3.2 SOILS

3.2.1 Introduction

This section discusses the soils resources in the proposed Project area. The description of the soils resources is based on information provided in the 2011 Final Environmental Impact Statement (Final EIS) as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the Final EIS, including the proposed reroute in Nebraska. The information that is provided here builds on the information provided in the Final EIS and, in many instances, replicates that information with relatively minor changes and updates. Other information is entirely new or substantially altered from that presented in the Final EIS. Specifically, the following information, data, methods, and/or analyses have been substantially updated in this section from the 2011 document:

- The number of miles of soil types crossed with specific characteristics has been updated; and
- The approximate acreage of impacted soil types with specific characteristic has been updated.

3.2.2 Environmental Setting

Soil characteristics present along the proposed Project route are identified and evaluated using information from the Natural Resources Conservation Service Soil Survey Geographic database (U.S. Department of Agriculture [USDA] 1932). The evaluation focused on soil characteristics of particular interest to the proposed pipeline construction. The following soil characteristics were evaluated:

- Highly erodible soils—these are prone to high rates of erosion when exposed to wind or water by removal of vegetation.
- Prime farmland soils—these have combinations of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if they are treated and managed according to acceptable farming methods. Undeveloped land with high crop production potential may be classified as prime farmland.
- Hydric soils—these are "formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Federal Register, July 13, 1994). These soils under normal conditions are saturated for a sufficient period of time during the growing season to support the growth of hydrophytic vegetation (USDA 2006).
- Compaction-prone soils—these include surface clay loam or soils of finer textures in somewhat poor to very poor drainage classes.
- Stony/rocky soils—these have a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class; or comprise more than 5 percent stones larger than 3 inches in the surface layer.
- Shallow-bedrock soils—these are typically defined as soils that have bedrock within 60 inches of the soil surface. However, for the purpose of the proposed Project, shallow-bedrock

soils are defined as those containing bedrock within 80 inches of the surface, because trenching typically would be done to that depth.

- Drought-prone soils—these include coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

Tables 3.2-1 and 3.2-2 summarize the approximate miles of pipeline right-of-way, by state, that would cross soils exhibiting these characteristics. The tables include the approximate acreage of soils containing these characteristics that would be disturbed by the proposed Project. More detail is provided in Appendix M, Soil Summary for Montana, South Dakota, and Nebraska [Appendix G-1, TransCanada DOS ER PDF Public Package Final 090712 Report], including a table listing soil associations from the NRCS Soil Survey Geographic database by milepost along the proposed Project route.

3.2.2.1 Montana

The proposed Project route in northern Montana would be located within the Northern Great Plains Spring Wheat Land Resource Region (USDA 2006). This region is characterized by glacially deposited till and lacustrine deposits. Soil profiles typically contain thick, dark topsoils that may contain bentonite (smectitic mineralogy). Soils are generally very deep, well-drained, and loamy or clayey. Small areas of alluvial deposits are present along rivers and drainageways and shale is exposed in some uplands. In northern Montana, soils generally are formed in glacial till. From McCone County to Fallon County along the proposed Project route (east central Montana), soils are formed on eroded plateaus and terraces. These soils are shallow to very deep, well-drained, and clayey or loamy. Some soils in this area have high bentonite contents and have saline or sodic chemical properties. In east-central Montana, the proposed pipeline route would lie within the Western Great Plains Range and Irrigated Land Resource Region (USDA 2006). This region consists of an elevated piedmont plain that is dissected by rivers and contains steep-sided buttes and badlands. Soil types vary from deep organic soils to shallow soils with thin topsoil thickness. In Montana, prime farmland soils occupy approximately 22 percent of the proposed pipeline route. The average freeze-free period is between 120 and 165 days.

3.2.2.2 South Dakota

The proposed Project route in South Dakota would be located within the Western Great Plains Range and Irrigated Land Resource Region (USDA 2006). In northwestern South Dakota, soils are shallow to very deep, well-drained, and loamy or clayey. To the southeast through Meade County, soils are shallow to very deep, somewhat excessively drained to moderately well-drained, and loamy or clayey. In southern South Dakota, from Hakkon County to Tripp County, areas of smectitic clays are present that have shrink-swell potential and may cause significant problems for roads and structural foundations. From central Tripp County to the state line, these clayey soils contain thick, dark, organically enriched layers of topsoil. Beginning at approximately Milepost (MP) 572, transitional aeolian sandy soils are present that generally consist of aeolian sands, sandy alluvium, and lesser amounts of loess and glacial outwash. In southern Tripp County to the state line, soils grade into deep, sandy deposits that are similar to the Nebraska Department of Environmental Quality (NDEQ)-defined Sand Hills Region soils in Nebraska. In South Dakota, prime farmland soils occupy approximately 35 percent of the proposed pipeline route. The average freeze-free period is between 135 and 165 days.

Table 3.2-1 Approximate Miles[a] of Soils with Specific Characteristics Crossed by the Proposed Project Route

State	Total Miles Affected[b]	Highly Erodible (Wind)	Highly Erodible (Water)	Prime Farmland	Hydric	Compaction-Prone	Stony/ Rocky	Shallow Bedrock	Drought-prone
Montana	285.7	5.2	111.8	63.1	1.5	235.9	32.1	4.0	21.0
South Dakota	315.3	16.7	104.8	110.2	5.1	253.4	9.0	1.0	65.9
Nebraska	274.4	44.3	158.9	175.9	47.1	136.8	32.5	0.3	41.0
Kansas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
North Dakota	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**875.4**	**66.2**	**375.5**	**349.2**	**53.6**	**626.1**	**73.7**	**5.3**	**127.9**

[a] Rounded to nearest tenth of a mile.
[b] Total miles affected, which include non-sensitive and sensitive soils and other substrates.

Table 3.2-2 Approximate Acreage[a] of Soils with Specific Characteristics Crossed by the Proposed Project Route[b]

State	Total Acres Affected	Highly Erodible (Wind)	Highly Erodible (Water)	Prime Farmland	Hydric	Compaction-Prone	Stony/ Rocky	Shallow Bedrock	Drought-prone
Montana	3,808.7	68.8	1,490.5	841.5	19.9	3,145.2	428.1	52.7	279.3
South Dakota	4,203.9	222.8	1,397.6	1,468.9	67.7	3,379.1	120.4	13.9	878.5
Nebraska	3,659.2	590.5	2,118.1	2,346.0	627.6	1,823.4	433.9	3.6	547.0
Kansas	15.0	0.0	1.0	14.0	0	15.0	2.0	6.0	0.0
North Dakota	56.1	0.0	56.0	44.9	0.0	0.0	0.0	0.0	0.0
Total	**11,742.8**	**882.1**	**5,063.3**	**4,715.3**	**715.2**	**8,362.7**	**984.4**	**76.1**	**1,704.9**

[a] Rounded to nearest tenth of an acre.
[b] Based on a total of 110-foot-wide right-of-way for a 36-inch pipeline, and including the two pump stations in Kansas, and pipe yard in North Dakota. Acreage does not account for disturbance associated with power lines, pipe stockpile sites, rail sidings, contractor yards, or construction camps (for acreage affected by these ancillary facilities see Table 2.1-6. Individual soils may occur in more than one characteristic class. Discrepancies in total mileage are due to rounding.

3.2.2.3 Nebraska

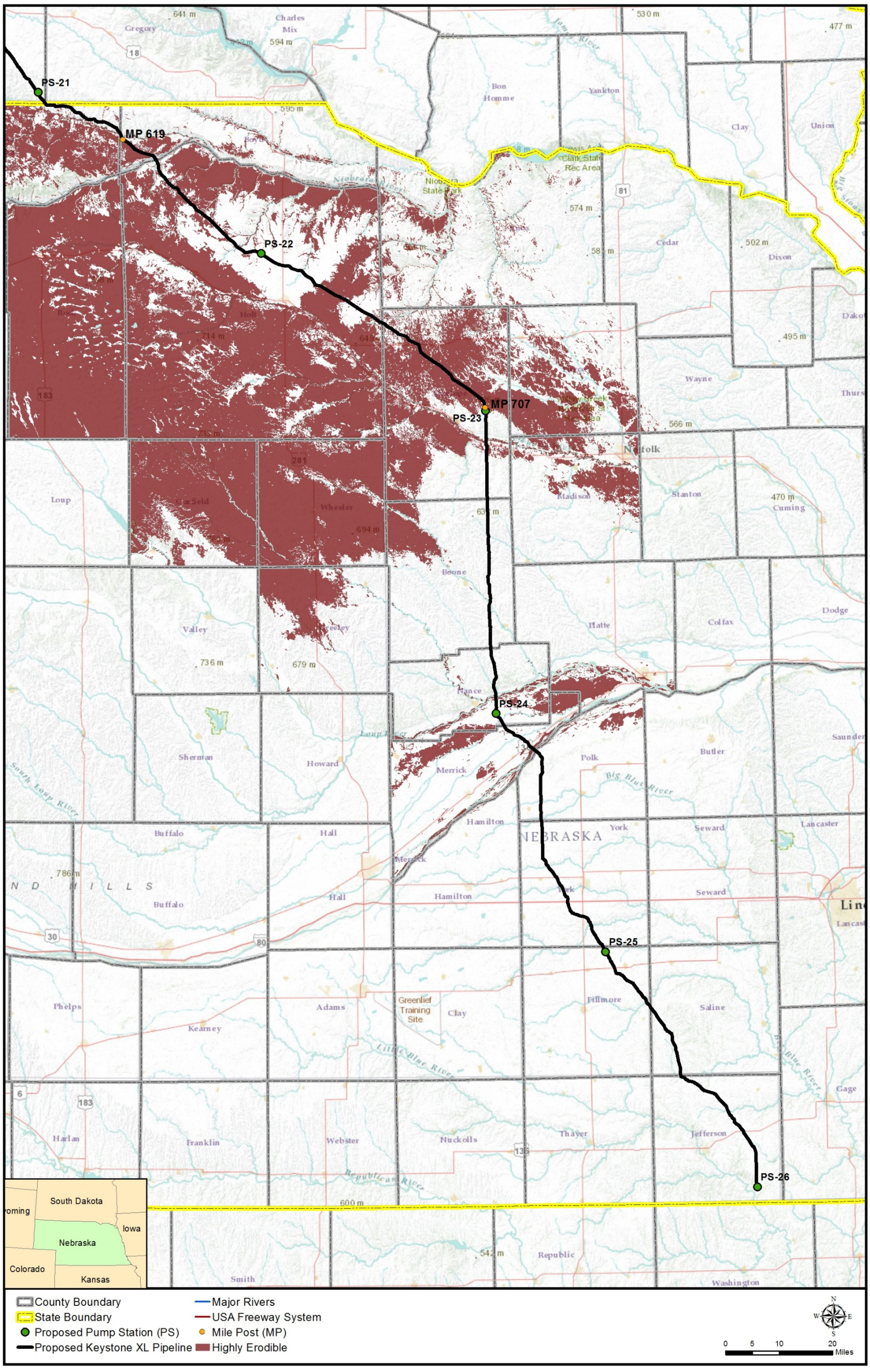
The proposed Project route in northern Nebraska would be located within the Western Great Plains Range and Irrigated Land Resource Region (USDA 2006). This region is characterized by a nearly level to gently rolling fluvial plain. Keya Paha, Boyd, and Holt counties lie within the Dakota-Nebraska Eroded Tableland Resource Area. These soils are generally sandy, very deep, and excessively drained to somewhat poorly drained. Also, within Holt and Boyd counties in the Tableland Resource Area, there are soils types that are silty or sandy loam soils.

In Antelope and Boone counties, the proposed Project route would encompass the Central Feed Grains and Livestock Land Resource Region. This area is further classified as the Loess Uplands Resource Area, with soils consisting of deep loess deposits that are susceptible to erosion if unvegetated. In the northern section of Antelope County, the soils are sandy loams that are frequently layered with very fine-grained ash layers that are susceptible to erosion by rain and wind. In Nance and Merrick counties, the proposed Project route would cross the Central Nebraska Loess Hills and the Central Loess Plains Resource Areas (Central Great Plains Winter Wheat and Range Land Resource Region). These areas feature soils consisting of deep loess with some organic enrichment.

South of the Platte River, the proposed Project route would cross flat to rolling loess-covered plains of the Rainwater Basin Plains, one of the largest concentrations of natural wetlands found in Nebraska. Many of the wetlands were drained for cultivation, with much of the area pivot irrigated to help provide a fertile area for crops. The soils are largely silty loams with fine sands in both flooded and rarely flooded areas. Glacial till is scattered throughout the area south of the Platte River and is encountered along the southern section of the proposed pipeline route.

In northern Nebraska, the proposed Project route, from approximately MP 619 to MP 707 in Boyd, Holt, and Antelope counties, would enter an area where the soils tend to be highly susceptible to erosion by wind and often exhibit characteristics of the NDEQ-defined Sand Hills Region (i.e., fragile soils [see Figure 3.2.2-1]). These soils consist of aeolian fine sands, loamy fine sands, or sandy alluvium, and are generally deep, well-to-excessively drained, and nearly level to moderately steep on uplands and streams terraces. The sandy soils typical of the NDEQ-defined Sand Hills Region have a high infiltration rate and high permeability; however, the fine-grained loess deposits further to the east can be as thick as 200 feet and can locally restrict water flow where fractures are absent (Stanton and Qi 2007, Johnson 1960).

Where the vegetative cover has been disturbed or removed without restoration, severe wind erosion associated with the prevailing northwesterly winds may create steep-sided, irregular, or conical depressions referred to as “blowouts.” Blowouts are most commonly associated with fence lines, windmills, and other features where cattle create trackways that allow the initiation of wind funneling (Wedin 2011). Two blowouts identified in the vicinity of the proposed Project route include a blowout in Keya Paha County, located approximately 6.5 miles from MP 611, southwest of the proposed pipeline route, and a blowout in Holt County, located approximately 1.6 miles from MP 634, south of the proposed pipeline route.



Source: USDA 2007.

Figure 3.2.2-1 Highly Wind Erodible Soils

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In this region, the most erosive months of the year are March, April, and May and the least erosive months are June, July, and August (Wedin 2011). In the spring months, sustained winds of 111 miles per hour with gusts of nearly double that velocity can occur (Stubbendieck et al. 1989). The proposed Project route would cross approximately 48 miles of highly wind erodible soils in Nebraska (see Table 3.2-1). In Nebraska, prime farmland soils occupy approximately 64 percent of the pipeline route. The average freeze free period is between 160 and 180 days.

3.2.2.4 Kansas

Two new pump stations would be located in Clay and Butler counties at MP 49.7 and MP 144.5, respectively, as part of the proposed Project. Shallow soils of the Hedville series are present in these areas. These soils are loamy soils that developed from the erosion of weathered non-calcareous sandstone. In Kansas, the average period where temperatures are above freezing is between 170 and 190 days.

3.2.2.5 North Dakota

During construction activities, a pipe yard and rail siding would be needed for on-site storage of pipes in North Dakota. The yard would be located in Bowman County in a flat and upland landscape area. The soils found in the area include the Belfield, Stady, and Stady-Lehr soil series. These soils are deep, well to moderately well drained soils that derived from material that consists of clayey or loamy alluvium from sedimentary rock. The shrink-swell potential of these soils is low.

3.2.3 Connected Actions

3.2.3.1 Bakken Marketlink Project

The Bakken Marketlink Project would include an approximately 5-mile-long pipeline, metering systems, three new storage tanks near Baker, Montana, and two new storage tanks within the boundaries of the proposed Cushing tank farm. TransCanada Keystone Pipeline, LP (Keystone) reported that the property proposed for the Bakken Marketlink facilities near Pump Station 14 is currently used as pastureland and hayfields. A survey of the property indicated that there were no waterbodies or wetlands on the property. The soils found in the proposed Project area include the Kremlin soil series. The Kremlin series consist of deep, well drained, and moderately permeable loamy soils that are in alluvial fans, stream terraces, and sedimentary plains.

3.2.3.2 Big Bend to Witten 230-kV Transmission Line

To meet the requirements of two new pump stations in Witten, South Dakota, a new 230-kV transmission line approximately 76 miles long would need to be added to the existing grid system to ensure system reliability. The soils found along the proposed transmission line route consist of two soil associations, the Millbor-Lakoma and the Sansarc-Opal. The Millboro-Lakoma association consists of deep to moderately deep, nearly level to strongly sloping, and well drained soils that are typically clayey. The Sansarc-Opal association consists of shallow to moderately deep, strongly sloping to steep and well drained clayey soils.

3.2.3.3 Electrical Distribution Lines and Substations

The proposed Project would require electrical service from local power providers for pump stations and other aboveground facilities in Montana, South Dakota, and Nebraska. In Montana, approximately 136 miles of new 115-kV electrical distribution lines would need to be constructed; in South Dakota, approximately 159 miles would need to be constructed; and in Nebraska, approximately 70 miles would be constructed. The precise locations of pump stations and distribution lines in Nebraska have not been determined. In Kansas, approximately 14 miles of distribution lines would be built. In general, the transmission lines would be constructed in the vicinity of the proposed Project route; as such, the same soil conditions discussed previously for Montana and South Dakota are expected to be encountered along the transmission line routes (see Sections 3.2.2.1, Montana, and 3.2.2.2, South Dakota).

3.2.4 References

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