8.0 GROUNDWATER RESOURCES

Groundwater is the primary source of water for private, public, commercial, and industrial uses along the preferred route. As discussed in Section 5.0, the preferred route traverses heavily glaciated terrain dominated by thick glacial drift deposits. Although groundwater occurs in both the glacial drift and underlying bedrock aquifers, the glacial drift aquifers tend to be more heavily used for water production in the Project area due to their greater accessibility and the occurrence of permeable aquifer sediments. Groundwater productivity and quality varies greatly throughout the Project area owing to the wide variability seen in the geology.

8.1 AQUIFERS

8.1.1 Glacial Aquifers

Thick glacial sediments, including till, outwash, alluvium and lacustrine deposits, cover much of the Project area. Groundwater yields from these glacial deposits vary but typically range from less than 1 gallon per minute ("gpm") in till and lacustrine deposits to upwards of 500 gpm in alluvium and outwash deposits (Kanivetsky, 1979). Well depths in the glacial deposits typically range from approximately 30- to 380-feet (USGS, 1985).

Unconsolidated glacial aquifers: occur above the bedrock; are typically comprised of sand and gravel deposits; and include alluvial outwash, beach-ridge, valley train, and ice-contact stratified drift deposits. Such deposits may occur as surficial phreatic aquifers or as buried aquifers resulting from repeated glaciations and are typically confined in nature.

Surficial aquifers are an important source of groundwater throughout the Project area, and can provide adequate water volumes to supply municipalities and irrigation systems. The depth of the material is generally less than 100-feet, but may reach several hundred feet in some areas (Adolphson et al., 1981). Short-term groundwater yields from unconfined surficial aquifers vary, but can range from approximately 10 to 3,000 gpm. Water quality of these surficial aquifers can be affected by surface activities, including industrial and agricultural land use, due to the relatively shallow depth of the water table and the relatively coarse texture of the material in the overlying unsaturated zone. Surficial aquifers generally yield good quality water (USGS, 1985).

Buried drift aquifers occur as well-sorted sands and gravels deposited in bedrock valleys, alluvial channels, and outwash plains formed by advancing and retreating glaciers. These deposits subsequently were covered by fine-textured materials (generally glacial till), which formed a confining layer above the aquifer. The confined buried sand and gravel deposits typically are less than 10-feet thick but may locally occur up to 150-feet thick (Adolphson et al., 1981). Buried drift aquifers have limited potential use for high capacity wells, but constitute an important source of groundwater in the region. Well yields range from approximately 10 gpm to 1,000 gpm (Adolphson et al., 1981). The confining layer (e.g., glacial till) above the aquifer generally protects it from contamination resulting from human

activity at the surface. Buried drift aquifers tend to contain highly mineralized water (USGS, 1985).

8.1.2 Cretaceous Aquifer

The Project traverses an occurrence of the Cretaceous Aquifer in Cass and Aitkin County. It is generally confined and ranges from 200- to 350-feet below the surface (Olsen and Mossler, 1982). Pumping rates of wells screened in this aquifer usually do not exceed 10 gpm, but can locally produce up to 25 gpm (Adolphson et al., 1985). This aquifer is not widely used for groundwater, except where drift aquifers are absent or where well yields are poor. Most water use from this aquifer is for rural domestic and livestock supplies, and the potential for development of large municipal and industrial water supplies is low.

8.1.3 Precambrian Aquifers

The preferred route crosses over Precambrian aquifers comprised of undifferentiated granite, greenstone, and slate from central Minnesota to the northwest and Proterozoic metasediments from central to eastern Minnesota. These aquifers can yield limited supplies of water to rural domestic and livestock wells where fractures, faults, and weatherized zones provide porosity and permeability. Wells in these aquifers are generally completed at depths ranging from 30- to 400-feet and generally yield between 1 and 25 gpm (Adolphson et al, 1981).

8.2 EXISTING GROUNDWATER RESOURCES

8.2.1 Public Water Supply Wells

The Minnesota Department of Health ("MDH") and the MGS jointly maintain a water well database known as the County Well Index ("CWI"). The CWI is a computerized database that contains basic information for over 340,000 water wells and boreholes drilled in Minnesota. CWI data is derived from water well contractors' documentation of geologic materials encountered during drilling. The CWI was used to identify public water supply wells located near the preferred route (MGS, 2013). No public water supply wells were identified in the vicinity of the Project.

8.2.2 Federal and State Designated Aquifers

The preferred route will not cross any Environmental Protection Agency ("EPA")-designated sole-source aquifers (EPA, 2013). The only EPA-designated sole-source aquifer in Minnesota is the Mille Lacs Aquifer, located south of the preferred route. However, the pipeline will cross about 0.2 miles of a Drinking Water Supply Management Area ("DWSMA") for Sundsrud's Court near approximate MP 431.6 in the vicinity of Park Rapids (MDH, 2013). MDH rates the sensitivity of the aquifer that supplies the well for that water supply as "high." EPND consultations with the operators of the DWSMA and the MDH

regarding this crossing are ongoing. The Project does not cross any Wellhead Protection Areas according to review of publicly available information (MDH, 2013).

8.2.3 Water Supply Wells

A review of the CWI database (MGS, 2013) identified 12 drilling records within 200-feet of the preferred route (see Table 8.2.3-1). Of these, one was for a test hole and one was for an irrigation well. The remaining logs were for ten residential domestic supply wells. EPND continues to consult with affected landowners regarding known cased wells in the vicinity of the right-of-way. If such wells are identified, the locations of these wells will be noted. EPND will develop site-specific plans for wells that could be impacted by construction.

Table 8.2.3-1
Wells/Boreholes Identified Within 200-Feet of the Sandpiper Pipeline Project

County	Milepost	Distance from Pipeline Centerline (feet)	Direction from Pipeline Centerline	Use
Clearwater	378.6	184	East	Domestic
	384.7	169	East	Domestic
Hubbard	411.0	54	East	Domestic
	413.5	69	West	Test hole-abandoned
	413.5	29	East	Irrigation
	421.0	67	East	Domestic
	430.2	62	East	Domestic
	431.6	118	East	Domestic
	431.6	121	East	Domestic
	436.2	41	East	Domestic
Carlton	588.8	195	North	Domestic
	595.4	182	North	Domestic

8.3 CONTAMINATED GROUNDWATER

EPND accessed a Minnesota Pollution Control Agency ("MPCA") database (MPCA, 2010) to identify sites with known or potential contamination within 0.5 mile of the Project. This database included federal regulatory listings, such as the National Priority List (or federal Superfund); Comprehensive Environmental Response, Compensation, and Liability Information System, (or potential National Priority List sites); No Further Response Action Planned; Resource Conservation and Recovery Act ("RCRA") Treatment, Storage, and Disposal; and RCRA hazardous waste generators. State listings included the: Permanent List of Priorities ("PLP", or state-equivalent Superfund); Delisted PLP; Voluntary

Investigation and Cleanup; Permitted Solid Waste Facilities; Unpermitted Dumps; Closed Landfill Program; and the State Assessment Program.

The following types of sites/facilities listed in the database were eliminated from further consideration: sites permitted for construction or industrial stormwater discharge, feedlots, waste water dischargers, and small to minimal hazardous waste generators regulated under RCRA. Table 8.3-1 summarizes the sites that were identified with potential contamination located within 0.5 mile of the Project. Based on this information, all of the 16 sites were determined to be more than 500-feet from the preferred route and, therefore, are not anticipated to impact or be impacted by the Project. Since inaccuracies are inherent to the database, it will be necessary to field-evaluate facilities on a site-by-site basis. Prior to Project construction, EPND will assess the potential for encountering contaminated groundwater if any of the sites are actually located within 500-feet of the preferred route. EPND will consult with the appropriate regulatory agencies to confirm the Project will not encounter contamination from the site. If necessary, appropriate avoidance or mitigation measures will be developed and implemented in accordance with applicable state and federal regulations.

Table 8.3-1
Contaminated Sites within 0.5 Mile of the Sandpiper Pipeline Project

County	City	Site/Facility Name	Milepost	Distance from Centerline (feet)	Listing Type
Polk	Fisher	B Wagner Farms	305.8	2,095	Landfill, Permitted By Rule
	Fisher	Sugro Inc	305.8	2,095	Tank Site
	Fisher	Bygland Lutheran Church	305.8	2,095	Tank Site
	Fisher	Mark Egeland Inc	305.8	2,095	Tank Site
	Fisher	Independent School District 600	305.8	2,095	Tank Site
	Crookston	Crookston Dump I	317.2	1,507	Unpermitted Dump Site
Clearwater	Clearbrook	Riviana Foods Inc - Clearbrook Facility	374.2	1,354	Multiple Activities
	Bagley	Friborg Residence	382.9	2,151	Leak Site
	Bagley	Clearwater County Demolition Debris Land Disposal	385.1	1,864	Multiple Activities
Hubbard	Lake Alice Township	Lake Alice Township Dump	411.6	2,334	Unpermitted Dump Site
	Park Rapids	Buck Stop	418.5	2,183	Tank Site
	Park Rapids	Headwaters Country Club Dump	429.7	1,777	Unpermitted Dump Site

Table 8.3-1
Contaminated Sites within 0.5 Mile of the Sandpiper Pipeline Project

County	City	Site/Facility Name	Milepost	Distance from Centerline (feet)	Listing Type
Cass	Backus	Grinning Bear Demolition Landfill	476.3	1,438	Landfill, Open
	Outing	Crooked Lake Dump	500.2	969	Unpermitted Dump Site
Aitkin	Palisade	Robinson Store & Ab Service	527.6	1,385	Multiple Activities
Carlton	Moose Lake	Minnesota Sex Offender Program Moose Lake	568.1	1,423	Multiple Activities

8.4 GENERAL CONSTRUCTION AND OPERATION IMPACTS AND MITIGATION

Construction of the project is not expected to have long-term impacts on groundwater resources. Ground disturbance associated with pipeline construction is primarily limited to the upper 10-feet, which is above the water table of most regional aquifers. Construction activities, such as trenching, backfilling, and dewatering, that encounter shallow surficial aquifers may result in minor short-term fluctuations in groundwater levels within the aquifer. Once the construction activity is complete, the groundwater levels typically recover quickly.

8.4.1 Blasting

Blasting to install the pipeline in a bedrock aquifer has the potential to adversely affect water quality and water yields in nearby water wells. Only 2.5 miles of the preferred route will cross areas with bedrock outcrops. If blasting is required, EPND will conduct these activities in accordance with applicable regulations.

8.4.2 Releases

The introduction of contaminants into groundwater due to accidental release of construction related chemicals, fuels, or hydraulic fluid during construction could have an adverse effect on groundwater quality, most notably near shallow water wells. Spill-related impacts from pipeline construction are primarily associated with fuel storage, equipment refueling, and equipment maintenance. EPND's EPP (see Appendix A) outlines measures that will be implemented to prevent accidental releases of fuels and other hazardous substances. The EPP also describes response, containment, and cleanup procedures. By implementing the protective measures set forth in the EPP, long-term contamination due to construction activities is not anticipated.

Accidental releases from the pipeline system during operations can also potentially affect groundwater. Pipeline operation is regulated by the U.S. Department of Transportation-Office of Pipeline Safety. EPND will implement an ongoing inspection program, under that office's regulations, to monitor the integrity of the pipeline system. Monitoring activities include regular inspection of the cathodic protection system, which addresses the possible corrosion potential for a steel pipe installed below the ground surface. In addition, EPND will use computerized inspection tools that travel through the inside of the pipeline to check pipe integrity. The EPND System is patrolled by air biweekly (26 times a year not to exceed 3 weeks between flights) to inspect surface conditions of land on or adjacent to the pipeline right-of-way. As required by federal law, EPND will maintain an Emergency Response Plan to address pre-planning, equipment staging, notifications, and leak containment procedures to be implemented in the event of a pipeline release.