type crossed by individual system alternatives. For example, SA-08 and SA-Applicant cross less public resource and recreation lands, but the total number of acres crossed by SA-Applicant is significantly greater than other system alternatives. SA-08 crosses six Minnesota Scientific and Natural Areas located within the corridor, which are generally considered exclusion areas for siting infrastructure.

SA-05 has the most public lands including the most North Dakota lands, the second most Minnesota BWSR lands and the most Iowa public lands. SA-07 has the second most public lands primarily because of the 121 Minnesota BWSR lands it crosses in western Minnesota. SA-03 crosses significantly more Waterfowl Production Areas than the other system alternatives with a concentration in Clay and Becker counties, Minnesota.

All System Alternatives were analyzed to determine if the corridors encounter public, conservation, or recreational land types which will span the entire corridor and will require additional analysis and plan development should the System Alternative move forward in the selection process.

All System Alternative corridors could potentially impact lands in the Working Lands Program (WLP) in McHenry County, North Dakota, which span the entire two-mile wide corridor.

SA-Applicant has the potential to impact an area of moderate biological diversity, which has been identified by the Minnesota County Biological Survey (MCBS) in Red Lake County, Minnesota. SA-Applicant also has the potential to impact the federal Clarke Waterfowl Production Areas (WPA) and a low quality MCBS site in Polk County, Minnesota. The Mississippi Headwaters State Forest Area (SFA) crosses the entire corridor width of the SA-Applicant in Clearwater County, Minnesota. The Crow Wing Chain Wildlife Management Area (WMA) spans the entire width of the SA-Applicant corridor in Hubbard County, Minnesota. The Foot Hills SFA crosses the entire SA-Applicant corridor in Cass County, Minnesota. The Land o Lakes SFA will be crossed twice by the SA-Applicant in Cass County, Minnesota. The SA-Applicant corridor is also entirely crossed by the Hill River SFA and the Grayling Marsh WMA in Aitkin County, Minnesota. The SA-Applicant corridor will intersect with the Salo Impoundment WMA and various MBCS sites near the Aitkin/Carlton County boarder.

The SA-03 corridor is spanned by a collection of MCBS sites, WPAs, and WMAs in Clay County, Minnesota. Additionally, there are a number of federal wetland easements and some WPAs within the corridor as SA-03 proceeds through Clay County into Becker County, Minnesota. SA-03 as proposed crosses a number of moderate and high quality MCBS sites as it nears the Todd/Morrison County boundary. A portion of the Crane Meadows National Wildlife Refuge is within the SA-03 corridor, and extends across approximately 75% of the corridor as it has been proposed. Additional

moderate and high quality MCBS sites cross the proposed SA-03 corridor in Mille Lacs and Isanti Counties, respectively.

SA-07 as proposed is completely spanned by the Rothsay WMA in Wilkins County, Minnesota. The SA-08 corridor is entirely crossed by a combination of a WPA, federal wetland easements, and a state designated shallow lake as the corridor enters Otter Tail County, Minnesota. Both SA-07 and SA-08 proceed southeast through Otter Tail County into Grant County, Minnesota, at which point both SAs encounter a number of federal wetland easements and Reinvest in Minnesota (RIM) lands. As SA-08 approaches the Douglas and Todd county line the corridor travels through an area with a complex of federal wetland easements and state designated shallow lakes. As the SA-06 corridor approaches the Grant and Stevens county line a number of state designated shallow lakes and federal wetland easements are present within the corridor. SA-07 continues south to the intersection of Pope, Swift, and Kandiyohi counties where the corridor encounters a habitat complex made up of Ordway Prairie and various federal and RIM wetland easements. Pine Bend Bluffs Scientific and Natural Area (SNA) is located in the middle of the proposed SA-08 corridor as it travels from Washington County to it's terminus in Dakota County, Minnesota. SA-06 and SA-07 travel north into Chisago County, Minnesota, at which point the proposed corridor goes through the Carlos Avery WMA, which spans the width of the SA-07 corridor. The SA-06 and SA-07 corridors are entirely spanned by the General C.C. Andrews SFA in Pine County, Minnesota.

There are a number of MCBS sites that SA-03, SA-06, SA-07, and SA-Applicant could potentially impact in Carlton County, Minnesota, as the sites span the width of all four of the proposed SA corridors.

The shared SA-04 and SA-05 corridor crosses a number of wildlife habitat lands in Pierce County, North Dakota. As SA-04 travels southeast and approaches the intersection of the Nicollet, Le Sueur and Blue Earth County borders, the corridor crosses through an area with a significant number of resource lands around the Minnesota River. The corridor crosses the Kasota Prairie SNA, several RIM wetland restorations, and MCBS areas of moderate and high biological significance. The SA-05 corridor, as proposed, encounters the Black Slough WPA and a large tract of land designated as a target area for the Working Land Initiative Program in Deuel/Brookings counties, South Dakota, and Lincoln County, Minnesota. As the SA-05 corridor travels southeast through Lincoln, Lyon, and Murray counties, Minnesota, the corridor bisects a number of large tracts of lands targeted for the Working Lands Initiative Program. The SA-04 corridor is entirely spanned by the Upper Mississippi River Wildlife Refuge as the proposed corridor proceeds east through Clinton County, Iowa, and into Rock Island County, Illinois. Where the proposed SA-04 and SA-05 corridors cross the Mississippi River from Clinton and Scott counties, Iowa, into Rock Island County, Illinois, is designated as Sovereign Waters under the Conservation and Recreational Public Lands program by the Iowa Department of Natural Resources (IA DNR).

Table 6-3 Public Resource and Recreational Lands within all System Alternatives

Ownership and Land Type – Number and (Acres)		SA-Applicant	SA-03	SA-04	SA-05	SA-06	SA-07	SA-08
Federal	U.S. Fish and Wildlife Service - National Wildlife Refuge	2 (57)	3 (401)	2 (807)	2 (123)	2 (58)	3 (74)	3 (74)
	U.S. Fish and Wildlife Service - National Tallgrass Prairie							1
	U.S. Forest Service - National Grassland			2 (902)	1 (893)			
	U.S. Forest Service - National Forest							
	Waterfowl Production Area	12 (1,691)	59 (3,067)	10 (4,178)	14 (3,599)	12 (4,011)	12 (8,625)	12 (7,408)
	National Park Service - National River and Recreation					1 (3,667)	1 (3,667)	1 (6,397)
	Total Federal	***14***	***61***	***14***	***18***	***15***	***16***	***16***
North Dakota	State Wildlife Areas - PLOTS lands	29 (3,419)	29 (3,419)	56 (7,972)	56 (7,972)	30 (2,278)	29 (3,419)	29 (3,419)
South Dakota	X				X			
Minnesota	State Forest	12 (39,650)	2 (914)			2 (5,025)	2 (5,025)	
	State Park	2 (2,494)	1 (672)			3 (5,156)	4 (4,747)	
	State Recreation Area	1 (15)				1 (754)	1 (758)	
	Natural Areas - Scientific and Natural Areas		1 (1,116)	1 (41)		1 (48)	1 (48)	6 (486)
	Conservation Areas - BWSR	8 (365)	54 (2,296)	69 (2,359)	8 (3,016)	81 (2,696)	121 (3,885)	27 (690)
	Total Minnesota	***23***	***58***	***70***	***83***	***87***	***129***	***33***
Iowa	State Wildlife Areas - State Recreation Area			1				

Ownership and Land Type – Number and (Acres)		SA-Applicant	SA-03	SA-04	SA-05	SA-06	SA-07	SA-08
				(14)				
	State Wildlife Areas - State Preserves				2 (41)			
	Conservation Areas - NRCS Easement			9 (374)	21 (1,500)			
	Total Iowa	***0***		***10***	***23***	***0***	***0***	
Illinois	**State Park**			2 (98)	1 (75)			
	Conservation Areas			5 (141)	3 (138)			
	Total Illinois	***0***	***0***	***7***	***4***	***0***	***0***	***0***
Total Number of Occurrences		**66**	**148**	**157**	**184**	**132**	**174**	**78**
Total Number of Acres		**47, 691**	**11,885**	**16,886**	**17,357**	**23,693**	**30,248**	**18,474**

6.4 Cities and Population Density

The proposed system alternatives either cross or are in close proximity to high population density areas or metro areas, as seen on the landcover and population density maps (Appendix A, Maps A8-A9 and A16-17). Population density and the number of cities crossed by each system alternative vary considerably by location. Generally, as the system alternatives move from west to east, population densities increase. SA-Applicant crosses the fewest number of cities and is also the shortest system alternative and traverses relatively low population density areas across North Dakota and northern Minnesota. In contrast SA-08, which largely follows the I-94 Corridor and is only 20 miles longer than SA-Applicant, crosses high population density areas and the greatest number of cities. In addition, as SA-08 approaches the Twin Cities, population density increases significantly and the number of cities increases. Of SA-08's 634 miles, approximately 60 miles are within this densely built environment.

SA-03 has 16 more cities within its corridor than the SA-Applicant and is approximately 85 miles longer. SA-03 has the second fewest communities within its corridor, which may be attributed to its relatively short length and location as it skirts the northern edge of the Twin Cities. . System Alternatives-04, 05, 06 and 07 have a range in the number of cities; the range is from 39 cities (the least) in SA-04 to the greatest number of cities in SA-06 at 59.. SA-05 is the longest SA at 1,012 miles and has 42 cities located within the 2-mile wide corridor. The number of cities located within SA-05 represents the middle of the range of cities identified between System Alternatives 04, 05, 06 and 07.

Table 6-4 Number of Cities within the two-mile-wide Corridors

		SA-APP	SA-03	SA-04	SA-05	SA-06	SA-07	SA-08
Length (miles)		617	689	937	1012	803	811	634
	State							
# of Cities	ND	7	7	9	9	19	17	17
	MN	7	23	9	9	40	40	59
	IA	NA	NA	13	13	NA	NA	NA
	IL	NA	NA	8	8	NA	NA	NA
	SD	NA	NA	NA	3	NA	NA	NA
Total		**14**	**30**	**39**	**42**	**59**	**57**	**76**
Cities > 1,000 population	ND	2	2	1	1	5	4	4
	MN	2	13	4	1	22	24	48
	IA	NA	NA	4	5	NA	NA	NA
	IL	NA	NA	4	4	NA	NA	NA
	SD	NA	NA	NA	1	NA	NA	NA
Total		**4**	**15**	**13**	**12**	**28**	**28**	**52**

Source: U.S. Census, 2010

6.5 Contaminated Sites

The number of contaminated sited crossed by the system alternatives is consistent with population densities and developed land within each corridor, as well as high consequence areas. SA-07 and SA-08, which cross Fargo, North Dakota, the Twin Cities and Superior, Wisconsin, have the highest numbers of contaminated sites. SA-06 also crosses a number of contaminated sites, primarily near Twin Cities. These sites likely correspond with current or previous industrial activities. The small number of contaminated sites crossed by SA-Applicant, SA-03 and SA-04 are consistent with low population densities and undeveloped land.

Table 6-5 Total Number of Contaminated Sites

System Alternative	Total Number of Contaminated Sites
SA-Applicant	17
SA-03	39
SA-04	58
SA-05	88
SA-06	119
SA-07	182
SA-08	288

Source: US EPA

6.6 High Consequence Areas and Natural Disaster Hazard Areas

High Consequence Areas (HCA) and Natural Disaster Hazard Areas are defined by the USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA) and include populated areas, drinking water sources, and unusually sensitive ecological resources that could be impacted in the event of a pipeline release. Natural Disaster Hazard Zones are defined as areas that present a higher risk of failure in the event of a flood or landslide.

In general, risks to populations and drinking water increase in densely populated urbanized areas.

SA-06 and SA-07 cross the greatest number of populated areas due to the fact that they cross the south and east sides of the Twin Cities. SA-08 follows I-94 and crosses numerous cities along the interstate in addition to cities on the north and east sides of the Twin Cities. SA-03 and SA-Applicant avoid major population areas and thus have lower population-related risks associated with them.

SA-06, 07 and 08 cross significantly more drinking water HCAs than the other system alternatives, due to proximity to smaller cities. SA-08 has the most drinking water HCAs because the route follows I-94 and is near numerous cities along the interstate.

SA-03 and 04 cross significantly more Ecological HCAs than the other system alternatives. SA-03 crosses areas with concentrations of state and federal resource lands in western North Dakota, western Minnesota and north of the Twin Cities. SA-04 includes concentrations of Ecological HCAs at the Minnesota River crossing near Mankato, Minnesota, and the Mississippi River near Davenport, Iowa.

The percentage of medium and high risk flood hazard areas within each system alternative ranges from approximately 29 percent in SA-05 to 19 percent in SA-07 and SA-Applicant (see Map 26). Flood hazard areas tend to be concentrated near larger rivers that typically flood and that have more erosion potential. Medium and high risk landslide hazard areas are largely located in central and eastern North Dakota. All system alternatives cross through this area, with SA-04, SA-05 and SA-06 traversing longer lengths of these areas as they travel southwest through North Dakota.

Table 6-6 High Consequence Areas

High Consequence Areas		**SA-Applicant**	**SA-03**	**SA-04**	**SA-05**	**SA-06**	**SA-07**	**SA-08**
High Populations Areas HCA	Number of Areas	1	1	2	4	2	4	4
	Acreage	1,625	1,625	9,037	9,171	12,646	21,323	72,986
Other Populations Areas HCA	Number of Areas	17	34	54	54	68	65	57
	Acreage	5,219	37,258	15,622	16,381	95,761	95,805	61,585
Drinking Water HCA	Number of Areas	26	40	32	36	219	160	249
	Acreage	1,106	1,633	8235	9,100	16,138	10,987	21,880
Ecological HCA	Number of Areas	65	164	153	70	35	42	16
	Acreage	22,229	26,721	37,725	52,087	20,735	25,980	10,728
Natural Disaster Hazard Areas								
Flood Hazard	Medium Risk %	12.9	14.2	12.5	19.2	15.1	12.9	15.8
	High Risk %	5.4	6.4	7.8	10.0	6.4	5.4	7.6
Landslide Hazard	Medium Risk %	28.2	25.2	31.2	41.4	36.6	21.8	27.2
	High Risk %	1.6	1.4	0.4	0.4	1.2	1.2	0.3

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