3.4 CLIMATE AND METEOROLOGY

This section describes current conditions and evaluates potential impacts to meteorology and climate that could result from the implementation of the proposed action or alternatives. Each alternative is examined by major project component: Mine Site, Transportation Corridor, and Pipeline.

SYNOPSIS

This section describes the affected environment and environmental consequences of the proposed project, with regard to climate and meteorology. The section briefly defines terms, describes the meteorological region, and then discusses each of the project components in turn. Climate refers to long-term weather conditions of a region, and meteorology is the science dealing with weather and climate. Both natural (e.g., mountains, oceans, solar impacts) and anthropogenic (e.g., land use) features determine the climate of a region. Climate can be characterized by multiple meteorological variables, the most common of which are temperature, solar radiation, relative humidity, precipitation, and wind speed and direction.

Because of Alaska's geographic location and its unique climate conditions, the amount of daylight during each season affects scheduling of construction and operational activities. Activities are often scheduled for long hours during summer and short hours or no operations during winter. The months from May to July in the summer are mostly daylight, with only twilight during the night hours. The months of November through January have little daylight. The longest daylight hours occur between June 19th and June 23rd and the shortest daylight hours occur between December 20th and December 24th (Sunrise Sunset 2015).

Regional climate conditions can influence the transport and dispersion of air pollutants that affect air quality. Meteorological data are used in air pollution dispersion models to predict the ambient air quality impacts of a source of air pollution. Ambient air quality impacts of the project are discussed in Section 3.8, Air Quality. In addition, meteorological data, specifically, data on precipitation are necessary for the purpose of preparing a water management plan that quantifies the water supply for, and assesses the hydrologic impacts of, the Donlin Gold Project. Meteorological inputs to water balance modeling are discussed in detail in Section 3.5, Surface Water Hydrology. Climate and meteorological data are also used to predict long-term climate change. The effects of (future) global climate change on many resources are being included as part of the cumulative impact discussion (Chapter 4, Cumulative Effects) as a reasonably foreseeable future action. Impact discussions will identify impacts associated with resource production and extraction that could contribute to climate change, as well as impacts that could be experienced by resources as a result of climate change.

EXISTING CONDITION SUMMARY

There are four major climatic zones in Alaska: Arctic, Continental, Transitional, and Maritime. The Mine Site would be located within the Continental zone; Transportation Corridor within the Continental, Transitional and Maritime zones; and the Pipeline within Continental and Transitional zones.

EXPECTED EFFECTS SUMMARY

Alternative 1 - No Action

Under the No Action Alternative, Donlin Gold would not establish a mine, construct a natural gas pipeline, or develop the associated transportation facilities. Therefore, no direct or indirect effects to climate or meteorological resources would occur due to the project.

Alternatives 2, 3A, 3B, 5A, and 6A

Any climate or meteorological impacts that would be attributable to the Donlin Gold Project would be due to the project's contribution to overall greenhouse gas emissions. These impacts are discussed in Section 3.26, Climate Change.

3.4.1 AFFECTED ENVIRONMENT

There are four major climatic zones in Alaska: Arctic, Continental, Transitional, and Maritime. As shown on No synthetic datasets were developed for solar radiation, barometric pressure, days equal to or below freezing, or mean snow depth, so data from the closest monitoring site were deemed to be most characteristic of the Mine Site for these parameters. The data presented in this section is based on historical records, for the purpose of establishing baseline climate conditions for the Project Area. For an analysis of potential future global climate scenarios, refer to Section 3.26, Climate Change.

3.4.1.1 TRANSPORTATION CORRIDOR

Table 3.4-3 lists characteristic climate conditions for various components of the Transportation Corridor facilities category of the project based on proximity of data collection sites. Data are provided for the following areas within the transportation Project Area (Transportation Corridor footprint), listed from northeast to southwest:

- North End: including airstrip, north half of mine access road, and northeast half of Birch Tree Crossing (BTC) mine access road (Alternative 4);
- Upriver Area: including south half of mine access road, Angyaruaq (Jungjuk) Port site, and river traffic from Jungjuk to Napaimute;
- Mid-River Area: including river traffic from Napaimute to 10 miles northeast of Tuluksak, southwest half of BTC Road, and BTC Port site;
- Lower River Area: including river traffic from 10 miles northeast of Tuluksak to Bethel, and Bethel Port site (connected action); and

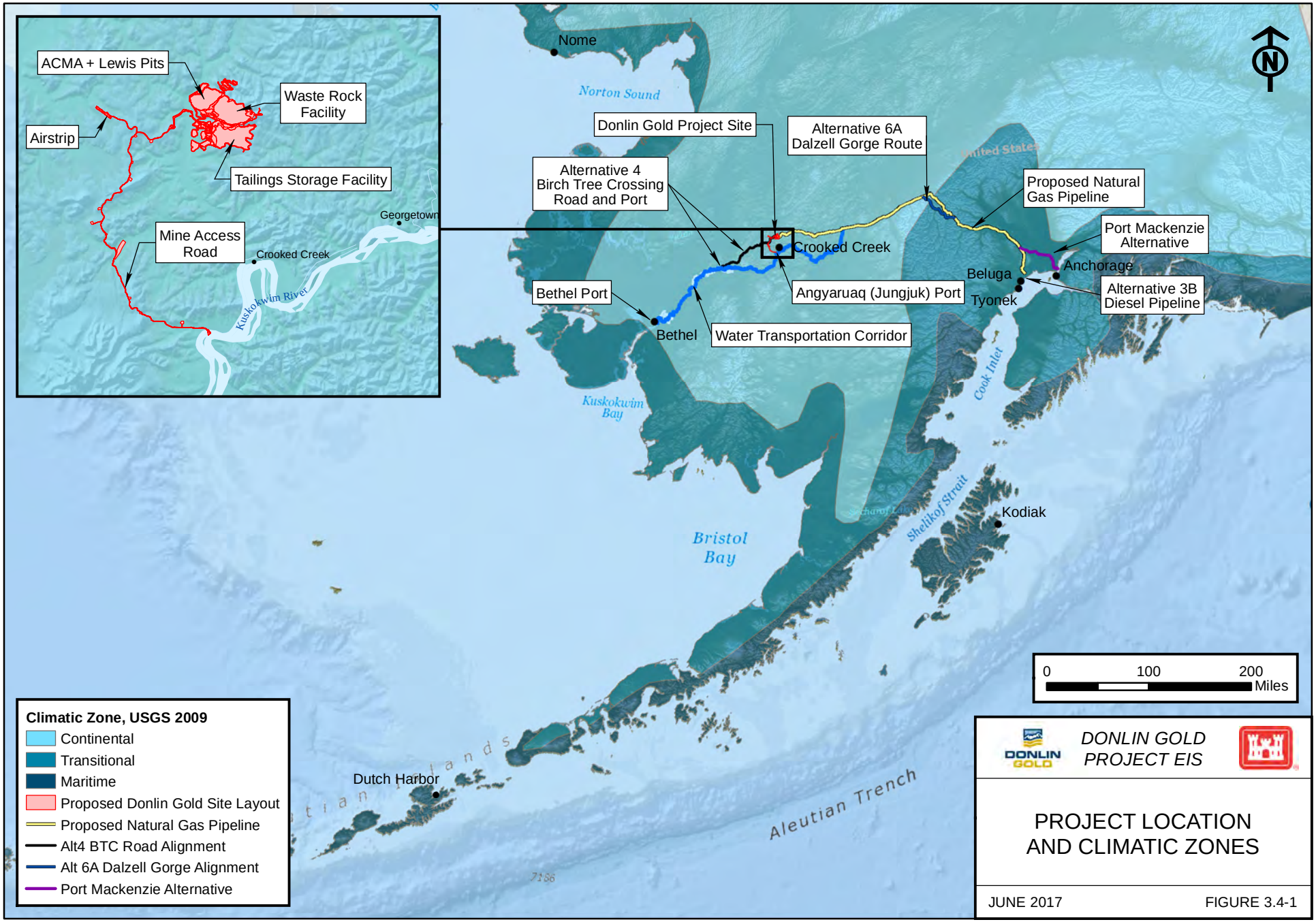
- Dutch Harbor tank farm.

Donlin Gold, LLC collected horizontal wind speed and direction, temperature, and solar radiation data in the immediate vicinity of the Transportation Corridor at the Jungjuk monitoring station located on the Kuskokwim River at the Angyaruaq (Jungjuk) Port site, and at BTC monitoring station located on the Kuskokwim River 11 miles west of Aniak. Data collected at the Mine Site at the American Ridge, Camp, and Hill 1918 stations are characteristic of the northeast portion of the Transportation Corridor component. The purpose of this data collection was to provide data for dispersion modeling to support the PSD application, and to characterize baseline climate conditions. The locations of the Camp, Jungjuk, and BTC monitoring stations are shown on Figure 3.4-3. Regional climate data are also available from NWS COOP stations at Dutch Harbor, Crooked Creek, Aniak, and Bethel (Figure 3.4-3).

, the Mine Site would be located within the Continental zone; Transportation Corridor within the Continental, Transitional and Maritime zones; and the Pipeline within Continental and Transitional zones.

The Continental zone climate is cool and relatively dry compared to coastal areas of Alaska, and has greater temperature extremes than all of the other climatic zones in Alaska. The Continental zone averages 20 inches of average annual precipitation and has an average temperature of about 22 degrees Fahrenheit (°F); the Transitional zone averages 30 inches of annual precipitation and 27°F; and the Maritime zone averages 70 inches of rain and 42°F (USGS 2009).

The following sections describe the baseline climate and meteorological conditions in the area of each component of the project.


ACMA + Lewis Pits
Waste Rock Facility
Airstrip
Tailings Storage Facility
Mine Access Road
Georgetown
Crooked Creek
Kuskokwim River
Nome
Norton Sound
Donlin Gold Project Site
Alternative 6A Dalzell Gorge Route
Alternative 4 Birch Tree Crossing Road and Port
Proposed Natural Gas Pipeline
Port Mackenzie Alternative
Crooked Creek
Anchorage
Beluga
Tyonek
Alternative 3B Diesel Pipeline
Bethel Port
Angyaruaq (Jungjuk) Port
Bethel
Water Transportation Corridor
Kuskokwim Bay
Cook Inlet
Shelikof Strait
Kodiak
Bristol Bay
Dutch Harbor
Aleutian Trench
0
100
200
Miles
Climatic Zone, USGS 2009
Continental
Transitional
Maritime
Proposed Donlin Gold Site Layout
Proposed Natural Gas Pipeline
Alt4 BTC Road Alignment
Alt 6A Dalzell Gorge Alignment
Port Mackenzie Alternative
DONLIN GOLD
DONLIN GOLD PROJECT EIS
PROJECT LOCATION AND CLIMATIC ZONES
JUNE 2017
FIGURE 3.4-1

3.4.1.2 MINE SITE

Site-specific data for temperature, solar radiation, barometric pressure, relative humidity, precipitation, wind direction, vertical wind speed, temperature differential, stability class, and horizontal wind speed[1] were collected in (or calculated for) the immediate vicinity of the Mine Site in order to establish baseline ambient air quality conditions for this EIS as well as for a Prevention of Significant Deterioration (PSD) permit application (see Section 3.8, Air Quality), The Project Area for the Mine Site component consists of the area within the mine site boundary and includes two open pits, a waste rock facility (WRF), ore processing facilities, a tailing storage facility (TSF), water treatment plants, facilities to house the workforce, equipment to transport ore from the open pit to the processing plant, hydrologic control features, and a power plant.

A summary of monthly climate conditions characteristic of the Mine Site is provided in Table 3.4-1. The data for each parameter were selected from one of several sources, depending on which was most representative of the Mine Site for the particular parameter. The various data sources are described below.

The terrain in the area of the Mine Site varies in elevation from about 500 to 2,100 feet in elevation and is comprised of muskeg, tundra and forest (MMA 2005; BGC 2011f). Because climate conditions were anticipated to vary in the area, Donlin Gold collected meteorological data at four[2] monitoring stations. The four sites are shown on Figure 3.4-2 and described in Table 3.4-2.

Generally, when selecting climate data to characterize a location, preference is given to the closest and most recent dataset. However, climate is a long-term description of the weather, so the collection period of the dataset must also be considered when determining whether data adequately characterize the baseline conditions of an area. The closest meteorological measurement site to the mine having long-term data is Crooked Creek, a National Weather Service (NWS) Cooperative (COOP) Observer Site located 11 miles south-southeast of the Mine Site (Figure 3.4-2). The Crooked Creek dataset consists of temperature, number of days less than or equal to 32°F (freezing point), total precipitation, snowfall, and snow depth data from 1949 through 1957, and from 1968 through 1974.

[1] Some of these data were collected or calculated specifically for the purpose of conducting dispersion modeling (i.e., vertical wind speed, temperature differential, wind direction, and stability class). The results of the dispersion modeling analysis are discussed in Section 3.8, Air Quality.

[2] Donlin Gold collected wind and temperature data from November 1, 2008 to October 31, 2009 at the Sonic Detection and Ranging (SODAR) station, located about 0.3 miles southeast of the Donlin Gold Camp, at altitudes from ground level to 3,300 feet. However, the report only included "upper air" data from 300 to 1,000 feet as needed for ambient modeling. Thus, the data do not necessarily characterize baseline ground level climate conditions, and are not presented here.

Table 3.4-1: Average Monthly Climate Data Characteristic of the Mine Site

Parameter	Location of Closest Data Source	Distance from Project Area[g]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Temperature (°F)	Camp Synthetic[a]	0 miles[f]	1940 to 2010	1	11	23	39	56	67	69	63	53	32	13	2
Minimum Temperature (°F)	Camp Synthetic[a]	0 miles[f]	1940 to 2010	-16	-10	-3	17	35	46	49	45	36	19	-2	-14
Mean Temperature (°F)	Camp Synthetic[a]	0 miles[f]	1940 to 2010	-7	1	10	28	46	56	59	55	44	26	6	-6
Number of Days Less Than or Equal to 32°F (Freezing Point)	Crooked Creek	11 miles SSE	1949 to 1974	30.4	27.2	29.9	26.1	15.4	1.7	0.7	2.3	11.5	25.8	28.9	30.6
Mean Solar Radiation (Watts/m^2)	American Ridge[b]	2 miles SE	2005 to 2010	7	35	102	166	216	192	181	136	83	39	14	4
Mean Barometric Pressure (inches Hg)	Camp[b]	0 miles[f]	5/1/2006 to 4/30/2012	28.81	28.89	28.83	28.93	29.05	29.03	29.04	28.99	28.68	28.75	28.77	28.77
Mean Wind Speed[i] (mph)	Camp Synthetic[c]	0 miles[f]	1940 to 2010	6.4	8.4	8.4	8.3	7.3	6.9	6.6	6.8	6.9	6.8	7.0	6.7
Mean Relative Humidity (%)	Camp Synthetic[d]	0 miles[f]	1940 to 2010	77.0	78.1	66.6	65.7	60.8	65.6	74.2	79.2	78.9	84.9	82.5	79.2
Total Precipitation (inches)	Camp Synthetic[e]	0 miles[f]	1940 to 2010	1.16	0.89	0.80	0.40	1.05	2.15	2.61	3.70	2.66	1.74	1.17	1.30
Mean Precipitation from Rainfall (inches)	Camp Synthetic[e]	0 miles[f]	1940 to 2010	0.00	0.00	0.16	0.36	1.05	2.15	2.61	3.70	2.66	0.89	0.00	0.00
Mean Precipitation from Snowfall (inches)	Camp Synthetic[e]	0 miles[f]	1940 to 2010	1.16	0.89	0.64	0.04	0.00	0.00	0.00	0.00	0.00	0.85	1.17	1.30
Mean Snow Depth (inches)	Crooked Creek	11 miles SSE	9/2/1949 to 11/30/1974	15	13	11	4	0	0	0	0	0	0	4	8
Sunrise Time[h] (AM)	Crooked Creek	0 miles	See note h	10:54	9:58	8:36	7:56	6:21	5:01	4:51	5:59	7:21	8:38	10:02	10:23

Table 3.4-1: Average Monthly Climate Data Characteristic of the Mine Site

Parameter	Location of Closest Data Source	Distance from Project Area[g]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunset Time[h] (PM)	Crooked Creek	0 miles	See note h	4:17	5:33	6:54	9:1	10:38	11:59	12:21	11:19	9:44	8:06	6:30	4:19
Day Length (hours and minutes)[h]	Crooked Creek	0 miles	See note h	5h 23m	7h 35m	10h 18m	13h 21m	16h 16m	18h 57m	19h 31m	17h 20m	14h 23m	11h 28m	8h 28m	5h 56m

Notes:

a Synthetic dataset for temperature based on data from McGrath with a 1:1 correlation; therefore, no scaling applied (BGC 2011f).
b Calculated monthly averages based on available data.
c Synthetic dataset for wind speed based on data from Camp, American Ridge, and Hill 1918 (BGC 2011f).
d Synthetic dataset for relative humidity based on data from Camp, American Ridge, and Snow Ridge (BGC 2011f).
e Synthetic dataset for precipitation (snowfall plus rainfall) is based on Crooked Creek, scaled to Mine Site (scaling factor = 1.33) (BGC 2011f).
f The Camp Synthetic data are assumed to have been collected at the Camp monitoring station within the Mine Site location.
g In this column, distances and directions are provided using the Mine Site as reference point (e.g., Crooked Creek is 11 miles SSE of the Mine Site). N = North; E = East; W = West; S = South.
h Daylight hours shown are hours of daylight for the first day of each month of calendar year 2014. As the length of time between sunrise and sunset should not change substantially from year to year, these figures can be used for approximations for other years as well. The longest daylight hours occur on June 20th through June 23rd for 19 hours and 41 minutes. The shortest daylight hours occur on December 20th through December 24th for 5 hours and 12 minutes (Sunrise Sunset 2015).
I Wind speed direction is predominantly from the SE (35%) and NNE (25%) (Air Sciences 2016).

Abbreviations:

°F = degrees Fahrenheit Hg = mercury m^2 = square meters mph = miles per hour NA = Not available

Sources: BGC 2011f; MMA 2007a,b,c, 2008e, 2009a,d,e, 2010a,b, 2011b, 2012b; WRCC 2013; Sunrise Sunset 2015.

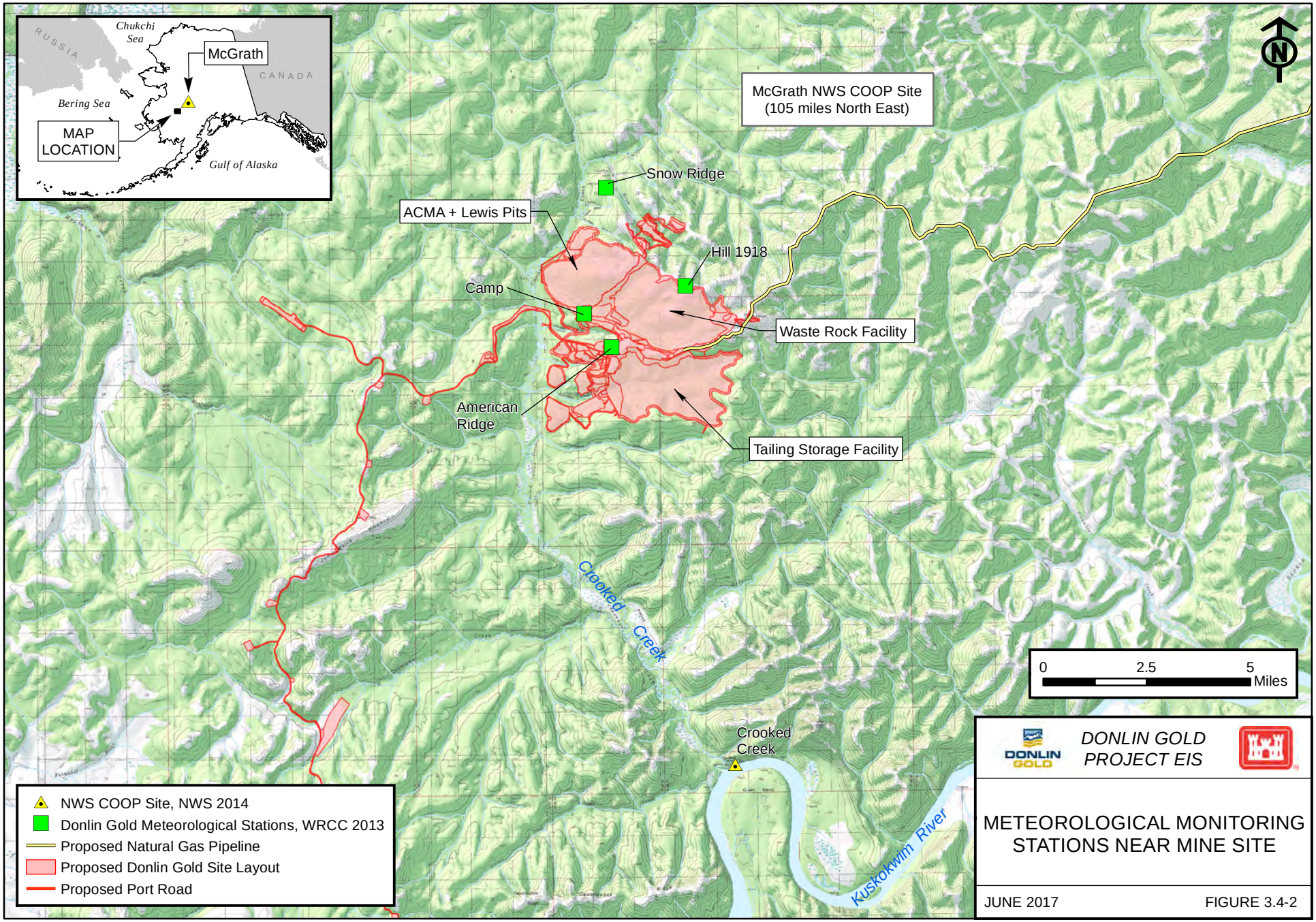

Chukchi Sea
RUSSIA
McGrath
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
McGrath NWS COOP Site (105 miles North East)
Snow Ridge
ACMA + Lewis Pits
Hill 1918
Camp
Waste Rock Facility
American Ridge
Tailing Storage Facility
Crooked Creek
Crooked Creek
Kuskokwim River
0
2.5
5
Miles
NWS COOP Site, NWS 2014
Donlin Gold Meteorological Stations, WRCC 2013
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
DONLIN GOLD
DONLIN GOLD PROJECT EIS
METEOROLOGICAL MONITORING STATIONS NEAR MINE SITE
JUNE 2017
FIGURE 3.4-2

Table 3.4-2: Description of Meteorological Monitoring Stations at Mine Site

Site Name	Snow Ridge	Camp	American Ridge	Hill 1918
Period of Data Collection	1995 – 2000	2005 - 2010	1999 – 2010	2007 – 2011
Location	Three miles north of Camp Site Station	Eastern edge of the exploration camp	200 yards southwest of highest point of American Ridge	On summit of a hill, about three kilometers east of open pit.
Elevation (feet)	630	778	810	1918
Vegetation	Alpine Shrub Tundra/Dwarf Birch Low Shrub	Bare Ground/Dwarf Birch Low Shrub	Alpine Shrub Tundra/ Dwarf Birch Low Shrub	Bare Ground/Lichen Mat

Source: MMA 2010d; BGC 2011f.

BGC Engineering (BGC) (2011f) analyzed precipitation data collected at the Mine Site Camp[3] monitoring station and determined the collection period to be insufficient to provide reliable precipitation estimates for conducting water balance calculations (BGC 2011f). Therefore a synthetic dataset was developed from both Mine Site and other sources to represent long-term climate at the Donlin Gold Mine Site. The direct measurements used, assumptions, and process of analysis to develop the synthetic dataset are described in detail in the Hydro-Meteorological Data: Synthesis & Analysis Final Report (BGC 2011f).Based on a review of all datasets and comparisons between the Mine Site and regional datasets, the data from long-term regional stations at McGrath and Crooked Creek, combined with the Camp Site data from both Camp Station and American Ridge (collectively referred to as Camp Site Stations), were determined to provide the best sources for developing a synthetic long-term precipitation record from which to estimate precipitation at Donlin Creek (BGC 2011f). The climate data from the Camp and Crooked Creek monitoring stations were scaled to more accurately represent the climate at the Mine Site based on differences in elevation and other factors. The development of this precipitation dataset for the purpose of water balance modeling is described in more detail in Section 3.5, Surface Water Hydrology. Synthetic datasets for the period 1940 through 2010 were also generated for temperature, wind speed, and relative humidity in order to provide consistency with the synthetic precipitation dataset.

For the purposes of establishing baseline conditions in this EIS, the synthetic datasets for precipitation, temperature, wind speed, and relative humidity are deemed more characteristic of the overall climate at the Mine Site than the shorter term data collected on-site. The synthetic dataset (BGC 2011f) does not have an exact physical location, thus, the location of the synthetic data is referred to as "Camp Synthetic" in Table 3.4-1.

No synthetic datasets were developed for solar radiation, barometric pressure, days equal to or below freezing, or mean snow depth, so data from the closest monitoring site were deemed to be most characteristic of the Mine Site for these parameters. The data presented in this section is

[3] The precipitation data collected at Snow Ridge was deemed unreliable due to measurement problems, thus was not used in the development of the synthetic data set.

based on historical records, for the purpose of establishing baseline climate conditions for the Project Area. For an analysis of potential future global climate scenarios, refer to Section 3.26, Climate Change.

3.4.1.3 TRANSPORTATION CORRIDOR

Table 3.4-3 lists characteristic climate conditions for various components of the Transportation Corridor facilities category of the project based on proximity of data collection sites. Data are provided for the following areas within the transportation Project Area (Transportation Corridor footprint), listed from northeast to southwest:

- North End: including airstrip, north half of mine access road, and northeast half of Birch Tree Crossing (BTC) mine access road (Alternative 4);
- Upriver Area: including south half of mine access road, Angyaruaq (Jungjuk) Port site, and river traffic from Jungjuk to Napaimute;
- Mid-River Area: including river traffic from Napaimute to 10 miles northeast of Tuluksak, southwest half of BTC Road, and BTC Port site;
- Lower River Area: including river traffic from 10 miles northeast of Tuluksak to Bethel, and Bethel Port site (connected action); and
- Dutch Harbor tank farm.

Donlin Gold, LLC collected horizontal wind speed and direction, temperature, and solar radiation[4] data in the immediate vicinity of the Transportation Corridor at the Jungjuk monitoring station located on the Kuskokwim River at the Angyaruaq (Jungjuk) Port site, and at BTC monitoring station located on the Kuskokwim River 11 miles west of Aniak. Data collected at the Mine Site at the American Ridge, Camp, and Hill 1918 stations are characteristic of the northeast portion of the Transportation Corridor component. The purpose of this data collection was to provide data for dispersion modeling to support the PSD application, and to characterize baseline climate conditions. The locations of the Camp, Jungjuk, and BTC monitoring stations are shown on Figure 3.4-3. Regional climate data are also available from NWS COOP stations at Dutch Harbor, Crooked Creek, Aniak, and Bethel (Figure 3.4-3).

The data collected at Jungjuk and BTC monitoring stations were obtained over a period of two years. Due to this short collection period, the data may not represent long-term (approximately 10 years or more of meteorological data) trends in the area. No synthetic datasets have been generated by Donlin Gold for the Transportation Corridor, however; and short-term site-specific data in this case were considered more characteristic of the area than long-term data collected farther away.

[4] Additional data collected or calculated for the purpose of conducting dispersion modeling (i.e., vertical wind speed, temperature differential, and stability class), are discussed in Section 3.8.

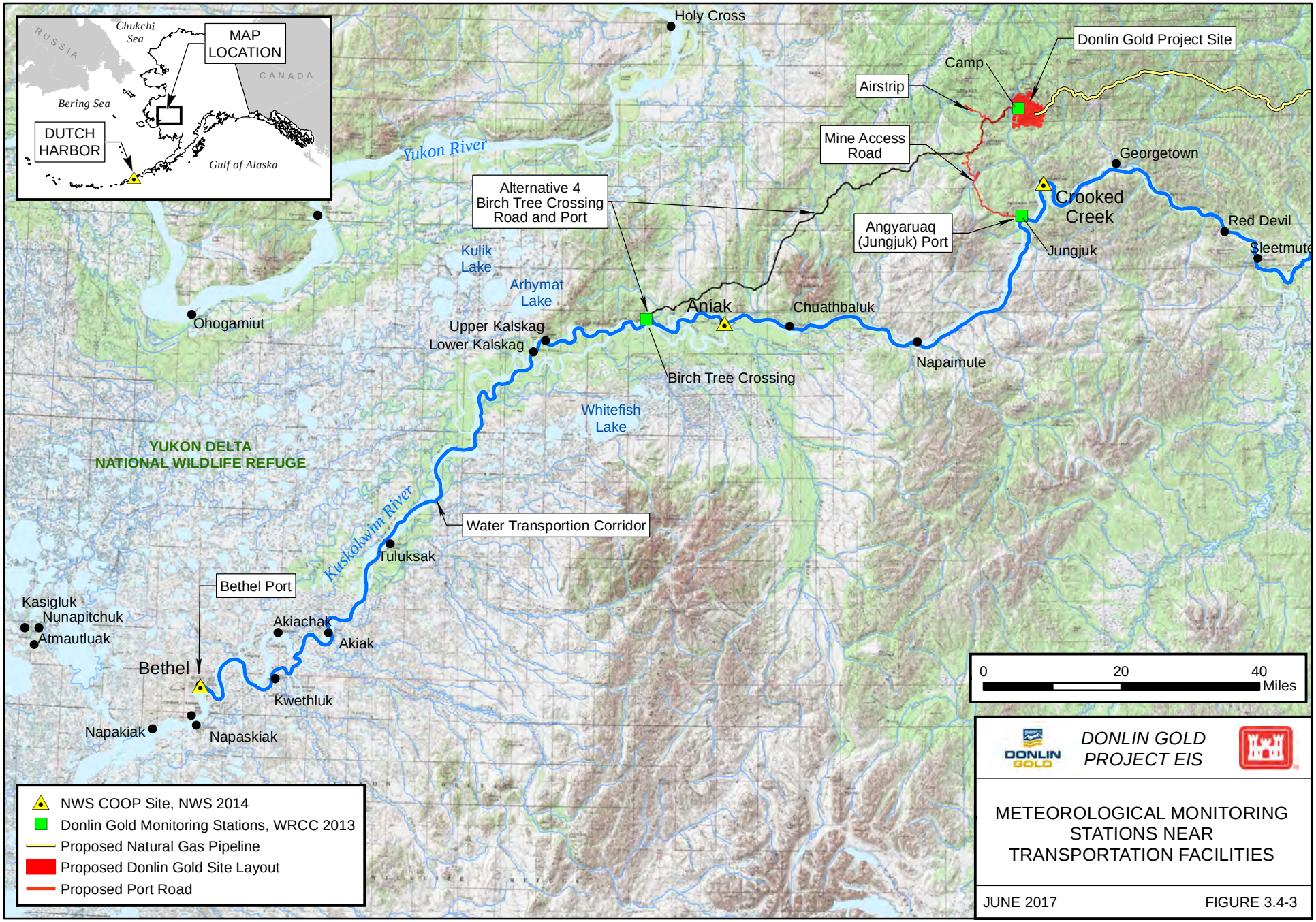

MAP LOCATION
DUTCH HARBOR
RUSSIA
Chukchi Sea
CANADA
Bering Sea
Gulf of Alaska
Holy Cross
Donlin Gold Project Site
Camp
Airstrip
Mine Access Road
Yukon River
Georgetown
Crooked Creek
Red Devil
Sleetmute
Alternative 4 Birch Tree Crossing Road and Port
Angyaruaq (Jungjuk) Port
Jungjuk
Kulik Lake
Arhymat Lake
Aniak
Chuathbaluk
Ohogamiut
Upper Kalskag
Lower Kalskag
Napaimute
Birch Tree Crossing
Whitefish Lake
YUKON DELTA NATIONAL WILDLIFE REFUGE
Kuskokwim River
Water Transportion Corridor
Tuluksak
Bethel Port
Kasigluk
Nunapitchuk
Atmautluak
Akiachak
Akiak
Bethel
Kwethluk
Napakiak
Napaskiak
0
20
40
Miles
NWS COOP Site, NWS 2014
Donlin Gold Monitoring Stations, WRCC 2013
Proposed Natural Gas Pipeline
Proposed Donlin Gold Site Layout
Proposed Port Road
DONLIN GOLD
DONLIN GOLD PROJECT EIS
METEOROLOGICAL MONITORING STATIONS NEAR TRANSPORTATION FACILITIES
JUNE 2017
FIGURE 3.4-3

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North End Transportation Corridor: Airstrip and North Half of Mine Access Road															
Maximum Temperature (°F)	Camp Synthetic [a]	0.8 mi. E to 10 mi. NE	1940 to 2010	1	11	23	39	56	67	69	63	53	32	13	2
Minimum Temperature (°F)	Camp Synthetic [a]	0.8 mi. E to 10 mi. NE	1940 to 2010	-16	-10	-3	17	35	46	49	45	36	19	-2	-14
Mean Temperature (°F)	Camp Synthetic [a]	0.8 mi. E to 10 mi. NE	1940 to 2010	-7	1	10	28	46	56	59	55	44	26	6	-6
Number of Days Less Than or Equal to 32°F (Freezing Point)	Crooked Creek	6 mi. NNW to 10 mi. NW	1949 to 1974	30.4	27.2	29.9	26.1	15.4	1.7	0.7	2.3	11.5	25.8	28.9	30.6
Mean Solar Radiation (Watts/m^2)	American Ridge [b]	2 mi. ESE to 9 mi. NE	2005 to 2010	7	35	102	166	216	192	181	136	83	39	14	4
Mean Barometric Pressure (inches Hg)	Camp [b]	0.8 mi. E to 10 mi. NE	5/1/2006 to 4/30/2012	28.81	28.89	28.83	28.93	29.05	29.03	29.04	28.99	28.68	28.75	28.77	28.77
Wind Speed (mph)	Camp Synthetic [c]	0.8 mi. E to 10 mi. NE	1940 to 2010	6.4	8.4	8.4	8.3	7.3	6.9	6.6	6.8	6.9	6.8	7.0	6.7
Mean Relative Humidity (%)	Camp Synthetic [d]	0.8 mi. E to 10 mi. NE	1940 to 2010	77.0	78.1	66.6	65.7	60.8	65.6	74.2	79.2	78.9	84.9	82.5	79.2
Mean Total Precipitation (inches)	Camp Synthetic [e]	0.8 mi. E to 10 mi. NE	1940 to 2010	1.16	0.89	0.80	0.40	1.05	2.15	2.61	3.70	2.66	1.74	1.17	1.30
Mean Precipitation from Rainfall (inches)	Camp Synthetic [e]	0.8 mi. E to 10 mi. NE miles	1940 to 2010	0.00	0.00	0.16	0.36	1.05	2.15	2.61	3.70	2.66	0.89	0.00	0.00
Mean Precipitation from Snowfall (inches)	Camp Synthetic [e]	0.8 mi. WSW to 10 mi. SSW	1940 to 2010	1.16	0.89	0.64	0.04	0.00	0.00	0.00	0.00	0.00	0.85	1.17	1.30
Mean Snow Depth (inches)	Crooked Creek	6 mi. NNW to 10 mi. NW	9/2/1949 to 11/30/1974	15	13	11	4	0	0	0	0	0	0	4	8
Sunrise Time[g] AM	Crooked Creek	6 mi. NE to	See note g	10:54	9:58	8:36	7:56	6:21	5:01	4:51	5:59	7:21	8:38	10:02	10:23

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		29 mi. WSW													
Sunset Time[g] PM	Crooked Creek	6 mi. NE to 29 mi. WSW	See note g	4:17	5:33	6:54	9:17	10:38	11:59	12:21	11:19	9:44	8:06	6:30	4:19
Day Length (hours and minutes) [g]	Crooked Creek[h]	6 mi. NE to 29 mi. WSW	See note g	5h 23m	7h 35m	10h 18m	13h 21m	16h 16m	18h 57m	19h 31m	17h 20m	14h 23m	11h 28m	8h 28m	5h 56m
Upriver Area: South Half of Mine Access Road, Angyaruaq (Jungjuk) Port, and River Traffic from Angyaruaq (Jungjuk) Port to Napaimute															
Maximum Temperature (°F)	Jungjuk[b]	0.2 mi. S to 24 mi. NE	10/1/2010 to 9/30/2012	28.9	40.2	40.7	55.0	74.6	75.1	73.4	73.5	61.4	49.2	37.7	37.4
Minimum Temperature (°F)	Jungjuk[b]	0.2 mi. S to 24 mi. NE	10/1/2010 to 9/30/2012	-41.7	-37.8	-27.5	-9.9	14.6	29.3	32.9	32.6	15.6	3.7	-25.5	-36.1
Mean Temperature (°F)	Jungjuk[b]	0.2 mi. N to 24 mi. NE	10/1/2010 to 9/30/2012	-8.7	10.2	9.1	30.1	44.5	53.3	53.8	52.0	43.7	29.8	8.8	3.1
Number of Days Less Than or Equal to 32°F (Freezing Point)	Crooked Creek	6 mi. SW to 29 mi. WSW	1949 to 1974	30.4	27.2	29.9	26.1	15.4	1.7	0.7	2.3	11.5	25.8	28.9	30.6
Mean Solar Radiation (Watts/m^2)	Jungjuk[b]	0.2 mi. S to 24 miles NE	10/1/2010 to 9/30/2012	17	40	120	182	219	197	153	119	79	41	18	6
Mean Barometric Pressure (inches Hg)	Camp[b]	11 mi. NE to 37 mi. NNE	5/1/2006 to 4/30/2012	28.81	28.89	28.83	28.93	29.05	29.03	29.04	28.99	28.68	28.75	28.77	28.77
Mean Wind Speed (mph)	Jungjuk[b]	0.2 mi. N to 24 mi. NE	10/1/2010 to 12/31/2011	3.5	3.6	3.5	3.8	3.9	3.9	3.9	3.5	3.7	2.7	3.0	3.4
Mean Relative Humidity (%)	Camp Synthetic[d]	11 mi. NE to 37 mi. NNE	1940 to 2010	77.0	78.1	66.6	65.7	60.8	65.6	74.2	79.2	78.9	84.9	82.5	79.2
Mean Total Precipitation (inches)	Crooked Creek	6 mi. SW to 29 mi. WSW	9/2/1949 to 11/30/1974	0.89	0.63	0.60	0.36	0.51	1.70	2.10	3.43	1.91	1.47	0.86	1.09
Mean Snowfall (inches)	Crooked Creek	6 mi. NE to 29 mi. WSW	9/2/1949 to 11/30/1974	14.6	9.1	7.6	1.7	0.2	0.1	0.0	0.0	0.0	3.1	13.0	12.3

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Snow Depth (inches)	Crooked Creek	6 mi. NE to 29 mi. WSW	9/2/1949 to 11/30/1974	15	13	11	4	0	0	0	0	0	0	4	8
Sunrise Time[g] AM	Crooked Creek	6 mi. NE to 29 mi. WSW	See note g	10:54	9:58	8:36	7:56	6:21	5:01	4:51	5:59	7:21	8:38	10:02	10:23
Sunset Time[g] PM	Crooked Creek	6 mi. NE to 29 mi. WSW	See note g	4:17	5:33	6:54	9:17	10:38	11:59	12:21	11:19	9:44	8:06	6:30	4:19
Day Length (hours and minutes)[g, h]	Crooked Creek	6 mi. NE to 29 mi. WSW	See note g	5h 23m	7h 35m	10h 18m	13h 21m	16h 16m	18h 57m	19h 31m	17h 20m	14h 23m	11h 28m	8h 28m	5h 56m
Mid-River Area: River Traffic from Napaimute to 10 miles northeast of Tuluksak, Southwest Half BTC Road, and BTC Port															
Maximum Temperature (°F)	Birch Tree Crossing[b]	39 mi. NE to 40 mi. NE	7/1/2010 to 3/31/2012	23.3	37.9	36.8	48.7	75.7	71.2	70.6	66.4	64.1	45.8	37.6	33.4
Minimum Temperature (°F)	Birch Tree Crossing[b]	39 mi. NE to 40 mi. NE	7/1/2010 to 3/31/2012	-33.8	-27.3	-13.4	-2.8	22.7	35.4	41	37.7	23.1	12.2	-18.4	-30.4
Mean Temperature (°F)	Birch Tree Crossing[f]	39 mi. NE to 40 mi. NE	7/1/2010 to 3/31/2012	-5.7	11.8	9.7	26.2	46.1	51.7	52.1	51.2	45.9	30.3	10.6	4.9
Number of Days Less Than or Equal to 32°F (Freezing Point)	Aniak	28 mi. NE to 48 mi. NE	1949 to 1990	29.6	27.5	29.6	26.9	13.0	0.8	0.2	0.7	9.3	25.8	28.6	30.2
Mean Solar Radiation (Watts/m^2)	Birch Tree Crossing[b]	39 mi. NE to 40 mi. NE	7/1/2010 to 3/31/2012	12	40	123	171	220	198	156	115	100	28	14	3
Mean Barometric Pressure (inches Hg)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Wind Speed (mph)	Birch Tree Crossing[b]	39 mi. NE to 40 mi. NE	7/1/2010 to 3/31/2012	11.0	8.8	9.7	7.7	6.6	6.2	6.0	5.9	7.6	7.0	8.4	8.2
Mean Relative Humidity (%)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Total Precipitation (inches)	Aniak	28 mi. NE to 48 mi. NE	9/1/1949 to 3/31/1990	0.82	0.86	0.92	0.71	1.08	1.54	2.34	4.11	2.69	1.20	1.46	1.10

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Snowfall (inches)	Aniak	28 mi. NE to 48 mi. NE	9/1/1949 to 3/31/1990	7.6	9.4	10.0	4.5	1.1	0.0	0.0	0.0	0.0	3.3	10.0	10.0
Mean Snow Depth (inches)	Aniak	28 mi. NE to 48 mi. NE	9/1/1949 to 3/31/1990	15	18	20	10	1	0	0	0	0	1	4	9
Sunrise Time[g] AM	Aniak	28 mi. NE to 48 mi. NE	See note g	10:57	10:02	8:41	8:02	6:28	5:11	5:01	6:07	7:28	8:44	10:06	10:26
Sunset Time[g] PM	Aniak	28 mi. NE to 48 mi. NE	See note g	4:26	5:41	7:00	9:22	10:42	12:01	12:23	11:22	9:49	8:12	6:37	4:28
Day Length (hours and minutes)[g, i]	Aniak[i]	28 mi. NE to 48 mi. NE	See note g	5h 30m	7h 39m	10h 19m	13h 20m	16h 14m	18h 50m	19h 23m	17h 16m	14h 21m	11h 29m	8h 31m	6h 2m
Lower River Area: River Traffic from 10 miles northeast of Tuluksak to Bethel, Bethel Port															
Maximum Temperature (°F)	Bethel	0 mi. to 44 mi. SW	9/3/1949 to 9/30/2012	12.0	15.4	20.9	33.1	49.6	59.9	62.6	59.7	52.1	35.8	23.4	14.1
Minimum Temperature (°F)	Bethel	0 mi. to 44 mi. SW	9/3/1949 to 9/30/2012	-0.8	1.4	4.9	17.2	32.6	43.1	48.0	46.6	38.6	24.4	11.3	1.2
Mean Temperature (°F)	Bethel	0 mi. to 44 mi. SW	9/3/1949 to 9/30/2012	5.6	8.5	12.9	25.1	41.1	51.5	55.3	53.1	45.3	30.0	17.4	7.6
Number of Days Less Than or Equal to 32°F (Freezing Point)	Bethel	0 mi. to 44 mi. SW	1949 to 2012	30.4	27.7	30.6	27.9	15.3	0.6	0.0	0.1	5.5	25.3	28.5	30.5
Mean Solar Radiation (Watts/m^2)	Birch Tree Crossing[b]	40 mi. NE to 80 mi. NE	7/1/2010 to 3/31/2012	12	40	123	171	220	198	156	115	100	28	14	3
Mean Barometric Pressure (inches Hg)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Wind Speed (mph)	Birch Tree Crossing[b]	40 NE to 80 mi. NE	7/1/2010 to 3/31/2012	11.0	8.8	9.7	7.7	6.6	6.2	6.0	5.9	7.6	7.0	8.4	8.2
Mean Relative Humidity (%)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Total Precipitation	Bethel	40 NE to	9/3/1949 to	0.77	0.71	0.75	0.72	0.95	1.55	2.26	3.35	2.50	1.47	1.29	1.06

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(inches)		44 mi. NE	9/30/2012												
Mean Snowfall (inches)	Bethel	40 mi. NE to 44 mi. NE	9/3/1949 to 9/30/2012	7.9	7.3	8.5	5.4	1.8	0.1	0.0	0.0	0.3	4.1	10.0	10.3
Mean Snow Depth (inches)	Bethel	40 mi NE to 44 mi. NE	9/3/1949 to 9/30/2012	8	8	9	5	0	0	0	0	0	0	3	6
Sunrise Time[g] AM	Bethel	40 mi NE to 44 mi. NE	See note g	10:57	10:06	8:48	8:12	6:42	5:29	5:20	6:22	7:39	8:52	10:11	10:28
Sunset Time[g] PM	Bethel	40 mi NE to 44 mi. NE	See note g	4:44	5:55	7:11	9:30	10:47	12:01A	2:30A	12:29A	10:42	8:22	6:50	4:44
Day Length (hours and minutes)[g, j]	Bethel[i]	40 mi NE to 44 mi. NE	See note g	5h 47m	7h 49m	10h 22m	13h 17m	16h 5m	18h 32m	19h 2m	17h 4m	14h 16m	11h 30m	8h 38m	6h 17m
Dutch Harbor Area: Tank Farm Expansion															
Maximum Temperature (°F)	Dutch Harbor	1.6 mi NE	1/1/1951 to 9/30/2012	36.7	37.4	38.5	40.8	46.0	51.5	56.8	58.8	53.9	47.3	42.5	39.0
Minimum Temperature (°F)	Dutch Harbor	1.6 mi NE	1/1/1951 to 9/30/2012	28.0	27.8	28.2	31.4	36.7	41.8	45.9	47.6	43.5	37.3	32.1	30.3
Mean Temperature (°F)	Dutch Harbor	1.6 mi NE	1/1/1951 to 9/30/2012	32.4	32.6	33.3	36.2	41.4	46.7	51.3	53.3	48.6	42.3	37.3	34.6
Number of Days Less Than or Equal to 32°F (Freezing Point)	Dutch Harbor	1.6 mi NE	1/1/1951 to 9/30/2012	22.1	20.2	22.5	16.6	4.1	0.1	0.0	0.1	0.7	4.4	14.3	18.7
Mean Solar Radiation (Watts/m^2)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Barometric Pressure (inches Hg)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Wind Speed (mph)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	Na
Mean Relative Humidity (%)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Mean Total Precipitation (inches)	Dutch Harbor	na	1/1/1951 to 9/30/2012	7.13	6.20	5.25	3.42	3.98	2.50	2.21	2.76	5.54	7.09	6.66	7.90

Table 3.4-3: Average Monthly Climate Data Characteristic of Transportation Corridor

Parameter	Location of Closest Data Source	Distance from Project Area	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Snowfall (inches)	Dutch Harbor	na	1/1/1951 to 9/30/2012	23.8	19.6	16.8	6.8	0.2	0.0	0.0	0.0	0.0	0.5	7.1	17.4
Mean Snow Depth (inches)	Dutch Harbor	na	1/1/1951 to 9/30/2012	4	5	4	1	0	0	0	0	0	0	0	3
Sunrise Time[g] AM	Unalaska	0 miles	See note g	10:25	9:54	8:55	8:40	7:31	6:42	6:39	7:19	8:14	9:07	10:06	10:01
Sunset Time[g] PM	Unalaska	0 miles	See note g	5:54	6:46	7:42	9:40	10:36	11:26	11:41	11:06	9:59	8:45	7:34	5:49
Day Length (hours and minutes)[g,k]	Unalaska	0 miles	See note g	7h 29m	8h 52m	10h 46m	13h 0m	15h 5m	16h 45m	17h 3m	15h 47m	13h 45m	11h 38m	9h 28m	7h 49m

Notes:

a Synthetic dataset for temperature based on data from McGrath with a 1:1 correlation; therefore, no scaling applied (BGC 2011f).
b Calculated monthly averages based on available data.
c Synthetic dataset for wind speed based on data from Camp, American Ridge, and Hill 1918 (BGC 2011f).
d Synthetic dataset for relative humidity based on data from Camp, American Ridge, and Snow Ridge (BGC 2011f).
e Synthetic dataset for precipitation (snowfall plus rainfall) is based on Crooked Creek, scaled to Mine Site (scaling factor = 1.33) (BGC 2011f).
f In this column, distances and directions are provided using the Project Area as reference point (e.g., Camp synthetic is 0.8 miles E of Airstrip and 10 miles NE of north half of Mine Access Road). N = North; E = East; W = West; S = South.
g Daylight hours shown are hours of daylight for the first day of each month of Year 2014. As the length of time between sunrise and sunset should not change substantially from year to year, these figures can be used for approximations for other years as well.
h The longest daylight hours for Crooked Creek occur on June 20th through June 23rd for 19 hours and 41 minutes. The shortest daylight hours occur on December 20th through December 24th for 5 hours and 12 minutes (Sunrise Sunset 2015).
i The longest daylight hours for Aniak occur on June 19th through June 24th for 19 hours and 32 minutes. The shortest daylight hours occur on December 20th through December 24th for 5 hours and 19 minutes (Sunrise Sunset 2015).
j The longest daylight hours for Bethel occur between June 19th and June 24th for 19 hours and 10 minutes. The shortest daylight hours occur between December 20th and December 24th for 5 hours and 37 minutes (Sunrise Sunset 2015).
k The longest daylight hours for Unalaska occur between June 20th ad June 24th for 17 hours and 8 minutes. The shortest daylight hours occur between December 20th and December 24th for 7 hours and 23 minutes (Sunrise Sunset 2015).

Abbreviations:

BTC = Birch Tree Crossing °F = degrees Fahrenheit Hg = mercury m^2 = square meters mi. = miles mph = miles per hour
na = Not available. Climate data are considered "not available" if the nearest data source is located farther than 100 miles from the Project Area.

Sources: BGC 2011f; MMA 2007a,b,c, 2008e, 2009a,d,e, 2010b, 2011a,b,c, 2012a,b, c; WRCC 2013; Sunrise Sunset 2015.

The methodology for selecting meteorological data characteristic of each area is the same as that discussed in Section 3.4.1.1. Long-term data are available for temperature, number of days less than or equal to 32°F (freezing point), total precipitation, snowfall, and snow depth from NWS COOP stations at Crooked Creek, Aniak Airport, and Bethel Airport (corresponding period of record are as shown in Table 3.4-3). The Aniak and Bethel sites are located on the Kuskokwim River in the area of river traffic; the Crooked Creek site is also located on the Kuskokwim River 6 miles north of the Angyaruaq (Jungjuk) Port site. Climate data are considered "not available" (na) if the nearest data source is located farther than 100 miles from the Project Area.

3.4.1.4 PIPELINE

Table 3.4-4 lists the characteristic climate data in the vicinity of the Pipeline based on proximity to data collection sites. Data are provided for the following areas within the Pipeline Project Area (project footprint), listed from east to west:

- East End of Pipeline: including compressor station, main pipeline route from Milepost (MP) 0 to MP 30, Tyonek or Port MacKenzie Diesel Pipeline (Alternative 3B and options) from Tyonek to MP 0, and Tyonek Port site; or from Port MacKenzie to MP 28.
- MP 30 to MP 100 (includes Alternative 2-North Option route from about MP 85 to MP 100);
- MP 100 to MP 200 (includes Alternative 2-North Option route from MP 100 to MP 112);
- MP 200 to MP 260; and
- MP 260 to MP 316.

Donlin Gold, LLC did not collect climate data in the immediate vicinity of the Pipeline route. Data were collected at American Ridge, Camp, and Hill 1918 monitoring stations, which are in the vicinity of the west end of the Pipeline route. Regional NWS COOP climate stations are also located at Beluga, Skwentna, Farewell, McGrath, and Crooked Creek NWS COOP sites; and the Camp monitoring station are shown on Figure 3.4-4.

The methodology for selecting meteorological data characteristic of a given area is discussed in Section 3.4.1.1. Long-term data are available for temperature, number of days less than or equal to 32°F (freezing point), total precipitation, snowfall, and snow depth data from NWS COOP stations at Beluga, Skwentna, Farewell, and McGrath (corresponding period of record shown in Table 3.4-4). In relation to the nearest part of the Project Area, these locations are, respectively: 9 miles southwest of MP 0 (9 miles northeast of Tyonek diesel pipeline [Alternative 3B] origin); 6 miles north-northeast of MP 50; 2 miles north of MP 150; and 55 miles north of MP 225.

Climate data are considered not available if the nearest data source is located farther than 100 miles from the Project Area.

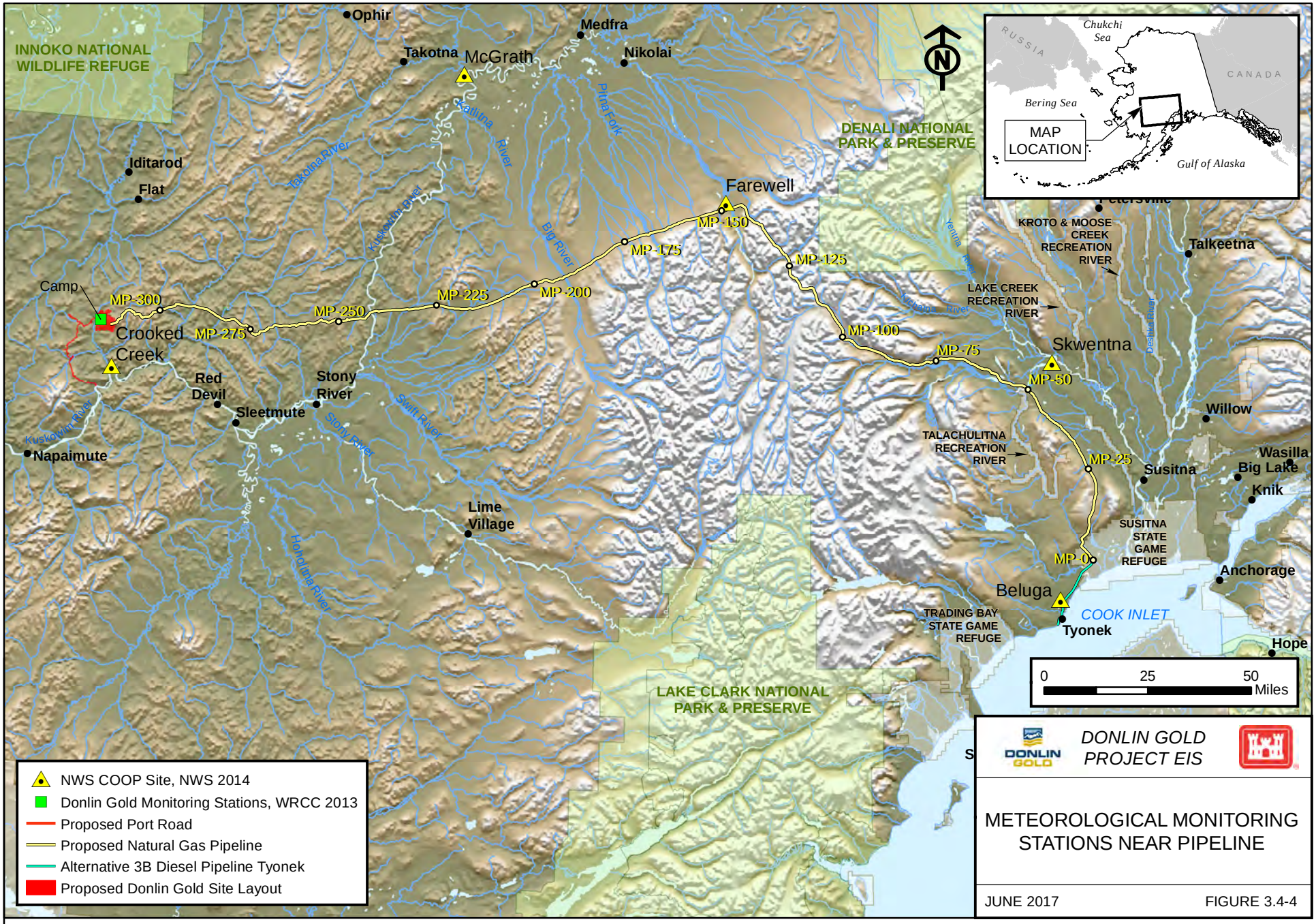

INNOKO NATIONAL WILDLIFE REFUGE
Ophir
Medfra
Takotna
McGrath
Nikolai
Kaiyuh Mountains
Kaiyuh River
Pitka Fork
DENALI NATIONAL PARK & PRESERVE
Iditarod
Flat
Takotna River
Kuskokwim River
Big River
Farewell
MP 150
MP 175
MP 125
Yentna River
KROTO & MOOSE CREEK RECREATION RIVER
Talkeetna
Camp
MP 300
MP 250
MP 225
MP 200
LAKE CREEK RECREATION RIVER
Crooked Creek
MP 275
MP 100
MP 75
Skwentna
Deshka River
MP 50
Red Devil
Stony River
Sleetmute
Swift River
Stony River
Willow
Kuskokwim River
Napaimute
TALACHULITNA RECREATION RIVER
MP 25
Susitna
Wasilla
Big Lake
Knik
Lime Village
Holitna River
SUSITNA STATE GAME REFUGE
MP 0
Anchorage
Beluga
COOK INLET
TRADING BAY STATE GAME REFUGE
Tyonek
Hope
LAKE CLARK NATIONAL PARK & PRESERVE
0
25
50
Miles
Chukchi Sea
RUSSIA
CANADA
Bering Sea
MAP LOCATION
Gulf of Alaska
NWS COOP Site, NWS 2014
Donlin Gold Monitoring Stations, WRCC 2013
Proposed Port Road
Proposed Natural Gas Pipeline
Alternative 3B Diesel Pipeline Tyonek
Proposed Donlin Gold Site Layout
DONLIN GOLD
DONLIN GOLD PROJECT EIS
METEOROLOGICAL MONITORING STATIONS NEAR PIPELINE
JUNE 2017
FIGURE 3.4-4

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
East End Pipeline: Compressor Station, Pipeline from MP 0 to MP 30, Tyonek to MP 0															
Maximum Temperature (°F)	Beluga	9 mi. SW to 36 mi. SSW	8/1/1973 to 6/30/1992	25.8	28.4	36.6	44.4	56.2	64.1	67.0	64.6	56.6	42.6	29.7	24.3
Minimum Temperature (°F)	Beluga	9 mi. SW to 36 mi. NNE	8/1/1973 to 6/30/1992	10.6	8.8	16.4	25.2	35.9	43.1	47.9	46.3	39.7	27.9	13.6	9.2
Mean Temperature (°F)	Beluga	9 mi. SW to 36 mi. SSW	8/1/1973 to 6/30/1992	18.2	18.6	26.5	34.8	46.0	53.6	57.5	55.5	48.2	35.3	21.7	16.7
Number of Days Less Than or Equal to 32°F (Freezing Point)	Beluga	9 mi. SW to 36 mi. SSW	1973 to 1992	29.8	27.2	29.2	24.9	8.6	0.1	0.0	0.3	5.1	20.6	28.0	29.9
Mean Total Precipitation (inches)	Beluga	9 mi. SW to 36 mi. SSW	8/1/1973 to 6/30/1992	1.64	1.24	1.27	0.93	1.05	1.46	2.21	3.49	5.40	4.01	1.97	2.38
Mean Snowfall (inches)	Beluga	9 mi. SW to 36 mi. SSW	8/1/1973 to 6/30/1992	11.6	9.7	11.7	3.0	1.0	0.0	0.0	0.0	0.0	0.0	13.7	23.4
Mean Snow Depth (inches)	Beluga	9 mi. SW to 36 mi. SSW	9/2/1949 to 11/30/1974	24	26	27	17	1	0	0	0	0	1	7	17
Sunrise Time[g] AM	Tyonek	0 mi. to 30 mi. NW	See note g	10:18	9:26	8:07	7:30	5:58	4:43	4:34	5:37	6:56	8:10	9:31	9:48
Sunset Time[g] PM	Tyonek	0 mi. to 30 mi. NW	See note g	3:59	5:11	6:28	8:48	10:06	11:22	11:43	10:45	9:14	7:39	6:06	3:59
Day Length (hours and minutes)[g,h]	Tyonek[h]	0 mi. to 30 mi. NW	See note g	5h 41m	7h 45m	10h 21m	13h 18m	16h 8m	18h 38m	19h 9m	17h 8m	14h 18m	11h 29m	8h 36m	6h 11m

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pipeline from MP 30 to MP 100 (including North Option MP 85 to MP 100)															
Maximum Temperature (°F)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	16.2	23.5	34.1	45.0	57.6	67.0	69.6	65.8	55.8	40.0	24.4	17.4
Minimum Temperature (°F)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	-2.1	1.6	9.1	23.4	33.4	43.3	47.3	44.9	36.1	24.1	9.3	0.6
Mean Temperature (°F)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	7.1	12.4	21.6	34.2	45.5	55.2	58.4	55.2	45.9	32.2	16.9	9.0
Number of Days Less Than or Equal to 32°F (Freezing Point)	Skwentna	22 mi. NNW to 51 mi. ESE	1949 to 2012	30.1	27.2	30.1	26.1	12.1	0.9	0.0	0.8	9.6	24.5	28.6	30.1
Mean Total Precipitation (inches)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	2.18	1.87	1.11	1.00	1.10	1.41	2.33	3.44	3.89	3.30	2.30	2.82
Mean Snowfall (inches)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	22.3	19.6	11.6	6.4	0.1	0.0	0.0	0.0	0.5	11.0	19.6	28.6
Mean Snow Depth (inches)	Skwentna	22 mi. NNW to 51 mi. ESE	9/1/1949 to 9/30/2012	32	38	38	26	2	0	0	0	0	2	10	22
Sunrise Time[g] AM	Skwentna	22 mi. NNW to 51 mi. ESE	See note g	10:29	9:32	8:10	7:29	5:53	4:33	4:22	5:31	6:54	8:11	9:36	9:58
Sunset Time[g] PM	Skwentna	22 mi. NNW to 51 mi. ESE	See note g	4:54	5:58	6:27	8:50	10:12	11:33	11:56	10:53	9:18	8:23	6:03	3:51
Day Length (hours and minutes)[g,i]	Skwentna[i]	22 mi. NNW to 51 mi. ESE	See note g	5h 21m	7h 34m	10h 17m	13h 21m	16h 19m	19h 0m	19h 34m	17h 22m	14h 24m	11h 28m	8h 27m	5h 54m

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pipeline from MP 100 to MP 200 (including North Option MP 100 to MP 112)															
Maximum Temperature (°F)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	7.4	20.2	28.0	44.1	57.6	67.1	69.8	64.7	53.5	35.1	15.6	15.4
Minimum Temperature (°F)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	-12.6	-4.0	0.1	19.7	34.2	42.7	47.1	43.6	33.0	16.2	-4.3	-5.5
Mean Temperature (°F)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	-2.8	8.0	14.0	32.4	46.0	55.1	58.5	54.2	43.2	25.7	5.7	4.9
Number of Days Less Than or Equal to 32°F (Freezing Point)	Farewell	43 mi. NW to 51 mi. NE	1985 to 2009	29.8	26.6	29.6	24.8	12.9	1.2	0.2	2.7	13.6	26.0	29.8	29.0
Mean Total Precipitation (inches)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	0.59	0.45	0.35	0.32	0.92	1.79	2.84	3.03	2.10	1.21	1.46	0.83
Mean Snowfall (inches)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	9.1	7.2	5.3	4.2	1.6	0.0	0.0	0.0	2.1	11.7	12.4	10.9
Mean Snow Depth (inches)	Farewell	43 mi. NW to 51 mi. NE	4/1/1985 to 2/28/2009	8	7	8	3	0	0	0	0	0	2	5	8
Sunrise Time[g]	Denali National Park	80 mi. NW to 50 mi. N	See note g	10:41 am	9:34 am	8:04 am	7:16 am	5:32 am	3:59 am	3:42 am	5:06 am	6:38 am	8:03 am	9:35 am	10:07 am
Sunset Time[g]	Denali National Park	80 mi. NW to 50 mi. N	See note g	3:17 pm	4:44 pm	6:12 pm	8:43 pm	10:14pm	11:48pm	12:17am	10:59pm	9:13 pm	7:28 pm	5:44 pm	3:22 pm
Day Length (hours and minutes)[g,j]	Denali National Park[j]	80 mi. NW to 50 mi. N	See note g	4h 35m	7h 10m	10h 9m	13h 28m	16h 42m	19h 50m	20h 34m	17h 53m	14h 35m	11h 25m	8h 9m	5h 15m

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pipeline from MP 200 to MP 260															
Maximum Temperature (°F)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/30/2012	1.0	11.4	22.9	39.1	56.0	66.8	68.5	63.2	52.9	32.3	13.0	2.2
Minimum Temperature (°F)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/30/2012	-17.2	-11.3	-3.8	16.7	34.9	45.8	49.5	45.4	35.8	18.9	-2.8	-14.8
Mean Temperature (°F)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/30/2012	-8.1	0.0	9.6	27.9	45.4	56.3	59.0	54.3	44.4	25.6	5.2	-6.3
Number of Days Less Than or Equal to 32°F (Freezing Point)	McGrath	53 mi. NNW to 72 mi. NE	1939 to 2012	30.9	28.1	30.7	27.9	10.8	0.2	0.0	0.9	9.9	27.8	29.7	30.9
Mean Solar Radiation (Watts/m^2)	American Ridge[b]	46 mi. E to 103 mi. E	2005 to 2010	7	35	102	166	216	192	181	136	83	39	14	4
Mean Barometric Pressure (inches Hg)	Camp[b]	48 mi. E to 105 mi. E	5/1/2006 to 4/30/2012	28.81	28.89	28.83	28.93	29.05	29.03	29.04	28.99	28.68	28.75	28.77	28.77
Mean Wind Speed (mph)	Camp Synthetic[c]	48 mi. E to 105 mi. E	1940 to 2010	6.4	8.4	8.4	8.3	7.3	6.9	6.6	6.8	6.9	6.8	7.0	6.7
Mean Relative Humidity (%)	Camp Synthetic[d]	48 mi. E to 105 mi. E	1940 to 2010	77.0	78.1	66.6	65.7	60.8	65.6	74.2	79.2	78.9	84.9	82.5	79.2
Mean Total Precipitation (inches)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/30/2012	0.99	0.85	0.79	0.71	0.91	1.60	2.27	2.91	2.29	1.37	1.27	1.22
Mean Snowfall (inches)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/-30/2012	9.1	7.2	5.3	4.2	1.6	0.0	0.0	0.0	2.1	11.7	12.4	10.9
Mean Snow Depth (inches)	McGrath	53 mi. NNW to 72 mi. NE	4/1/1939 to 9/30/2012	23.9	19.6	18.4	4.5	0.0	0.0	0.0	0.0	0.0	3.1	17.1	23.7
Sunrise Time[g] AM	McGrath	53 mi. NNW to 72 mi. NE	See note g	10:57	9:55	8:29	7:44	6:04	4:37	4:24	5:39	7:08	8:29	9:57	10:24 am

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sunset Time[g] PM	McGrath	53 mi. NNW to 72 mi. NE	See note g	3:54pm	5:16 pm	6:41 pm	9:09 pm	10:35 pm	12:03 am	12:28 am	11:18pm	9:37 pm	8:41 pm	6:14 pm	3:58 pm
Day Length (hours and minutes)[g,k]	McGrath[k]	53 mi. NNW to 72 mi. NE	See note g	4h 57m	7h 21m	10h 12m	13h 25m	16h 31m	19h 26m	20h 5m	17h 39m	14h 30m	11h 26m	8h 17m	5h 33m
Pipeline from MP 260 to MP 316															
Maximum Temperature (°F)	Camp Synthetic[a]	3 mi. WSW to 48 mi. W	1940 to 2010	1	11	23	39	56	67	69	63	53	32	13	2
Minimum Temperature (°F)	Camp Synthetic[a]	3 mi. WSW to 48 mi. W	1940 to 2010	-16	-10	-3	17	35	46	49	45	36	19	-2	-14
Mean Temperature (°F)	Camp Synthetic[a]	3 mi. WSW to 48 mi. W	1940 to 2010	-7	1	10	28	46	56	59	55	44	26	6	-6
Number of Days Less Than or Equal to 32°F (Freezing Point)	Crooked Creek	10 mi. WSW to 47 mi. WSW	1949 to 1974	30.4	27.2	29.9	26.1	15.4	1.7	0.7	2.3	11.5	25.8	28.9	30.6
Mean Solar Radiation (Watts/m^2)	American Ridge[b]	1 mi. WSW to 46 mi. W	2005 to 2010	7	35	102	166	216	192	181	136	83	39	14	4
Mean Barometric Pressure (inches Hg)	Camp[b]	3 mi. WSW to 48 mi. W	5/1/2006 to 4/30/2012	28.81	28.89	28.83	28.93	29.05	29.03	29.04	28.99	28.68	28.75	28.77	28.77
Mean Wind Speed (mph)	Camp Synthetic[c]	3 mi. WSW to 48 mi. W	1940 to 2010	6.4	8.4	8.4	8.3	7.3	6.9	6.6	6.8	6.9	6.8	7.0	6.7
Mean Relative Humidity (%)	Camp Synthetic[d]	3 mi. WSW to 48 mi. W	1940 to 2010	77.0	78.1	66.6	65.7	60.8	65.6	74.2	79.2	78.9	84.9	82.5	79.2
Total Precipitation (inches)	Camp Synthetic[e]	3 mi. WSW to 48 mi. W	1940 to 2010	1.16	0.89	0.80	0.40	1.05	2.15	2.61	3.70	2.66	1.74	1.17	1.30
Mean Precipitation from Rainfall (inches)	Camp Synthetic[e]	3 mi. WSW to 48 mi. W	1940 to 2010	0.00	0.00	0.16	0.36	1.05	2.15	2.61	3.70	2.66	0.89	0.00	0.00

Table 3.4-4: Average Monthly Climate Data Characteristic of Pipeline

Parameter	Location of Closest Data Source	Distance from Project Area[f]	Period of Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Precipitation from Snowfall (inches)	Camp Synthetic[e]	3 mi. WSW to 48 mi. W	1940 to 2010	1.16	0.89	0.64	0.04	0.00	0.00	0.00	0.00	0.00	0.85	1.17	1.30
Mean Snow Depth (inches)	Crooked Creek	10 mi. WSW to 47 mi. WSW	9/2/1949 to 11/30/1974	15	13	11	4	0	0	0	0	0	0	4	8
Sunrise Time[g] AM	Crooked Creek	10 mi. WSW to 47 mi. WSW	See note g	10:54	9:58	8:36	7:56	6:21	5:01	4:51	5:59	7:21	8:38	10:02	10:23
Sunset Time[g] PM	Crooked Creek	10 mi. WSW to 47 mi. WSW	See note g	4:17	5:33	6:54	9:1	10:38	11:59	12:21AM	11:19	9:44	8:06	6:30	4:19
Day Length (hours and minutes)[g, l]	Crooked Creek[l]	10 mi. WSW to 47 mi. WSW	See note g	5h 23m	7h 35m	10h 18m	13h 21m	16h 16m	18h 57m	19h 31m	17h 20m	14h 23m	11h 28m	8h 28m	5h 56m

Notes:

a Synthetic dataset for temperature based on data from McGrath with a 1:1 correlation; therefore, no scaling applied (BGC 2011f).
b Calculated monthly averages based on available data.
c Synthetic dataset for wind speed based on data from Camp, American Ridge, and Hill 1918 (BGC 2011f).
d Synthetic dataset for relative humidity based on data from Camp, American Ridge, and Snow Ridge (BGC 2011f).
e Synthetic dataset for precipitation (snowfall plus rainfall) is based on Crooked Creek, scaled to Mine Site(scaling factor = 1.33) (BGC 2011f).
f In this column, distances and directions are provided using the Project Area as reference point (e.g., Camp synthetic is 3 miles WSW of Pipeline Mile Post 313 and 48 miles W of Mile Post 260). N = North; E = East; W = West; S = South.
g Daylight hours shown are hours of daylight for the first day of each month of calendar year 2014. As the length of time between sunrise and sunset should not change substantially from year to year, these figures can be used for approximations for other years as well.
h The longest daylight hours for Tyonek occur on June 19th through June 24th for 19 hours and 18 minutes. The shortest daylight hours occur on December 21st through December 23rd for 5 hours and 30 minutes (Sunrise Sunset 2015).
i The longest daylight hours for Skwentna occur on June 19th through June 24th for 19 hours and 44 minutes. The shortest daylight hours occur on December 21st through December 23rd for 5 hours and 9 minutes (Sunrise Sunset 2015).
j The longest daylight hours for Denali National Park occur on June 21st through June 22nd for 20 hours and 49 minutes. The shortest daylight hours occur on December 20th through December 24th for 4 hours and 21 minutes (Sunrise Sunset 2015).
k The longest daylight hours for McGrath occur on June 20th through June 23rd for 20 hours and 17 minutes. The shortest daylight hours occur on December 20th through December 24th for 4 hours and 44 minutes (Sunrise Sunset 2015).
l The longest daylight hours for Crooked Creek occur on June 20th through June 23rd for 19 hours and 41 minutes. The shortest daylight hours occur on December 20th through December 24th for 5 hours and 12 minutes (Sunrise Sunset 2015).

°F = degrees Fahrenheit Hg = mercury m^2 = square meters mph = miles per hour na = not available

Sources: BGC 2011f; MMA 2007a,b,c, 2008e, 2009a,d,e, 2010a,b, 2011b, 2012b; WRCC 2013; Sunrise Sunset 2015.

3.4.2 ENVIRONMENTAL CONSEQUENCES

Climate pertains to long-term weather conditions and is characterized by meteorological parameters listed in Affected Environment, Section 3.4.1 such as temperature, solar radiation, barometric pressure, wind speed, relative humidity, or precipitation. A change to these parameters is referred to as global climate change. These parameters are influenced by natural (e.g., mountains, oceans, solar impacts) and anthropogenic (e.g., land use) features. Recently the Intergovernmental Panel on Climate Change (IPCC) has found that climate change is extremely likely to be caused by human influences, specifically the release of greenhouse gases that affect Earth's absorption of solar radiation (IPCC 2013). The effect of (future) global climate change on many resources is being included as part of the cumulative impact discussion (Chapter 4, Cumulative Effects) as a reasonably foreseeable future action. Impacts to physical, biological, and social resources associated with climate change are discussed in Section 3.26, Climate Change.

3.4.2.1 ALTERNATIVE 1 – NO ACTION

Under the No Action Alternative, Donlin Gold would not establish a Mine Site, construct a natural gas pipeline, or develop transportation facilities. Therefore, no direct or indirect effects to climate or meteorological resources would occur.

3.4.2.2 ALTERNATIVES 2, 3A, 3B, 4, 5A, AND 6A

Any climate or meteorological impacts that would be attributable to the Donlin Gold Project would be due to air pollutants emitted during project operations and to the project's small contribution to global greenhouse gas emissions. Pollutant and dust impacts may vary with time but could increase haze and reduce solar radiation and affect temperature and even precipitation slightly in the vicinity of the Project Area. The relative high humidity, and low intensity and longer duration of precipitation events will make erosion control during construction and operations more manageable under this climate regime. Climate impacts related to global climate change are discussed in Section 3.26, Climate Change.