# APPENDIX Q PROJECT VEGETATION FIELD STUDY REPORTS

The following report * is included in this Appendix.

**2015 VEGETATION FIELD STUDY REPORT (USAI-P1-SRZZZ-00-000006-000)**

APPENDIX A 2015 VEGETATION FIELD SURVEY PROTOCOLS

APPENDIX A VEGETATION CLASSIFICATION DATA FORMS

APPENDIX B WETLAND AND VEGETATION SURVEY GEAR LIST

APPENDIX C QA/QC CHECKLIST

APPENDIX B 2015 WETLAND AND VEGETATION FIELD DATA SUMMARY TABLE AND DATA FORMS **

APPENDIX C 2015 WETLAND DELINEATION MAPS ***

* Note: The 2016 Wetland and Vegetation Field Study Report (USAI-P1-SRZZZ-00-000016-000), is found in Appendix G of Resource Report No. 2

** Note: Wetland and Vegetation Field Data Summary Table and Data Forms are provided digitally under separate cover

*** Note: The Wetland delineation maps are provided in Appendix F of Resource Report No. 2

Alaska LNG™

# 2015 VEGETATION FIELD STUDY REPORT

## USAI-P1-SRZZZ-00-000006-000

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# 1.0 PURPOSE AND SCOPE

This Vegetation Field Study Report provides an interim review of the vegetation cover types that were classified, mapped and field surveyed for the Alaska Liquefied Natural Gas (LNG) Project (Project) during the 2015 field season. The area that was surveyed in 2015 includes the proposed Project's Revision (Rev) B route from Nikiski milepost (MP) 804, northwest across Cook Inlet to Beluga (MP 764) then north along the Rev B route to the Brooks Range foothills where the northern extent of field data collection occurred (approximately milepost, MP, 86) (Figure 1-1). Results presented in this report include the entire Rev B route and off right-of-way (ROW) roads and facilities.

## 1.1 PROJECT DESCRIPTION

Please see Project Description at the beginning of this Resource Report.

## 1.2 PURPOSE

Information concerning vegetation which may be impacted by the Project is required as part of the National Environmental Policy Act (NEPA) process. The data will constitute baseline information included in Resource Report No. 3 of the Environmental Report and the subsequent Environmental Impact Statement (EIS) which will be developed to analyze potential Project-related direct, indirect, and cumulative impacts.

Specific objectives of this vegetation field study included:

- Completing vegetation surveys along the proposed Rev B alignment; and
- Using field survey results to update aerial imagery based vegetation mapping.

Pre-field vegetation mapping was conducted using aerial imagery to identify vegetation cover types which may be impacted by the Project. In 2015, field surveys were then conducted to verify the accuracy of the vegetation cover types and boundaries identified during the pre-field mapping effort, and to further characterize the plant communities. Field data is then used to improve the accuracy of future Project vegetation mapping efforts.

## 1.3 STUDY AREA

The 2015 field season focused on the Project's proposed Rev B route, which contained centerline modifications from the 2014 Vegetation Field Study Report (Rev A 90% confidence route). Field verification of vegetation communities during the 2015 season occurred from the southern terminus of the route at Nikiski, Alaska, (MP 804) to Cook Inlet at MP 792, and the west side of Cook Inlet (MP 764), along the Rev B route to the Brooks Range foothills near MP 86, which was the furthest extent north that 2015 field work was conducted.

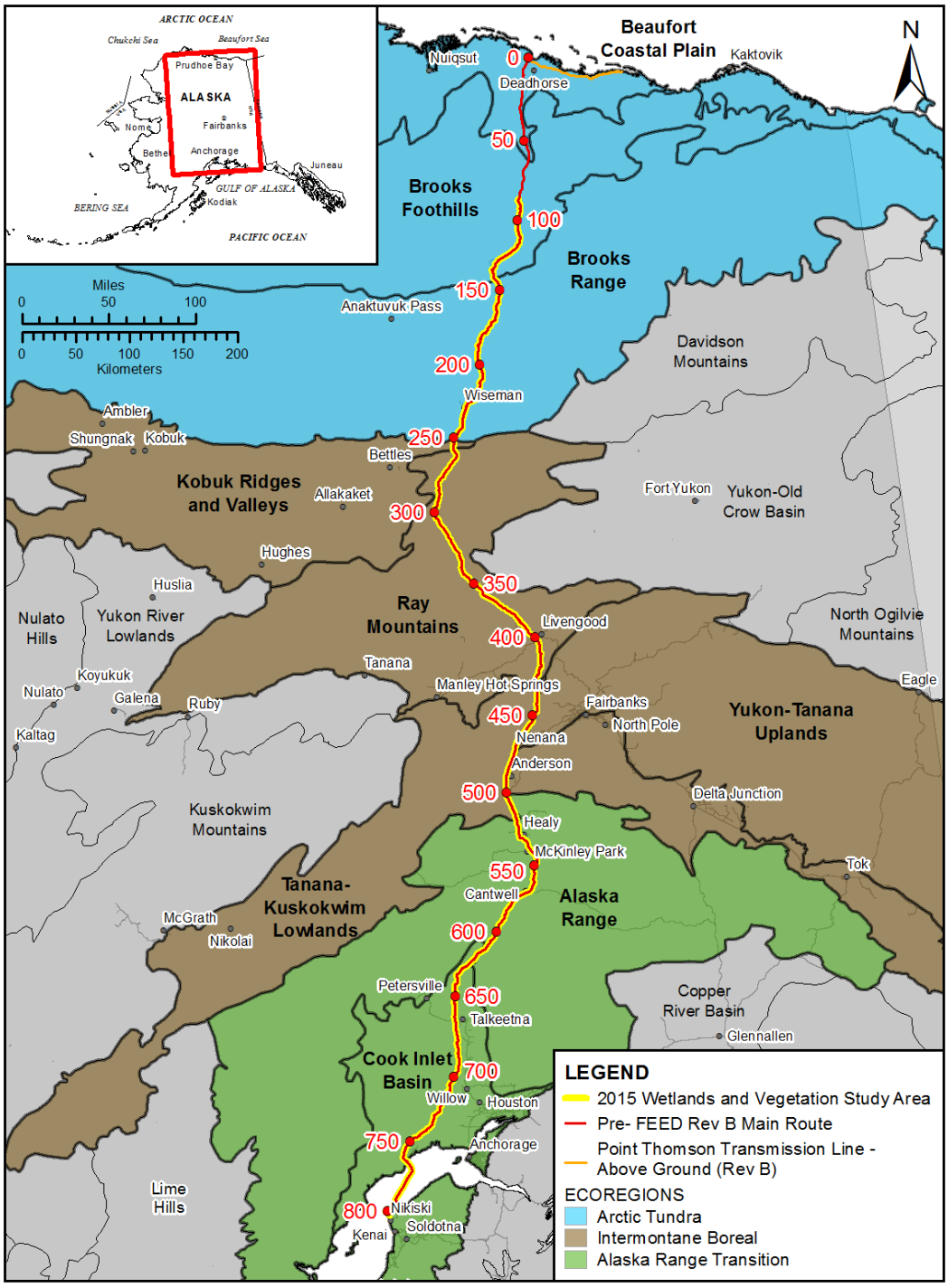
The survey area included in this 2015 Vegetation Field Study Report corresponds to the 2000 foot wide corridor used for the mapping of wetlands and waterbodies. Field work was primarily concentrated within the field survey corridor to ensure that it occurred near areas most likely to be disturbed by the proposed project. Proposed off-ROW access roads and facilities footprints (those added to the route prior to September 9, 2015) were also included in the field survey and mapping.

The Project route passes through three ecoregions, with nine sub-ecoregions (Figure 1-1), as described by Nowacki et al. (2001):

- Alaska Range Transition Ecoregion
  - Cook Inlet Basin Sub-Ecoregion
  - Alaska Range Sub-Ecoregion
- Intermontane Boreal Ecoregion
  - Tanana-Kuskokwim Lowlands Sub-Ecoregion
  - Yukon-Tanana Uplands Sub-Ecoregion
  - Ray Mountains Sub-Ecoregion
  - Kobuk Ridges and Valleys Sub-Ecoregion
- Arctic Tundra Ecoregion
  - Brooks Range Sub-Ecoregion
  - Brooks Foothills Sub-Ecoregion
  - Beaufort Coastal Plain Sub-Ecoregion

Ecoregions are defined as a unit of land or water with a geographically distinct compilation of species, communities, and environmental conditions (World Wildlife Fund 2015). The Alaska LNG corridor begins in the Cook Inlet Basin, continues through the Alaska Range, and then through the Tanana-Kuskokwim Lowlands, Yukon-Tanana Uplands, Ray Mountains, Kobuk Ridges and Valleys, then up through the Brooks Range and Brooks Foothills before ending in the Beaufort Coastal Plain. Each ecoregion is described below.

**Figure 1-1. Ecoregions within the Alaska LNG Study Area**



### 1.3.1 Alaska Range Transition Ecoregion

The mountains of the Alaska Range are very high and steep. Much of the area on steep mountain slopes is barren of vegetation, but high elevation valley bottoms contain dwarf scrub communities on windswept sites. The Alaska Range has a cold subarctic continental climate. With elevations ranging from 2000 feet to 13,000 feet, and some peaks as high as 20,000 feet, the area experiences a wide range of climatic conditions. The region was heavily glaciated in the late Pleistocene, and glaciers still occupy many valleys. Streams are generally glacial fed, swift and braided with heavy sediment loads. Dwarf and low scrub communities are common and open needleleaf forests and woodlands occur primarily on well drained sites at lower elevations.

#### 1.3.1.1 Cook Inlet Basin Sub-Ecoregion

The Cook Inlet Basin Sub-Ecoregion is located in Southcentral Alaska, adjacent to Cook Inlet. The project begins within the Cook Inlet Basin at Nikiski (MP 804) and exits this sub-ecoregion at MP 616.5 in Denali State Park. The area is dominated primarily by spruce and birch, with cottonwood and willow along riparian habitats and thick alder on upland slopes. The terrain is level to rolling with an elevation range from sea level to 2,000 feet. The basin is generally permafrost free.

According to Gallant et al. (1995), needleleaf forests are widespread and dominated by white spruce (*Picea glauca*), black spruce (*P. mariana*), and Sitka spruce (*P. sitchensis*). Broadleaf forests are dominated by quaking aspen (*Populus tremuloides*), balsam poplar (*P. balsamifera*), black cottonwood (*P. trichocarpa*), and Alaska paper birch (*Betula neoalaskana*). Mixed forests are co-dominated by combinations of these needle-leaf and broadleaf tree species with alders (*Alnus spp.*) often providing a tall shrub layer under the forest canopy. Low growing shrubs commonly include resin birch (*Betula glandulosa*), dwarf birch (*B. nana)*, prickly rose (*Rosa acicularis*), willow (*Salix spp.*), bog Labrador-tea (*Rhododendrum groenlandicum*), and other ericaceous species. Dry to mesic sites support a variety of grasses including rough fescue (*Festuca altaica*), red fescue (*F. rubra*), Bering's tufted hairgrass (*Deschampsia beringensis*), large-flower blue grass (*Poa eminens*), and purple reedgrass (*Calamagrostis purpurascens*). Forbs associated with these dry to mesic sites include larkspur-leaf monkshood (*Aconitum delphinifolium*) and tall bluebells (*Mertensia paniculata*) with low shrubs such as lingonberry (*Vaccinium vitis-idaea)*, black crowberry (*Empetrum nigrum)*, net-vein willow (*Salix reticulata*) and woolly willow (*S. lanata)*. Feathermosses (*Pleurozium schreberi* and *Hylocomium splendens*) sometimes form a patchy to continuous moss layer. Sphagnum mosses may occur. Mesic to moist sites support graminoid communities dominated by bluejoint grass (*C. Canadensis*), with herbs such as narrow-leaf fireweed (*Chamerion angustifolium)*, seacoast angelica (*Angelica lucida*), western lady fern *(Athyrium cyclosorum*), field horsetail *(Equisetum arvense*) and water horsetail (*E. fluviatile*).

#### 1.3.1.2 Alaska Range Sub-Ecoregion

The corridor enters the Alaska Range Sub-Ecoregion at approximately MP 616.5 in Denali State Park and exits to the north at MP 516.5 north of Healy. Nowacki et al. (2001) states that because of the Alaska Range's high elevation, "a cold continental climate prevails and much of the area is barren of vegetation". However, the corridor passes through valley bottoms in this sub-ecoregion that are typically dominated by willow, shrub birch (*Betula spp.*), and alder communities. According to Gallant et al. (1995) dwarf scrub communities are most common where vegetation does occur, growing on well drained, windswept sites. More protected slopes provide moist to mesic conditions that support low or tall scrub communities. Open needleleaf forests and woodlands occur primarily on well drained sites in the lower valleys along the route, and on lower hillslopes. Dwarf scrub communities are typically dominated by mountain-avens (*Dryas spp.*), ericaceous species (such as, lingonberry, bog blueberry *(V. uliginosum*), white arctic mountain-heather *(Cassiope tetragona*), black torpedoberry *(Arctous alpina*), and red topedoberry (*A.*

*rubra*), or combinations of these species. Graminoid species, such as Canadian single-spike sedge (*Carex scirpoidea)* and Bigelow's sedge (*C. bigelowii*) and alpine holygrass (*Anthoxanthum monticola*), may be present and may even codominate with shrubs. Low scrub communities are dominated by resin and dwarf birch, and ericaceous shrubs or by willows. Common herbs are rough fescue, alpine holygrass, Bigelow's sedge, arctic sweet coltsfoot (*Petasites frigidus*), and arctic wormwood (*Artemisia norvegica*). Tall scrub communities occur at the altitudinal treeline, along streambanks, in drainages, and on floodplains. These communities are dominated by felt-leaf willow (*S. alaxensis*), little-tree willow (*S. arbusculoides*), diamond-leaf willow *(S. pulchra*), and woolly willow, alder, a mixture of willow and alder, or a mixture of willow and shrub birch. Low shrubs, such as Alaska bog willow (*S. fuscescens*), Beauverd spirea (*Spiraea stevenii*), narrow-leaf Labrador-tea (*R. decumbens*), and bog blueberry, occur in the more open stands.

### 1.3.2 Intermontane Boreal Ecoregion

The vegetation of the Intermontane Boreal Forest Ecoregion is a complex array of plant communities shaped by fire, soil temperature, drainage, aspect and exposure (Alaska Department of Natural Resources [ADNR], 2011). Throughout this ecoregion, expanses of boreal forests of both needleleaf and deciduous species are dissected by broad, flat river floodplains and a diversity of wetlands. This ecoregion spans most of the central portion of the state, east to the border (Nowacki et al., 2001).

A continental subarctic climate prevails, marked by short, warm summers and long, cold winters (Wiken et al., 2011). The mean annual temperature for the area is approximately 10.4°F, with a summer and winter mean temperature of 50.9°F and -9.4°F, respectively. The frost-free period ranges from 20 to 70 days. The western part of the region is generally wetter; there, mean annual precipitation ranges from between 11.8 to 35.4 inches on the higher mountains (Wiken et al., 2011).

#### 1.3.2.1 Tanana-Kuskokwim Lowlands Sub-Ecoregion

The route enters the Tanana-Kuskokwim Lowlands north of Healy (MP 516.5) and approaches the boundary with the Yukon-Tanana Uplands near MP 455 where it weaves along the boundary, in and out until MP 430.3. The route passes through a large alluvial plain along the Tanana and Nenana rivers and tributaries, and extends through the lower-lying areas north of Nenana to Livengood. In this area, undifferentiated sediments of fluvial and glaciofluvial origin are capped by varying thicknesses of eolian silts and organic soils (Nowacki et al., 2001). Surface moisture is rather abundant due to the gentle topography, patches of impermeable shallow permafrost, and poor soil drainage in fine textured eolian deposits. Permafrost is thin and discontinuous, and temperatures are near the melting point. Collapse-scar bogs and fens caused by subsiding permafrost are frequent (Nowacki et al., 2001).

The region has a dry sub-arctic, continental-influenced climate, marked by cool to mild summers and long, cold winters. Summer temperatures can be relatively warm. The mean annual temperature for the area is approximately 14.5°F, with a summer and winter mean temperature of 45.5°F and -14.8°F, respectively. Mean annual precipitation ranges between 7.9 to 31.5 inches and mostly occurs during summer convective storms (Wiken et al., 2011).

Boreal forest communities of needleleaf, deciduous, and mixed forest occur as a result of the interplay of permafrost, surface water, fire, local elevation relief, and hill slope aspect. Lightning fires are very frequent. Black spruce woodland and dwarf tree communities occur in bogs, with tamarack (*Larix laricina*) in low, wet areas. White spruce and balsam poplar are common along rivers. Active floodplains and river bars support stands of tall alders and willows. South-facing slopes support stands of white spruce, Alaska paper birch, and aspen (Nowacki et al., 2001). The coldest, wettest areas tend to occur on permafrost flats that support birch, ericaceous shrubs and sedge (*Carex spp.*) and tussock cottongrass (*Eriophorum vaginatum*). Wet sedge meadows and

aquatic vegetation occur in sloughs and oxbow ponds. Tall willow, resin birch, and alder communities are scattered throughout (Nowacki et al., 2001).

#### 1.3.2.2 Yukon-Tanana Uplands Sub-Ecoregion

A small section of the Project (MP 455 to 442.7) passes through the Yukon-Tanana Uplands. Within this region, the hillsides adjacent to the Tanana River are within the Yukon-Tanana Uplands, whereas the lower elevations along the Tanana River are within the Tanana-Kuskokwim Lowlands. Several acres of off-corridor access routes identified east of the route are also within the Yukon-Tanana Uplands.

The vegetation is dominated by black spruce woodlands, especially on north-facing slopes, while white spruce, Alaska paper birch, and aspen usually are restricted to warm, south-facing slopes. Black spruce grows in muskegs, lowlands, and on north-facing slopes where the annual thaw is shallow and permafrost is close to the surface (Nowacki et al., 2001). The largest black spruce trees generally reach diameters of seven inches at breast height and heights of 56 feet, but many are no larger than four inches diameter at breast height and 30 feet tall (ADNR, 2011). Black spruce stands are the most widespread of all stand types in the interior, and some stands contain tamarack and Alaska paper birch. The black spruce trees in muskegs and woodlands are typically scattered and stunted, and the understory is dominated by mosses, sedges, the tussock-forming cottongrass, ericaceous shrubs, and herbs such as roundleaf sundew (*Drosera rotundifolia*) (ADNR, 2011). Bogs, fens, shrub swamps, and other wetlands are also common in this region. Scrub-graminoid herbaceous communities, including willow, dwarf birch, Labrador-tea, and shrubby cinquefoil (*Dasiphora fruticosa*) occupy lowland bogs and other very wet areas (ADNR, 2011).

Floodplains are dominated by white spruce, balsam poplar, alders, and willows (Nowacki et al., 2001). Resin birch and Dryas-lichen tundra prevail at higher elevations. Black spruce woodlands, sedge-tussock communities, and scrub bogs are common in valley bottoms. Above the tree line, dwarf birch, ericaceous shrubs, and Dryas-lichen tundra are the dominants. The highest elevations are mostly barren (Nowacki et al., 2001).

This region has one of the highest incidences of lightning strikes in Alaska and wildfires are common (Nowacki et al., 2001).

#### 1.3.2.3 Ray Mountains Sub-Ecoregion

The route enters the Ray Mountains about 25 miles south of Livengood (MP 430.3) and exits the sub-ecoregion at MP 257.1, which is about four miles north of the South Fork Koyukuk River. This sub-ecoregion consists of an overlapping series of compact, east-west trending ranges underlain by the Ruby terrane that includes low hills both north and south of the Yukon River. The Ray Mountains consist of metamorphic bedrock usually covered with rubble, and soils are subsequently shallow and rocky. Permafrost is generally discontinuous and ranges from thin to moderately thick (Nowacki et al., 2001). The climate is strongly continental, with dry, cold winters and somewhat moist, warm summers. Precipitation increases with elevation (Wiken et al., 2011).

The vegetation throughout this region is dominated by black spruce woodlands and dwarf tree communities, while closed and open mixed needleleaf and deciduous forests of white spruce, Alaska paper birch, and aspen usually are restricted to warm, south-facing slopes (Nowacki et al. 2001). Floodplains are dominated by white spruce, balsam poplar, alders, and willows. Forest understory varies greatly with stand density and the amount of moisture on the forest floor. Common tall shrubs found in various mixtures in white spruce forests include green alder (*Alnus viridis ssp. fruticosa*) and Bebb willow (*Salix bebbiana*), common low shrubs include narrowed-leaved Labrador-tea (*Rhododendrum tomentosum*), bog blueberry, and especially lingonberry. In mixed forest stands on floodplains, horsetail (*Equisetum spp.*) is a major ground cover, with feathermosses and foliose lichens prominent in the moist habitats (Nowacki et al., 2001). Resin

birch and Dryas-lichen tundra prevail at higher elevations. Forest fires only occasionally occur in the summer in the Ray Mountains Sub-Ecoregion (Nowacki et al., 2001).

#### 1.3.2.4 Kobuk Ridges and Valleys Sub-Ecoregion

The route passes briefly through the east tip of the Kobuk Ridges and Valleys (MP 257.1 to 252). Forests and woodlands dominate much of the valley bottoms and mountainsides of the Kobuk Ridges and Valleys Sub-Ecoregion with black spruce in wetland bogs, white spruce and balsam poplar along rivers, and white spruce, Alaska paper birch, and aspen on well-drained uplands. Tall and short shrublands of willow, birch, and alder communities occur on ridges. Trees become increasingly sparse, less robust, and restricted to lower elevations in the west – here forests are slowly invading along rivers and streams (e.g., lower Noatak River) (Nowacki et al., 2001).

Needleleaf, broadleaf, and mixed forests occur over a variety of sites. Tall shrub communities which may include felt-leaf willow (*S. alaxensis*), gray-leaf willow (*S. glauca*), woolly willow, green alder (*Alnus viridis* ssp. *Fruticose*), and Sitka alder (*Alnus viridis* ssp. *sinuata*) grow in areas of newly exposed alluvium, such as floodplains, streambanks, drainageways, and lake margins, on burned or otherwise disturbed areas, and near timberline. Low scrub communities (gray-leaf willow, diamond-leaf willow, woolly willow, resin birch, dwarf birch, green alder, high-bush cranberry *(Viburnum edule), Vaccinium spp., Arctous spp.,* and *Rhododendrum spp.*) occur in moist areas and on north-facing slopes. The wettest sites support tall scrub swamps (thin-leaf alder (*Alnus incana* ssp. *tenuifolia*), green alder, diamond-leaf willow and woolly willow), low scrub bogs (leatherleaf (*Chamaedaphne calyculata),* sweet gale (*Myrica gale), and* Beauverd spirea), or scrub-graminoid communities (diamond-leaf willow, net-vein willow, Barclay's willow *(S. barclayi),* under-green willow *(S. commutata),* Alaska bog willow, resin birch, dwarf birch, Labrador-tea, bog blueberry, lingonberry, small cranberry (*V. oxycoccos*), shrubby cinquefoil, sweet gale, thin-leaf alder, and bog rosemary *(Andromeda polifolia),* with tussock cottongrass, Bigelow's sedge, water sedge *(C. aquatilis*), several flower sedge *(C. pluriflora)* and bluejoint grass). Recently burned areas display a succession of recovery stages that include mesic forb herbaceous communities (narrow-leaf fireweed), mesic graminoid herbaceous communities (bluejoint grass), scrub communities (little-tree willow, Barclay's willow, Bebb willow, and Scouler's willow (*S. scouleriana*) and broadleaf, needleleaf, and mixed forests (Gallant et al. 1995).

### 1.3.3 Arctic Tundra Ecoregion

As the northernmost ecoregion in Alaska, the Arctic Tundra Ecoregion is bounded by the Arctic Ocean to the north and includes the Brooks Range to the south. The poorly drained, treeless coastal plain rises very gradually from sea level across the Arctic Coastal Plain, to the Brooks Range Foothills and then abruptly into the Brooks Range. The region has an arctic climate, and the entire area is underlain by thick permafrost. Because of poor soil drainage, wet graminoid herbaceous communities are the predominant vegetation cover, and numerous thaw lakes dot the region (Gallant et al.1995).

The Ecoregion has very low mean annual temperatures (average winter low of -22°F and average summer maximum of 46.4°F) and very low annual precipitation (5.5 inches annually). Winds are generally persistent and strong (Gallant et al.1995).

#### 1.3.3.1 Brooks Range Sub-Ecoregion

Entering the Brooks Range at MP 252 the route exits this sub-ecoregion at MP 143.3. The dry polar climate of the Brooks Range Sub-Ecoregion has short, cool summers and long, cold winters; and air temperatures decrease rapidly with rising elevation. Valleys and lower mountain slopes on the north side of the range are covered by mixed shrub-sedge tussock tundra with willow thickets along rivers and streams. Alpine tundra and barrens dominate at higher elevations along the entire crest of the range. On the south side, lower mountain slopes and valleys possess

sedge tussocks and shrubs. The arctic tree line skirts across the range in Canada and is restricted to the south side of the range in Alaska. Here, sparse conifer-birch forests and tall shrublands occur in larger valleys (Nowacki et al., 2001).

Because of the shallow soils, high winds, and harsh climate in this ecoregion, vegetation cover is sparse and generally limited to valleys and lower hillslopes. Drier sites support dwarf scrub communities. Wet to mesic sites support mesic graminoid herbaceous communities. Dwarf scrub communities are dominated by ericaceous species (e.g., black torpedoberry, red topedoberry, *Vaccinium spp.*, narrow-leaf Labrador-tea, black crowberry, and white arctic mountain-heather), mountain-avens, and willow (round-leaf willow (S. *rotundifolia*), arctic willow *(S. arctica*), and polar willow (*S. polaris*)). Herbaceous species (*Carex spp.*) and fruticose lichens (*Cladina spp*. and *Cetraria spp*.) may co-dominate with shrubs in some areas. Graminoid herbaceous communities are dominated by sedges (water sedge and Bigelow's sedge) and willows (diamond-leaf willow and woolly willow). Mosses (*Tomenthypnum nitens, Distichium capillaceum, Drepanocladus spp.*, and *Campylium stellatum*) are often abundant (Gallant et al.1995).

### 1.3.3.2 Brooks Range Foothills Sub-Ecoregion

Entering the Brooks Range Foothills at MP 143.3 the route passes through mesic graminoid herbaceous and dwarf scrub communities, before entering the Beaufort Coastal Plain at MP 62. (Gallant et al. 1995). Open low scrub occurs along drainages. Mesic graminoid herbaceous communities dominated by tussock-forming sedges are widespread. Typical species are tussock cottongrass and Bigelow's sedge. Low shrubs, such as dwarf birch, black crowberry, narrow-leaf Labrador-tea, and lingonberry often occur and may co-dominate with sedges. Mosses (e.g., *Hylocomium splendens and Sphagnum spp*.), and lichens (e.g., *Cetraria cucullata, Cladonia spp.,* and *Cladina rangiferina*) are common between tussocks. Dwarf scrub communities (*Vaccinium spp.*) are dominated by mat-forming mountain-avens, white arctic mountain-heather, and *Arctous spp.* accompanied by ericaceous species and prostrate willows (net-vein willow and skeleton-leaf willow [*S. phlebophylla*]). Open low scrub communities are co-dominated by alders and willows (e.g., woolly willow, diamond-leaf willow, and gray-leaf willow). Mosses (e.g., *Tomenthypnum nitens* and *Drepanocladus spp*.) are usually abundant (Gallant et al. 1995).

### 1.3.3.3 Beaufort Coastal Plain Sub-Ecoregion

Leaving the Brooks Range Foothills at MP 62 the route enters the Beaufort Coastal Plain. Vegetation within the Beaufort Coastal Plain is dominated by wet sedge tundra in drained lake basins, swales, and floodplains, and by tussock tundra and sedge-*Dryas* tundra on gentle ridges. Low willow thickets grow on well-drained riverbanks (Nowacki et al. 2001).

Gallant et al. 1995 describes the distribution of vegetation communities in relation to microtopographic features that affect soil drainage. Sedge communities are generally dominated by water sedge and tall cottongrass (*E. angustifolium*). Mosses (usually *Scorpidium spp*. or *Drepanocladus spp.*) are common. Grass communities are generally dominated by Fisher's tundragrass (*Dupontia fischeri*) and alpine meadow-foxtail (*Alopecurus alpinus*), but pendantgrass (*Arctophila fulval)* dominates where surface water is 6 to 79 inches deep. Dwarf scrub communities are common, which include entireleaf mountain-avens (*Dryas integrifolia*), lingonberry, white arctic mountain-heather, black torpedoberry and red topedoberry, and net-vein willow and skeleton-leaf willow

# 2.0 METHODOLOGY

Vegetation Field Study Protocols (**Appendix A**) were prepared by experienced scientists prior to the 2015 field season. A copy of these protocols was sent to FERC prior to field work, on June 8, 2015. The protocols, summarized below, follow standard methods which have been used in Alaska to map wetlands and vegetation for large linear projects (e.g. Alaska Stand Alone Pipeline Project, Foothills West, Gravina Access Road, and Knik Arm Bridge and Toll Authority's Knik Arm Crossing). The protocols comprise a three-phased iterative approach, including: 1) vegetation pre-mapping relying primarily on aerial imagery interpretation; 2) collection of ground reference data at pre-determined field targets; and 3) revision of the vegetation pre-mapping based on the results of the field efforts. The vegetation field study's field surveys were completed in conjunction with the wetland field surveys.

Vegetation pre-mapping was completed in 2013, 2014 and early 2015 for the Mainline corridor between Livengood to the west side of Cook Inlet near Beluga, and across Cook Inlet to Nikiski. In addition, pre-mapping was completed in 2015 for Rev B route adjustments and off-ROW access roads and facility sites from Livengood to the Brooks Foothills. This report summarizes the pre-mapping effort and focuses on the results of the field data collection. Since both wetland and vegetation field data were collected at the same time, some wetland data are presented in the appendices of this report. However, all wetland information is contained in the 2015 Wetland Field Study Report (Alaska LNG 2015).

Vegetation was classified using Level I, II, and III of the hierarchical Alaska Vegetation Classification System (Viereck et al. 1992). Level I classifies vegetation using the dominant growth form, as either forest (tree), scrub, or herbaceous. Level II further classifies vegetation based on vegetation type (e.g., needleleaf, broadleaf, graminoid, forb) and vegetation height (e.g., tall or low scrub). The most detailed level of classification for this study, Level III, classifies the canopy cover of the community into either woodland with 10-25% canopy cover, open forest with 25-60% cover or closed with a canopy cover between 60-100%. Level III can also be used to classify a community's composition (e.g., ericaceous or willow dwarf scrub). Classification to Level III of the Viereck system provides the detail necessary to characterize plant communities for the purpose of assessing habitat type.

## 2.1 VEGETATION PRE-MAPPING

Vegetation cover type boundaries were delineated on digital ortho-rectified and geo-referenced true color aerial imagery with 1.6 foot pixel resolution (Vegetation Pre-Mapping). Preliminary vegetation maps were created in a Geographic Information System (GIS) platform, using a "heads-up" digitizing effort that utilized Light Detection and Ranging (LiDAR) generated topographic contours and other ancillary data such as National Wetland Inventory (NWI) and soil survey datasets. The pre-mapping process, including data and imagery sources and mapping standards, is described further in **Appendix A**, and in the 2015 Wetland Field Study Report (Alaska LNG 2015).

The wetland (2015 Wetland Field Study Report) and vegetation mapping effort resulted in the classification of mapping polygons as either wetland (i.e., meeting the U.S. Army Corps of Engineers and FERC's wetland delineation criteria as a wetland), other aquatic habitats (including deepwater aquatic habitats, unvegetated ponds, river channels, and other special aquatic sites as described by USACE), or non-wetland. The dominant vegetation structure (trees, shrubs, herbaceous vegetation) in wetland polygons was classified using both the Cowardin (1979) classification system and the Alaska Vegetation Classification System (Viereck et al., 1992). Within non-wetland polygons, the vegetation was classified using only the Viereck system. Both wetland and upland polygons can have up to three Viereck codes depending on the complexity of the vegetation communities and size of the polygon. For this vegetation field study, the term

"upland" refers to any non-wetland polygon. It should be noted that although a polygon was classified as "upland" during wetland mapping, that does not mean that the vegetation within the polygon is upland vegetation. Mesic vegetation communities are common in polygons that do not meet the wetland criteria, as defined by the U.S. Army Corps of Engineers methods. Upland polygon vegetation classification was done within the same 2000 foot field survey corridor used for wetland mapping (referred to as the "upland vegetation classification area"). Vegetation was mapped at a scale of 1:2,400 (1 inch to 200 feet) or finer.

## 2.2 FIELD TARGET SELECTION

Field targets for the vegetation survey were the same as those selected for the wetland survey, although vegetation points were taken in adjacent uplands as well as wetlands. As discussed in the 2015 Wetland Field Study Report (Alaska LNG 2015), field targets were selected based on changes in aerial vegetation signatures, NWI classification, and NRCS soil classification. The primary focus of the pre-selected field targets was to characterize specific vegetation types which represent all similar types in the region. Field targets were used to confirm areas where subject matter experts had high confidence in the aerial interpretation and were also placed in low-confidence areas to provide field data where the photo signatures or landscape features were not readily discernible for the reliable classification of vegetation.

## 2.3 VEGETATION FIELD DATA COLLECTION

Vegetation field surveys were conducted at the same time as the wetland field surveys and by the same field crew. Vegetation data were collected from early June through early September, 2015, and focused on field targets from Nikiski (MP 804) to the Brooks Range foothills (MP 86). Crew composition information is provided in the 2015 Wetland Field Study Report (Alaska LNG 2015).

Some planned field targets were relocated or cancelled during the 2015 field season based on land status and access permissions. When access to a specific field target was not obtained, a new field target was located on nearby accessible parcels in an area with similar aerial photography vegetation signatures and site conditions as the original field target. Field targets sampled by crews during the 2015 field season consisted of wetlands, non-wetlands, and areas where subject matter experts had low confidence in the wetland and vegetation mapping.

Vegetation Field Study Protocols are provided in **Appendix A**. Data were collected at each site as either a Determination Point (DP), where a hard copy data form was completed, or an Observation Point (OP), in which notes and photographs were used to describe the vegetation and confirm mapping without completing a formal data form. Typically, a DP was completed at each pre-determined field target, and OPs, and additional DPs if needed, were completed in the surrounding area. Vegetation classification data (Level I, II, and III of the Alaska Vegetation Classification System, Viereck et al., 1992) were recorded on each Wetland Determination Data Form or on a Vegetation Classification Data Form if no wetland survey was conducted. A Global Positioning System (GPS) device was used to collect limited field data on an electronic form that was developed for the Project.

The field crew chief examined vegetation and topography to determine appropriate sampling location(s) at each field target. Although field targets were used to guide the location of field crews, field crew chiefs were allowed discretion in the number, type (DP or OP), and final location of data points. This flexible approach allowed scientists to collect data in locations that best described the target community, allowed them to collect additional data as field conditions warranted, and enhanced efficiency by allowing scientists to collect observational data if a similar community was thoroughly described nearby. Field crew chiefs used their best professional judgment and collected appropriate field data to adequately revise the vegetation pre-mapping.

Field crew chiefs maintained field logbooks and hardcopy field maps with aerial photography, field targets, and pre-mapped wetland and vegetation boundaries and classifications. Daily field

Quality Assurance/Quality Control (QA/QC) procedures are described in Section 2.4. Hardcopy and electronic vegetation data forms, field notes, maps, GPS data, and site photos were uploaded daily to the Project SharePoint website.

Regional vegetation guides were used to identify plants including: Flora of Alaska and Neighboring Territories (Hulten 1968), Wetland Sedges of Alaska (Tande and Lipkin 2003), Alaska Trees and Shrubs (Viereck and Little 2007), and Willows of Interior and Southcentral Alaska (Collet 2004, 2010). Non-vascular plants (lichens, mosses, liverworts) and fungi were not surveyed or recorded as part of this effort. Rare and sensitive plants and invasive species were recorded when encountered, but there was no specific effort to search for them.

## 2.4 QUALITY ASSURANCE / QUALITY CONTROL

Each crew member was responsible for collecting and recording clear and accurate data. The field crew chief reviewed all hardcopy and electronic data forms and completed a QA/QC checklist before leaving each site.

The field crew manager ensured that all data files were uploaded to the Project website. These transmitted files were then downloaded and reviewed by office-based data management staff. A vegetation subject matter expert checked each hardcopy data sheet and electronic data form for quality and consistency, as it was received. If problems arose, the field crew was notified promptly to ensure that any data quality issues were corrected in a timely manner. Corrected data (using a single line strikethrough) were re-uploaded to the Project SharePoint website.

## 2.5 VEGETATION MAP REVISIONS

The vegetation pre-mapping was revised to incorporate the results of the 2015 field studies, including revision of the vegetation classification (i.e., Viereck classification). Map revisions followed protocols utilized for pre-mapping, and included the 2015 GPS data, vegetation classification data forms, wetland determination data forms, site photographs, logbooks, and field maps as additional data sources. Map revisions were only made with post-processed GPS data and field forms that passed the QA/QC process (Section 2.4).

Generally, the vegetation pre-mapping revision process involved:

- Exporting spatial data for all field targets and photo points from the Alaska LNG database;
- Compiling electronic copies of all notes, sketches, and photographs associated with above points; and
- Using this data in a GIS platform to update files through heads-up digitizing, or modifying the initial map on screen as described in the Vegetation Field Study Protocols (**Appendix A**).

When updating the map for both wetland and upland polygons, changes were not necessarily applied solely to the polygon containing field data. Rather, field data were used to “recalibrate” that portion of the map (generally within one half mile of the data collection site), represented by a particular spectral signature (combination of color, tone, shadow, etc.), and recoded in that area as deemed appropriate. Plant species composition data collected in the vegetation section of the Wetland Determination Data Form and the Vegetation Classification Data Form were used to classify vegetation within the polygon, and to inform the classification of similar polygons (in texture, color, and pattern).

## 2.6 MERCHANTABLE TIMBER

Existing data will be analyzed to identify timber management areas within the 2000 foot mapping corridor. If timber production areas are identified within the mapping corridor, available volumetric data will be acquired from the Bureau of Land Management or the State of Alaska as appropriate, and will be used to determine the approximate board feet of merchantable timber. Data will be acquired for publication in the 2016 Vegetation Study Report. No field work will be required for analysis of merchantable timber.

# 3.0 RESULTS

## 3.1 VEGETATION CLASSIFICATION AND MAPPING

A total of 175 upland sites and 135 wetland sites were surveyed by the field crews, at or near the 310 field targets that were completed. Viereck Vegetation data were collected at the 310 field targets and an additional 146 points (OPs or additional DPs) in the vicinity of these field targets, for a total of 456 field plots. Data from these sites were used as a reference during the heads-up digitization of upland and wetland cover types for the study area. Due to the inherent differences in the Cowardin and Viereck classification systems, all wetlands were also classified with Viereck codes in order to be compatible with the upland vegetation classification. The 2015 Wetland and Vegetation Field Data Summary Table and Data Forms are provided in **Appendix B.**

Table 3-1 presents a summary of Level I Viereck cover types by ecoregion and **Appendix C** contains Vegetation Classification Maps of the corridor. Data presented in the following tables includes the entire Rev B route and off-ROW access roads and facilities (those added to the route prior to 9/9/15).

**Table 3-1. Vegetation Cover Types by Ecoregion**

| Cover Type | Alaska Range Transition Ecoregion (acres) | Intermontane Boreal Ecoregion (acres) | Arctic Tundra Ecoregion (acres) | Total (acres) |
|---|---|---|---|---|
| **Forest**[1] | 41,658.9 | 33,269.3 | 5,112.7 | 80,040.9 |
| **Scrub**[1] | 15,360.4 | 25,931.3 | 36,276.1 | 77,567.8 |
| **Herbaceous**[1] | 4,216.8 | 4,717.3 | 30,575.5 | 39,509.6 |
| **Disturbed**[2] | 1,450.6 | 2,282.4 | 2,620.8 | 6,353.8 |
| **No Vegetation**[3] | 8,190.4 | 652.0 | 5047.9 | 13,890.3 |
| **Total** | 70,877.1 | 66,852.3 | 79,633.0 | 217,362.4 |

1 - Based on The Alaska Vegetation Classification (Viereck et al., 1992).
2 - Areas of human disturbance.
3 – Includes Waters and Probable Waters of the U.S.

The study area contains all 30 of the Level III cover types described by Viereck et al. (1992). Table 3-2 provides a summary of the cover types, including representative species.

**Table 3-2. Vegetation Cover Types Occurring within the Study Area**

| Cover Type | Code | General Location | Representative Plants |
|---|---|---|---|
| **Forest** | | | |
| Closed needleleaf (conifer) forest; 60 to 100% canopy | I A 1 | Closed white and black spruce forests are found on floodplain terraces and uplands throughout interior Alaska. | White spruce (*Picea glauca*) and black spruce (*P. mariana*). |
| Open needleleaf (conifer) forest; 25 to 60% canopy | I A 2 | Open white and black spruce forest is very common in lowland and upland areas of interior Alaska. White spruce forest also occurs near the tree line in the Brooks Range. | Tamarack (*Larix laricina*), white spruce, black spruce, *Vaccinium* spp., and feathermosses. |
| Needleleaf (conifer) woodland; 10- to 25% canopy | I A 3 | Black spruce woodland is common on floodplains, slopes, and ridges throughout interior Alaska. White spruce and mixed spruce woodland is common at the tree lines of interior Alaska and the Brooks Range. | White spruce, black spruce, Alaska paper birch (*Betula neoalaskana*), *Vaccinium* spp., and feathermoss. |
| Closed broadleaf forest; 60 to 100% canopy | I B 1 | Typically occurs in interior Alaska. Balsam poplar communities occur frequently in the floodplains and in isolated stands on the north slope of the Brooks Range. Alaska paper birch and quaking aspen are common in uplands, especially on south-facing slopes. | Balsam poplar (*Populus balsamifera*), Alaska paper birch, and quaking aspen (*P. tremuloides*). |
| Open broadleaf forest; 25 to 60% canopy | I B 2 | Typically occurs in interior and northern Alaska. Alaska paper birch and quaking aspen forest can be found on well-drained, steep sites. Balsam poplar occurs as open clumps near the tree line and as isolated groves on the north slope of the Brooks Range. | Alaska paper birch, quaking aspen, balsam poplar, and ericaceous shrubs. |
| Broadleaf woodland; 10 to 25% canopy | I B 3 | Alaska paper birch woodland typically occurs on dry sites in northern interior Alaska. | Alaska paper birch. |
| Closed mixed forest; 60 to 100% canopy | I C 1 | Typically occurs in Interior Alaska. White spruce mixed forests favor warmer, dry slopes and floodplains while black spruce mixes more commonly occur in colder, wetter sites. | White spruce, black spruce, Alaska paper birch, quaking aspen, and balsam poplar. |
| Open mixed forest; 25 to 60% canopy | I C 2 | Typically occurs in upland sites in Interior Alaska. | White spruce, black spruce, and Alaska paper birch. |
| Mixed woodland, 10 to 25% canopy | I C 3 | Occurs in dry upland sites in Interior Alaska. | White spruce, black spruce, and Alaska paper birch. |

| Cover Type | Code | General Location | Representative Plants |
|---|---|---|---|
| **Scrub** | | | |
| Closed dwarf tree scrub; trees <3 meters (m) tall; 60 to 100% canopy | II A 1 | Closed dwarf blackspruce scrub is uncommon but may occur in very cold and wet soils in interior Alaska. | Blackspruce. |
| Open dwarf tree scrub; trees <3 m tall; 25 to 60% canopy | II A 2 | Dwarf blackspruce scrub is typically found in very cold and wet soils in Interior Alaska. | Blackspruce, Alaska paper birch, bog Labrador-tea (*Rhododendrum groenlandicum*), and cloudberry (*Rubus chamaemorus*). |
| Dwarf tree scrub woodland; trees <3 m tall; 10 to 25% canopy | II A 3 | Dwarf blackspruce scrub woodland is typically found in wet sites near tree line in Interior Alaska. | Blackspruce. |
| Closed tall scrub; shrubs ≥1.5 m tall at maturity with 75 to 100% canopy | II B 1 | Occur throughout most of Alaska on stream banks and floodplains. | Willow (*Salix spp.*), alder (*Alnus spp.*), resin birch (*Betula glandulosa*), and soapberry (*Sheperdia canadensis*). |
| Open tall scrub; shrubs ≥1.5 m tall at maturity with 25 to 75% canopy | II B 2 | Typically occur on floodplains, drainages, and near and above the tree line in Interior Alaska. | Willow, alder, resin birch, and soapberry. |
| Closed low scrub; shrubs 20 centimeters (cm) to 1.5 meters tall at maturity | II C 1 | Typically occur on floodplains and river terraces and steep slopes near the tree line in Interior and northern Alaska. Low willow shrub communities also occur in moist protected drainages and around lakes and ponds on the Arctic Coastal Plain. | Willow, alder, resin birch, and dwarf birch (*Betula nana)*. |
| Open low scrub; shrubs 20 cm to 150 cm tall at maturity | II C 2 | Shrubby tussock wetlands and tundra occupy vast areas of northern Alaska and also occur in lowlands and alpine areas of the Interior. Low willow communities occur in the uplands of northern and Interior Alaska. | Willow, alder, birch (*Betula spp.*), sedge, and ericaceous shrubs. |
| Dryas dwarf scrub; <20 cm tall at maturity | II D 1* | Common on windswept alpine sites throughout the northern two-thirds of the state and occasionally is present on well-drained, exposed arctic lowland sites. | Willow, sedge, and lichen |
| Ericaceous dwarf scrub; < 20 cm tall at maturity | II D 2* | Commonly occur in alpine areas and on slopes and windswept areas of interior, northern and western Alaska. | Ericaceous shrubs such as black torpedoberry *(Arctous alpine),* lingonberry *(Vaccinium vitis-idaea),* bog blueberry *(V. uliginosum),* narrowed-leaved Labrador-tea (*Rhododendron tomentosum),* black crowberry *(Empetrum nigrum) and* white arctic mountain-heather *(Cassiope tetragona).* |

| Cover Type | Code | General Location | Representative Plants |
|---|---|---|---|
| Willow dwarf scrub; < 20 cm tall at maturity | II D 3* | Common in alpine areas and other windswept tundra settings throughout the state (except Southeast) occurring in habitats such as snowbeds, wet high-alpine drainage channels, gelifluction lobes, windblown high-center polygon summits, stabilized sand dunes, mesic slopes, exposed slopes and ridges. | Dwarf willows (polar willow (*Salix polaris),* net-vein willow (*S. reticulate),* skeleton-leaf willow (*S. phlebophylla),* round-leaf willow (S. *rotundifolia*), arctic seashore willow *(S. ovalifolia),* and arctic willow *(S. arctica*)) and other dwarf shrubs *(*black crowberry, clubmoss mountain-heather (*Cassiope lycopodioides)*), *Dryas spp.,* bog blueberry, lingonberry, and narrowed-leaved Labrador-tea. |
| **Herbaceous** | | | |
| Dry graminoid herbaceous | III A 1 | Typically found on dry slopes at low elevation and on sub-alpine and alpine slopes and plateaus of Interior Alaska. | Grass (*Festuca* spp., *Poa spp*.) ericaceous shrubs, and willow. |
| Mesic graminoid herbaceous | III A 2 | Tussock tundra is widespread in the Arctic foothills and parts of the Arctic Coastal Plain and is also found along floodplains, valley bottoms, and on upland slopes throughout Alaska. | Tussock cottongrass (*Eriophorum vaginatum*), bluejoint grass (*Calamagrostis Canadensis*), sedge, alder, and willow. |
| Wet graminoid herbaceous (emergent); shrubs provide <25% cover | III A 3 | Common on Arctic lowlands and in alpine areas. | Sedge, cottongrass (*Eriophorum* spp.), grass (*Festuca* spp., *Poa* spp.), and pendantgrass (*Arctophila fulva*), willow. |
| Dry forb herbaceous | III B 1 | Sparsely vegetated communities typically found in alpine areas and rocky, well-drained sites throughout Alaska. | Dwarf fireweed (*Chamerion latifolium*), dwarf alpine hawksbeard (*Crepis nana*), wild sweetpea (*Hedysarum mackenzii*), and *Saxifraga* spp. |
| Mesic forb herbaceous | III B 2 | Primarily occur on rich, sheltered, well-drained sites with deep soils. | Narrow-leaf fireweed (*Chamerion angustifolium*), bellflowers (*Campanula spp*.), wild celery (*Angelica spp*.), lupin *(Lupinus spp.),* wormwood *(Artemisia spp.),* sweet pea (*Lathyrus spp.), Anemone spp.,* larkspur (*Delphinium spp*.), *and* larkspur-leaf monkshood (*Aconitum delphinifolium*). *Sedges, grasses, ferns and mosses also are common.* |
| Wet forb herbaceous (emergent) | III B 3 | Occurs in permanently flooded sites (usually with 15 – 100 centimeters of water), including sloughs, oxbow lakes, sluggish rivers and lake margins. | Water horsetail (*Equisetum fluviatile*), buckbean *(Menyanthes trifoliate*), purple marshlocks (*Comarum palustre*), *and Potamogeton spp.* |
| Mosses | III C 1 | Wet bryophyte communities reportedly occur in the southern (high precipitation) part of the state, while dry bryophytes are most common on windswept coarse mineral substrates (sand dunes and gravelly slopes). | Liverworts such as *Gymnocolea acutiloba, Scapania paludosa,* and *Nardia spp.* and mosses such as *Racomitrium spp.* |
| Lichens | III C 2 | Common in windblown rocky sites with little or no soil development primarily in alpine regions throughout Alaska. | Crustose lichen. |

| Cover Type | Code | General Location | Representative Plants |
|---|---|---|---|
| Freshwater Aquatic herbaceous | III D 1 | Widely distributed throughout Alaska in ponds, sloughs, and oxbow lakes. | Pond lily (*Nuphar polysepalum*), marestail (*Hipperis vulgaris*), buttercup (*Ranunculus* spp.), burreed (*Sparganium* spp.), water milfoil (*Myriophylum spicatum*), pondweed (*Potamogeton* spp.), and aquatic moss (*Fontanalis neomexicana*). |
| Brackish water aquatic herbaceous | III D 2 | Common in brackish ponds in coastal marshes throughout the state. | Fourleaf marestail *(Hippurus tetraphylla),* sago pondweed *(Stuckenia pectinate),* spiral ditchgrass *(Ruppia cirrhosa)* and horned pondweed *(Zannichellia palustris)*. |
| Marine aquatic herbaceous | III D 3 | Occur in protected bays, inlets, and lagoons with clear water along the Alaska coast as far north as the Seward Peninsula. | Eelgrass and various species of marine algae. |

Source: The Alaska Vegetation Classification (Viereck et al., 1992).
*In some instances, dwarf scrub vegetation could only be classified to Viereck Level II.

## 3.2 PRIMARY COVER TYPES BY ECOREGION

Primary vegetation cover types by ecoregion are presented in Tables 3-3 through 3-5. The Alaska Range Transition Ecoregion (Table 3-3) is predominantly covered by forested communities, accounting for 58.8 percent of all coverage. Both scrub (21.7 percent) and herbaceous (6.0 percent) communities comprise much smaller coverages. Non-vegetated areas comprise a high percent (13.6 percent) primarily due to nearly 6,500 acres of estuarine habitat in the Cook Inlet.

**Table 3-3. Vegetation Cover by Types along the Project Corridor[1], within the Alaska Range Transition Ecoregion**

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| **Forest** | | | | |
| Closed needleleaf (conifer) forest (I A 1) | 37.2 | 134.2 | 171.4 | |
| Closed needleleaf (conifer) forest, open dwarf tree scrub (I A 1, II A 2) | 31.1 | - | 31.1 | |
| Closed needleleaf (conifer) forest, open tall scrub (I A 1, II B 2) | - | 95.4 | 95.4 | |
| Closed needleleaf (conifer) forest, open low scrub (I A 1, II C 2) | 3.2 | - | 3.2 | |
| Closed needleleaf (conifer) forest, mesic graminoid herbaceous (I A 1, III A 2) | 0.6 | - | 0.6 | |
| Open needleleaf (conifer) forest (I A 2) | 395.8 | 1,713.6 | 2,109.4 | |
| Open needleleaf (conifer) forest, needleleaf (conifer) woodland (I A 2, I A 3) | - | 15.9 | 15.9 | |
| Open needleleaf (conifer) forest, open broadleaf forest (I A 2, I B 2) | 8.2 | - | 8.2 | |
| Open needleleaf (conifer) forest, broadleaf woodland (I A 2, I B 3) | 11.5 | - | 11.5 | |
| Open needleleaf (conifer) forest, open dwarf tree scrub (I A 2, II A 2) | 170.2 | - | 170.2 | |
| Open needleleaf (conifer) forest, closed tall scrub (I A 2, II B 1) | 9.2 | 83.4 | 92.6 | |
| Open needleleaf (conifer) forest, open tall scrub (I A 2, II B 2) | 365.0 | 2,536.2 | 2,901.2 | |
| Open needleleaf (conifer) forest, open tall scrub, closed low scrub (I A 2, II B 2, II C 1) | - | 29.0 | 29.0 | |
| Open needleleaf (conifer) forest, closed low scrub (I A 2, II C 1) | 97.8 | - | 97.8 | |
| Open needleleaf (conifer) forest, open low scrub (I A 2, II C 2) | 695.8 | 1,863.3 | 2,559.1 | |
| Needleleaf (conifer) woodland, closed tall scrub (I A 3, II B 1) | 14.5 | - | 14.5 | |
| Needleleaf (conifer) woodland, open tall scrub (I A 3, II B 2) | 73.6 | 868.0 | 941.6 | |
| Needleleaf (conifer) woodland, closed low scrub (I A 3, II C 1) | 8.7 | - | 8.7 | |
| Needleleaf (conifer) woodland, open low scrub (I A 3, II C 2) | 138.4 | 1,356.4 | 1,494.8 | |
| Needleleaf (conifer) woodland, open low scrub, mesic graminoid herb. (I A 3, II C 2, III A 2) | 15.0 | - | 15.0 | |
| Closed broadleaf forest (I B 1) | - | 64.5 | 64.5 | |
| Closed broadleaf forest, closed tall scrub (I B 1, II B 1) | - | 30.7 | 30.7 | |
| Closed broadleaf forest, open tall scrub (I B 1, II B 2) | - | 9.0 | 9.0 | |
| Open broadleaf forest (I B 2) | 10.0 | 143.8 | 153.8 | |
| Open broadleaf forest, closed tall scrub (I B 2, II B 1) | - | 415.9 | 415.9 | |
| Open broadleaf forest, open tall scrub (I B 2, II B 2) | 424.0 | 2,097.4 | 2,521.4 | |
| Open broadleaf forest, open low scrub (I B 2, II C 2) | 31.1 | 822.2 | 853.3 | |
| Open broadleaf forest, mesic graminoid herbaceous (I B 2, III A 2) | 47.4 | 1,115.0 | 1,162.4 | |
| Open broadleaf forest, wet graminoid herbaceous (emergent) (I B 2, III A 3) | - | 56.8 | 56.8 | |
| Broadleaf woodland, closed tall scrub (I B 3, II B 1) | - | 106.4 | 106.4 | |
| Broadleaf woodland, open tall scrub(I B 3, II B 2) | 36.6 | 703.4 | 740.0 | |
| Broadleaf woodland, open tall scrub, mesic graminoid herbaceous (I B 3, II B 2, III A 2) | - | 80.3 | 80.3 | |
| Broadleaf woodland, open low scrub (I B 3, II C 2) | 0.6 | 1.3 | 1.9 | |
| Broadleaf woodland, mesic graminoid herbaceous (I B 3, III A 2) | 5.1 | 31.0 | 36.1 | |
| Broadleaf woodland, wet graminoid herbaceous (emergent) (I B 3, III A 3) | - | 84.9 | 84.9 | |
| Closed mixed forest (I C 1) | 30.0 | 2,130.1 | 2,160.1 | |
| Closed mixed forest, open tall scrub (I C 1, II B 2) | - | 4.5 | 4.5 | |
| Closed mixed forest, open low scrub (I C 1, II C 2) | 1.8 | 306.3 | 308.1 | |
| Open mixed forest (I C 2) | 22.6 | 945.7 | 968.3 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Open mixed forest, open needleleaf (conifer) forest (I C 2, I A 2) | 14.2 | 1.9 | 16.1 | |
| Open mixed forest, Closed broadleaf forest (I C 2, I B 1) | - | 19.9 | 19.9 | |
| Open mixed forest, closed tall scrub (I C 2, II B 1) | 34.4 | 3,008.8 | 3,043.2 | |
| Open mixed forest, open tall scrub (I C 2, II B 2) | 455.9 | 5,350.4 | 5,806.3 | |
| Open mixed forest, closed low scrub (I C 2, II C 1) | - | 555.0 | 555.0 | |
| Open mixed forest, open low scrub (I C 2, II C 2) | 763.6 | 8,083.4 | 8,847.0 | |
| Open mixed forest, mesic graminoid herbaceous (I C 2, III A 2) | 97.8 | 179.4 | 277.2 | |
| Mixed woodland (I C 3) | - | 11.7 | 11.7 | |
| Mixed woodland, closed tall scrub (I C 3, II B 1) | 9.5 | 2,095.2 | 2,104.7 | |
| Mixed woodland, open tall scrub (I C 3, II B 2) | 51.8 | 310.0 | 361.8 | |
| Mixed woodland, open low scrub (I C 3, II C 2) | 5.8 | 47.0 | 52.8 | |
| Mixed woodland, Mesic graminoid herbaceous (I C 3, III A 2) | - | 16.1 | 16.1 | |
| Mixed woodland, Mesic forb herbaceous (I C 3, III B 2) | - | 17.5 | 17.5 | |
| **Subtotal** | **4,118.0** | **37,540.9** | **41,658.9** | **58.8%** |
| **Scrub** | | | | |
| Closed dwarf tree scrub (II A 1) | 0.3 | - | 0.3 | |
| Closed dwarf tree scrub, open low scrub (II A 1, II C 2) | 0.2 | - | 0.2 | |
| Open dwarf tree scrub (II A 2) | 131.2 | 1.4 | 132.6 | |
| Open dwarf tree scrub, open needleleaf (conifer) forest (II A 2, I A 2) | 747.0 | - | 747.0 | |
| Open dwarf tree scrub, open tall scrub (II A 2, II B 2) | 351.0 | 1.1 | 352.1 | |
| Open dwarf tree scrub, closed low scrub (II A 2, II C 1) | 6.1 | - | 6.1 | |
| Open dwarf tree scrub, open low scrub (II A 2, II C 2) | 1,154.7 | 62.2 | 1,216.9 | |
| Open dwarf tree scrub, mesic graminoid herbaceous (II A 2, III A 2) | 86.8 | - | 86.8 | |
| Dwarf tree scrub woodland (II A 3) | 3.5 | - | 3.5 | |
| Dwarf tree scrub woodland, open tall scrub (II A 3, II B 2) | 0.6 | - | 0.6 | |
| Dwarf tree scrub woodland, open low scrub (II A 3, II C 2) | 414.9 | - | 414.9 | |
| Dwarf tree scrub woodland, open low scrub, wet graminoid herbaceous (II A 3, II C 2, III A 3) | 9.2 | - | 9.2 | |
| Dwarf tree scrub woodland, mesic graminoid herbaceous (II A 3, III A 2) | 37.9 | - | 37.9 | |
| Closed tall scrub (II B 1) | 139.1 | 573.3 | 712.4 | |
| Closed tall scrub, needleleaf (conifer) woodland (II B 1, I A 3) | 7.7 | 248.0 | 255.7 | |
| Closed tall scrub, open mixed forest (II B 1, I C 2) | 0.4 | - | 0.4 | |
| Closed tall scrub, mixed woodland (II B 1, I C 3) | 1.0 | 10.9 | 11.9 | |
| Closed tall scrub, open dwarf tree scrub (II B 1, II A 2) | 1.5 | - | 1.5 | |
| Closed tall scrub, open tall scrub (II B 1, II B 2) | 17.9 | - | 17.9 | |
| Closed tall scrub, closed low scrub (II B 1, II C 1) | 0.5 | - | 0.5 | |
| Closed tall scrub, open low scrub (II B 1, II C 2) | 32.2 | 296.4 | 328.6 | |
| Closed tall scrub, mesic graminoid herbaceous (II B 1, III A 2) | 18.6 | - | 18.6 | |
| Closed tall scrub, wet graminoid herbaceous (emergent) (II B 1, III A 3) | 0.3 | - | 0.3 | |
| Open tall scrub (II B 2) | 361.5 | 310.8 | 672.3 | |
| Open tall scrub, open needleleaf (conifer) forest (II B 2, I A 2) | 9.9 | 25.2 | 35.1 | |
| Open tall scrub, needleleaf (conifer) woodland (II B 2, I A 3) | 48.7 | 31.7 | 80.4 | |
| Open tall scrub, closed broadleaf forest (II B 2, I B 1) | 3.3 | - | 3.3 | |
| Open tall scrub, open broadleaf forest (II B 2, I B 2) | 49.1 | - | 49.1 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Open tall scrub, broadleaf woodland (II B 2, I B 3) | 67.3 | 32.6 | 99.9 | |
| Open tall scrub, mixed woodland (II B 2, I C 3) | - | 5.5 | 5.5 | |
| Open tall scrub, open dwarf tree scrub (II B 2, II A 2) | 49.2 | 74.2 | 123.4 | |
| Open tall scrub, dwarf tree scrub woodland (II B 2, II A 3) | - | 87.6 | 87.6 | |
| Open tall scrub, closed low scrub (II B 2, II C 1) | - | 88.9 | 88.9 | |
| Open tall scrub, open low scrub (II B 2, II C 2) | 186.1 | 1,081.2 | 1,267.3 | |
| Open tall scrub, open low scrub, dwarf tree scrub woodland (II B 2, II C 2, II A 3) | 0.1 | - | 0.1 | |
| Open tall scrub, open low scrub, mesic graminoid herbaceous (II B 2, II C 2, III A 2) | 2.1 | - | 2.1 | |
| Open tall scrub, dryas dwarf scrub (II B 2, II D 1) | 19.0 | - | 19.0 | |
| Open tall scrub, dry graminoid herbaceous (II B 2, III A 1) | 0.6 | 3.5 | 4.1 | |
| Open tall scrub, mesic graminoid herbaceous (II B 2, III A 2) | 110.6 | 9.8 | 120.4 | |
| Open tall scrub, wet graminoid herbaceous (emergent) (II B 2, III A 3) | 2.9 | - | 2.9 | |
| Open tall scrub, Lichens (II B 2, III C 2) | - | 0.8 | 0.8 | |
| Closed low scrub (II C 1) | 207.5 | 171.7 | 379.2 | |
| Closed low scrub, open needleleaf (conifer) forest (II C 1, I A 2) | 1.5 | - | 1.5 | |
| Closed low scrub, needleleaf (conifer) woodland (II C 1, I A 3) | - | 16.7 | 16.7 | |
| Closed low scrub, open dwarf tree scrub (II C 1, II A 2) | 184.2 | - | 184.2 | |
| Closed low scrub, dwarf tree scrub woodland (II C 1, II A 3) | 45.5 | 0.1 | 45.6 | |
| Closed low scrub, Closed tall scrub (II C 1, II B 1) | 6.0 | - | 6.0 | |
| Closed low scrub, open tall scrub (II C 1, II B 2) | 13.3 | 352.1 | 365.4 | |
| Closed low scrub, open low scrub, open dwarf tree scrub (II C 1, II C 2, II A 2) | 1.5 | - | 1.5 | |
| Closed low scrub, mesic graminoid herbaceous (II C 1, III A 2) | 392.0 | - | 392.0 | |
| Closed low scrub, wet graminoid herbaceous (emergent) (II C 1, III A 3) | 33.5 | - | 33.5 | |
| Open low scrub (II C 2) | 632.2 | 111.8 | 744.0 | |
| Open low scrub, open needleleaf (conifer) forest (II C 2, I A 2) | 20.6 | 1.0 | 21.6 | |
| Open low scrub, needleleaf (conifer) woodland (II C 2, I A 3) | 350.4 | 139.1 | 489.5 | |
| Open low scrub, broadleaf woodland (II C 2, I B 3) | - | 44.8 | 44.8 | |
| Open low scrub, open dwarf tree scrub (II C 2, II A 2) | 139.4 | 3.4 | 142.8 | |
| Open low scrub, dwarf tree scrub woodland (II C 2, II A 3) | 266.2 | 3.0 | 269.2 | |
| Open low scrub, open tall scrub (II C 2, II B 2) | 19.6 | 46.1 | 65.7 | |
| Open low scrub, open tall scrub, open dwarf tree scrub (II C 2, II B 2, II A 2) | 3.7 | - | 3.7 | |
| Open low scrub, open tall scrub, mesic graminoid herbaceous (II C 2, II B 2, III A 2) | 3.8 | - | 3.8 | |
| Open low scrub, dry graminoid herbaceous (II C 2, III A 1) | - | 2,604.5 | 2,604.5 | |
| Open low scrub, mesic graminoid herbaceous (II C 2, III A 2) | 1,855.1 | 207.2 | 2,062.3 | |
| Open low scrub, wet graminoid herbaceous (emergent) (II C 2, III A 3) | 345.7 | - | 345.7 | |
| Open low scrub, Dry forb herbaceous (II C 2, III B 1) | 27.1 | - | 27.1 | |
| Open low scrub, Mesic forb herbaceous (II C 2, III B 2) | 16.7 | 3.6 | 20.3 | |
| Open mixed forest, lichens (I C 2, III C 2) | 4.3 | - | 4.3 | |
| Ericaceous dwarf scrub, mesic graminoid herbaceous (II D 2, III A 2) | 16.3 | - | 16.3 | |
| Ericaceous dwarf scrub, wet graminoid herbaceous (emergent) (II D 2, III A 3) | 45.3 | - | 45.3 | |
| No vegetation, open tall scrub (NONE, II B 2)[5] | 0.2 | - | 0.2 | |
| No vegetation, open low scrub (NONE, II C 2)[5] | - | 5.6 | 5.6 | |
| **Subtotal** | **8,704.6** | **6,655.8** | **15,360.4** | **21.7%** |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| **Herbaceous** | | | | |
| Dry graminoid herbaceous (III A 1) | 0.6 | 51.2 | 51.8 | |
| Dry graminoid herbaceous, open tall scrub (III A 1, II B 2) | - | 1.5 | 1.5 | |
| Dry graminoid herbaceous, closed low scrub (III A 1, II C 1) | 14.2 | - | 14.2 | |
| Dry graminoid herbaceous, open low scrub (III A 1, II C 2) | - | 25.5 | 25.5 | |
| Mesic graminoid herbaceous (III A 2) | 277.6 | 498.9 | 776.5 | |
| Mesic graminoid herbaceous, needleleaf (conifer) woodland (III A 2, I A 3) | 7.8 | - | 7.8 | |
| Mesic graminoid herbaceous, broadleaf woodland (III A 2, I B 3) | 43.0 | - | 43.0 | |
| Mesic graminoid herbaceous, open dwarf tree scrub (III A 2, II A 2) | 13.3 | - | 13.3 | |
| Mesic graminoid herbaceous, dwarf tree scrub woodland (III A 2, II A 3) | 6.0 | - | 6.0 | |
| Mesic graminoid herbaceous, closed tall scrub (III A 2, II B 1) | 0.3 | - | 0.3 | |
| Mesic graminoid herbaceous, open tall scrub (III A 2, II B 2) | 72.8 | 16.1 | 88.9 | |
| Mesic graminoid herbaceous, closed low scrub (III A 2, II C 1) | 37.2 | - | 37.2 | |
| Mesic graminoid herbaceous, open low scrub (III A 2, II C 2) | 577.0 | 180.4 | 757.4 | |
| Mesic graminoid herbaceous, ericaceous dwarf scrub (III A 2, II D 2) | 13.6 | - | 13.6 | |
| Mesic graminoid herbaceous, wet graminoid herbaceous (emergent) (III A 2, III A 3) | 10.2 | - | 10.2 | |
| Wet graminoid herbaceous (emergent) (III A 3) | 1,109.3 | - | 1,109.3 | |
| Wet graminoid herbaceous (emergent), open mixed forest (III A 3, I C 2) | 0.0 | - | 0.0 | |
| Wet graminoid herbaceous (emergent), dwarf tree scrub woodland (III A 3, II A 3) | 9.1 | - | 9.1 | |
| Wet graminoid herbaceous (emergent), open tall scrub (III A 3, II B 2) | 27.6 | - | 27.6 | |
| Wet graminoid herbaceous (emergent), closed low scrub (III A 3, II C 1) | 1.3 | - | 1.3 | |
| Wet graminoid herbaceous (emergent), open low scrub (III A 3, II C 2) | 707.1 | - | 707.1 | |
| Wet graminoid herbaceous (emergent), ericaceous dwarf scrub (III A 3, II D 2) | 31.5 | - | 31.5 | |
| Wet graminoid herbaceous (emergent), mesic graminoid herbaceous (III A 3, III A 2) | 48.5 | - | 48.5 | |
| Wet graminoid herbaceous (emergent), lichens (III A 3, III C 2) | 4.5 | - | 4.5 | |
| Wet graminoid herbaceous (emergent), freshwater aquatic herbaceous (III A 3, III D 1) | 4.4 | - | 4.4 | |
| Dry forb herbaceous (III B 1) | - | 80.3 | 80.3 | |
| Mesic forb herbaceous (III B 2) | - | 2.7 | 2.7 | |
| Mesic forb herbaceous, mesic graminoid herbaceous (III B 2, III A 2) | - | 1.3 | 1.3 | |
| Wet forb herbaceous (emergent) (III B 3) | 0.2 | - | 0.2 | |
| Freshwater aquatic herbaceous (III D 1) | 324.6 | - | 324.6 | |
| Freshwater aquatic herbaceous, wet graminoid herbaceous (emergent) (III D 1, III A 3) | 11.4 | - | 11.4 | |
| Freshwater aquatic herbaceous, no vegetation (III D 1, NONE)[5] | 1.8 | - | 1.8 | |
| No vegetation, mesic graminoid herbaceous (NONE, III A 2)[5] | - | 0.7 | 0.7 | |
| No vegetation, wet graminoid herbaceous (emergent) (NONE, III A 3)[5] | 1.7 | - | 1.7 | |
| No vegetation, freshwater aquatic herbaceous (NONE, III D 1)[5] | 1.6 | - | 1.6 | |
| **Subtotal** | **3,358.2** | **858.6** | **4,216.8** | **6.0%** |
| **No Vegetation** | | | | |
| Disturbed | | | 1,450.6 | |
| Lacustrine unconsolidated bottom (L1UB/L2UB) | | | 196.5 | |
| Estuarine subtidal unconsolidated bottom (E1UB) | | | 6,494.9 | |
| Estuarine intertidal unconsolidated shore (E2US) | | | 386.4 | |
| Palustrine unconsolidated bottom (PUB) | | | 386.5 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Riverine lower perennial (R2) | | | 224.7 | |
| Riverine upper perennial (R3) | | | 413.5 | |
| Riverine intermittent streambed (R4SB) | | | 38.1 | |
| Upland | | | 49.8 | |
| **Subtotal** | | | **9,641.0** | **13.6%** |
| | | | | |
| **TOTAL[4]** | **16,180.8** | **45,055.3** | **70,877.1** | **100%** |

1- The corridor is comprised of a 2000-foot-wide corridor (1000 feet on either side of the proposed centerline). Also included are the off-ROW areas (added prior to 9/9/15) with a 300 foot corridor (150 feet on either side).
2- Vegetation types from Alaska Classification System (Viereck et al., 1992).
3- Areas are rounded to the nearest 1/10th acre. GIS data can be consulted for more accurate numbers.
4- Total wetland and upland acres do include partially vegetated areas but do not include areas devoid of any vegetation.
5- Mapped polygon is a mosaic of bare ground and partial vegetation cover.
*In some instances, dwarf scrub vegetation could only be classified to Viereck Level II.

The Intermontane Boreal Ecoregion (Table 3-4) is dominated by forested (49.8 percent) and scrub (38.8 percent) communities. Herbaceous communities make up only 7.1 percent of overall land cover.

**Table 3-4. Vegetation Cover by Types along the Project Corridor[1], within the Intermontane Boreal Ecoregion**

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| **Forest** | | | | |
| Closed needleleaf (conifer) forest (I A 1) | 4.8 | 275.6 | 280.4 | |
| Closed/open needleleaf (conifer) forest (I A 1, I A 2) | - | 77.3 | 77.3 | |
| Closed needleleaf (conifer) forest, open tall scrub (I A 1, II B 2) | - | 3.0 | 3.0 | |
| Open needleleaf (conifer) forest (I A 2) | 872.0 | 3,398.2 | 4,270.2 | |
| Open/closed needleleaf (conifer) forest (I A 2, I A 1) | - | 297.7 | 297.7 | |
| Open needleleaf (conifer) forest, needleleaf (conifer) woodland (I A 2, I A 3) | 31.1 | 8.2 | 39.3 | |
| Open needleleaf (conifer) forest, open mixed forest (I A 2, I C 2) | 40.7 | 459.8 | 500.5 | |
| Open needleleaf (conifer) forest, mixed woodland (I A 2, I C 3) | 10.2 | - | 10.2 | |
| Open needleleaf (conifer) forest, open dwarf tree scrub (I A 2, II A 2) | 1,347.5 | 56.2 | 1,403.7 | |
| Open needleleaf (conifer) forest, closed tall scrub (I A 2, II B 1) | 19.0 | 0.3 | 19.3 | |
| Open needleleaf (conifer) forest, open tall scrub (I A 2, II B 2) | 988.6 | 478.9 | 1,467.5 | |
| Open needleleaf (conifer) forest, closed low scrub (I A 2, II C 1) | 852.2 | 5.6 | 857.8 | |
| Open needleleaf (conifer) forest, open low scrub (I A 2, II C 2) | 2,079.2 | 756.1 | 2,835.3 | |
| Open needleleaf (conifer) forest, ericaceous dwarf scrub (I A 2, II D 2) | 9.9 | - | 9.9 | |
| Open needleleaf (conifer) forest, dry graminoid herbaceous (I A 2, III A 1) | - | 93.5 | 93.5 | |
| Needleleaf (conifer) woodland (I A 3) | 51.9 | 81.0 | 132.9 | |
| Needleleaf (conifer) woodland, open needleleaf (conifer) forest (I A 3, I A 2) | 1.3 | - | 1.3 | |
| Needleleaf (conifer) woodland, open mixed forest (I A 3, I C 2) | 1.6 | - | 1.6 | |
| Needleleaf (conifer) woodland, open dwarf tree scrub (I A 3, II A 2) | 3.2 | - | 3.2 | |
| Needleleaf (conifer) woodland, dwarf tree scrub woodland (I A 3, II A 3) | 15.4 | - | 15.4 | |
| Needleleaf (conifer) woodland, open tall scrub (I A 3, II B 2) | 145.3 | 440.1 | 585.4 | |
| Needleleaf (conifer) woodland, closed low scrub (I A 3, II C 1) | 56.0 | 11.5 | 67.5 | |
| Needleleaf (conifer) woodland, open low scrub (I A 3, II C 2) | 357.6 | 381.4 | 739.0 | |
| Needleleaf (conifer) woodland, ericaceous dwarf scrub (I A 3, II D 2) | 2.2 | - | 2.2 | |
| Needleleaf (conifer) woodland, dry graminoid herbaceous (I A 3, III A 1) | - | 55.7 | 55.7 | |
| Closed broadleaf forest (I B 1) | 7.1 | 1,447.4 | 1,454.5 | |
| Closed broadleaf forest, open needleleaf (conifer) forest (I B 1, I A 2) | - | 0.1 | 0.1 | |
| Closed broadleaf forest, needleleaf (conifer) woodland (I B 1, I A 3) | - | 281.1 | 281.1 | |
| Closed/open broadleaf forest (I B 1, I B 2) | - | 48.5 | 48.5 | |
| Closed broadleaf forest, broadleaf woodland (I B 1, I B 3) | - | 2.8 | 2.8 | |
| Closed broadleaf forest, closed mixed forest (I B 1, I C 1) | - | 37.9 | 37.9 | |
| Closed broadleaf forest, closed tall scrub (I B 1, II B 1) | 16.8 | 23.1 | 39.9 | |
| Closed broadleaf forest, open tall scrub (I B 1, II B 2) | 33.0 | - | 33.0 | |
| Open broadleaf forest (I B 2) | 0.5 | 330.6 | 331.1 | |
| Open broadleaf forest, needleleaf (conifer) woodland (I B 2, I A 3) | 1.3 | 1.2 | 2.5 | |
| Open broadleaf forest, closed mixed forest (I B 2, I C 1) | 9.4 | 18.6 | 28.0 | |
| Open broadleaf forest, open mixed forest (I B 2, I C 2) | 1.1 | - | 1.1 | |
| Open broadleaf forest, open dwarf tree scrub (I B 2, II A 2) | 4.2 | - | 4.2 | |
| Open broadleaf forest, closed tall scrub (I B 2, II B 1) | - | 3.2 | 3.2 | |
| Open broadleaf forest, open tall scrub (I B 2, II B 2) | 236.5 | 525.7 | 762.2 | |
| Open broadleaf forest, open low scrub (I B 2, II C 2) | 2.3 | 16.4 | 18.7 | |
| Open broadleaf forest, mesic graminoid herbaceous (I B 2, III A 2) | 0.7 | - | 0.7 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Broadleaf woodland (I B 3) | - | 30.5 | 30.5 | |
| Broadleaf woodland, open tall scrub (I B 3, II B 2) | 6.5 | 9.3 | 15.8 | |
| Broadleaf woodland, dry graminoid herbaceous (I B 3, III A 1) | - | 2.8 | 2.8 | |
| Broadleaf woodland, dry forb herbaceous (I B 3, III B 1) | - | 26.8 | 26.8 | |
| Closed mixed forest (I C 1) | 32.3 | 7,337.0 | 7,369.3 | |
| Closed mixed forest, closed needleleaf (conifer) forest (I C 1, I A 1) | - | 8.7 | 8.7 | |
| Closed mixed forest, closed broadleaf forest (I C 1, I B 1) | - | 865.1 | 865.1 | |
| Closed/open mixed forest (I C 1, I C 2) | - | 243.2 | 243.2 | |
| Closed mixed forest, closed tall scrub (I C 1, II B 1) | - | 4.2 | 4.2 | |
| Closed mixed forest, open tall scrub (I C 1, II B 2) | - | 72.9 | 72.9 | |
| Closed mixed forest, open low scrub (I C 1, II C 2) | - | 0.0 | 0.0 | |
| Closed mixed forest, wet forb herbaceous (emergent) (I C 1, III B 3) | 3.9 | - | 3.9 | |
| Open mixed forest (I C 2) | 41.9 | 3,059.3 | 3,101.2 | |
| Open mixed forest, open needleleaf (conifer) forest (I C 2, I A 2) | - | 255.8 | 255.8 | |
| Open mixed forest, needleleaf (conifer) woodland (I C 2, I A 3) | 1.9 | - | 1.9 | |
| Open mixed forest, open broadleaf forest (I C 2, I B 2) | - | 12.7 | 12.7 | |
| Open/closed mixed forest (I C 2, I C 1) | - | 150.5 | 150.5 | |
| Open mixed forest, open dwarf tree scrub (I C 2, II A 2) | 9.2 | - | 9.2 | |
| Open mixed forest, closed tall scrub (I C 2, II B 1) | 1.7 | 0.1 | 1.8 | |
| Open mixed forest, open tall scrub (I C 2, II B 2) | 134.6 | 2,784.2 | 2,918.8 | |
| Open mixed forest, closed low scrub (I C 2, II C 1) | - | 5.5 | 5.5 | |
| Open mixed forest, open low scrub (I C 2, II C 2) | 4.9 | 803.9 | 808.8 | |
| Open mixed forest, willow dwarf scrub (I C 2, II D 3) | - | 27.9 | 27.9 | |
| Open mixed forest, mesic graminoid herbaceous (I C 2, III A 2) | 0.2 | - | 0.2 | |
| Mixed woodland (I C 3) | 1.7 | 79.8 | 81.5 | |
| Mixed woodland, closed tall scrub (I C 3, II B 1) | - | 13.7 | 13.7 | |
| Mixed woodland, open tall scrub (I C 3, II B 2) | 22.5 | 233.1 | 255.6 | |
| Mixed woodland, closed low scrub (I C 3, II C 1) | 3.2 | 8.4 | 11.6 | |
| Mixed woodland, open low scrub (I C 3, II C 2) | - | 150.1 | 150.1 | |
| **Subtotal** | **7,467.1** | **25,802.2** | **33,269.3** | **49.8%** |
| **Scrub** | | | | |
| Closed dwarf tree scrub (II A 1) | 27.0 | 55.5 | 82.5 | |
| Closed dwarf tree scrub, open low scrub (II A 1, II C 2) | 109.6 | - | 109.6 | |
| Open dwarf tree scrub (II A 2) | 916.3 | 125.2 | 1,041.5 | |
| Open dwarf tree scrub, open needleleaf (conifer) forest (II A 2, I A 2) | 114.1 | - | 114.1 | |
| Open dwarf tree scrub, needleleaf (conifer) woodland (II A 2, I A 3) | 14.0 | - | 14.0 | |
| Open dwarf tree scrub, open mixed forest (II A 2, I C 2) | 4.4 | 0.2 | 4.6 | |
| Open dwarf tree scrub, dwarf tree scrub woodland (II A 2, II A 3) | 25.2 | - | 25.2 | |
| Open dwarf tree scrub, closed tall scrub (II A 2, II B 1) | 1.7 | - | 1.7 | |
| Open dwarf tree scrub, open tall scrub (II A 2, II B 2) | 116.9 | 12.8 | 129.7 | |
| Open dwarf tree scrub, closed low scrub (II A 2, II C 1) | 7.5 | - | 7.5 | |
| Open dwarf tree scrub, open low scrub (II A 2, II C 2) | 3,221.9 | 19.9 | 3,241.8 | |
| Open dwarf tree scrub, dwarf scrub (II A 2, II D)* | 10.1 | - | 10.1 | |
| Open dwarf tree scrub, ericaceous dwarf scrub (II A 2, II D 2) | 22.3 | - | 22.3 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Open dwarf tree scrub, mesic graminoid herbaceous (II A 2, III A 2) | 123.7 | - | 123.7 | |
| Dwarf tree scrub woodland (II A 3) | 74.7 | - | 74.7 | |
| Dwarf tree scrub woodland, open dwarf tree scrub (II A 3, II A 2) | 2.3 | - | 2.3 | |
| Dwarf tree scrub woodland, open tall scrub (II A 3, II B 2) | 7.2 | - | 7.2 | |
| Dwarf tree scrub woodland, closed low scrub (II A 3, II C 1) | 38.7 | - | 38.7 | |
| Dwarf tree scrub woodland, open low scrub (II A 3, II C 2) | 291.2 | 0.2 | 291.4 | |
| Dwarf tree scrub woodland, ericaceous dwarf scrub (II A 3, II D 2) | 0.6 | - | 0.6 | |
| Closed tall scrub (II B 1) | 160.0 | 347.2 | 507.2 | |
| Closed tall scrub, open broadleaf forest (II B 1, I B 2) | 0.2 | - | 0.2 | |
| Closed tall scrub, broadleaf woodland (II B 1, I B 3) | 7.9 | 12.8 | 20.7 | |
| Closed tall scrub, mixed woodland (II B 1, I C 3) | 7.8 | 22.3 | 30.1 | |
| Closed tall scrub, open dwarf tree scrub (II B 1, II A 2) | 0.6 | - | 0.6 | |
| Closed/open tall scrub (II B 1, II B 2) | 4.7 | - | 4.7 | |
| Closed tall/low scrub (II B 1, II C 1) | 17.6 | 0.1 | 17.7 | |
| Closed tall scrub, open low scrub (II B 1, II C 2) | 11.4 | 12.5 | 23.9 | |
| Closed tall scrub, dry graminoid herbaceous (II B 1, III A 1) | - | 69.5 | 69.5 | |
| Closed tall scrub, no vegetation (II B 1, NONE)[5] | - | 0.3 | 0.3 | |
| Open tall scrub (II B 2) | 383.3 | 549.8 | 933.1 | |
| Open tall scrub, open needleleaf (conifer) forest (II B 2, I A 2) | 13.3 | - | 13.3 | |
| Open tall scrub, needleleaf (conifer) woodland (II B 2, I A 3) | 103.4 | - | 103.4 | |
| Open tall scrub, broadleaf woodland (II B 2, I B 3) | 107.1 | 12.7 | 119.8 | |
| Open tall scrub, broadleaf woodland, mesic graminoid herbaceous (II B 2, I B 3, III A 2) | 2.2 | - | 2.2 | |
| Open tall scrub, closed mixed forest (II B 2, I C 1) | - | 2.3 | 2.3 | |
| Open tall scrub, open mixed forest (II B 2, I C 2) | 3.7 | - | 3.7 | |
| Open tall scrub, mixed woodland (II B 2, I C 3) | 11.9 | 9.2 | 21.1 | |
| Open tall scrub, open dwarf tree scrub (II B 2, II A 2) | 137.9 | - | 137.9 | |
| Open tall scrub, dwarf tree scrub woodland (II B 2, II A 3) | 63.6 | 24.1 | 87.7 | |
| Open tall scrub, closed low scrub (II B 2, II C 1) | 90.8 | 14.6 | 105.4 | |
| Open tall scrub, closed/open low scrub (II B 2, II C 1, II C 2) | 2.0 | - | 2.0 | |
| Open tall scrub, open low scrub (II B 2, II C 2) | 237.4 | 1,399.0 | 1,636.4 | |
| Open tall scrub, dryas dwarf scrub (II B 2, II D 1) | 8.3 | - | 8.3 | |
| Open tall scrub, dry graminoid herbaceous (II B 2, III A 1) | 21.5 | 211.8 | 233.3 | |
| Open tall scrub, mesic graminoid herbaceous (II B 2, III A 2) | 349.8 | 6.7 | 356.5 | |
| Open tall scrub, wet graminoid herbaceous (emergent) (II B 2, III A 3) | 91.4 | - | 91.4 | |
| Closed low scrub (II C 1) | 115.8 | 3.8 | 119.6 | |
| Closed low scrub, open needleleaf (conifer) forest (II C 1, I A 2) | 3.6 | - | 3.6 | |
| Closed low scrub, needleleaf (conifer) woodland (II C 1, I A 3) | 266.0 | - | 266.0 | |
| Closed low scrub, open dwarf tree scrub (II C 1, II A 2) | 25.2 | 1.0 | 26.2 | |
| Closed low scrub, dwarf tree scrub woodland (II C 1, II A 3) | 66.5 | - | 66.5 | |
| Closed low scrub, open tall scrub (II C 1, II B 2) | 125.5 | - | 125.5 | |
| Closed/open low scrub (II C 1, II C 2) | 15.6 | - | 15.6 | |
| Closed low scrub, ericaceous dwarf scrub (II C 1, II D 2) | 2.1 | - | 2.1 | |
| Closed low scrub, mesic graminoid herbaceous (II C 1, III A 2) | 495.4 | 1.0 | 496.4 | |
| Closed low scrub, wet graminoid herbaceous (emergent) (II C 1, III A 3) | 235.5 | - | 235.5 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Open low scrub (II C 2) | 1,142.7 | 799.3 | 1,942.0 | |
| Open low scrub, open needleleaf (conifer) forest (II C 2, I A 2) | 10.4 | - | 10.4 | |
| Open low scrub, needleleaf (conifer) woodland (II C 2, I A 3) | 94.0 | 7.8 | 101.8 | |
| Open low scrub, broadleaf woodland (II C 2, I B 3) | 7.0 | - | 7.0 | |
| Open low scrub, closed mixed forest (II C 2, I C 1) | - | 0.9 | 0.9 | |
| Open low scrub, open mixed forest (II C 2, I C 2) | - | 53.4 | 53.4 | |
| Open low scrub, mixed woodland (II C 2, I C 3) | - | 766.6 | 766.6 | |
| Open low scrub, closed dwarf tree scrub (II C 2, II A 1) | - | 36.3 | 36.3 | |
| Open low scrub, open dwarf tree scrub (II C 2, II A 2) | 1,225.9 | 0.2 | 1,226.1 | |
| Open low scrub, dwarf tree scrub woodland (II C 2, II A 3) | 1,662.5 | 1.6 | 1,664.1 | |
| Open low scrub, open tall scrub (II C 2, II B 2) | 140.6 | 479.2 | 619.8 | |
| Open low scrub, dwarf scrub (II C 2, II D)* | 12.4 | - | 12.4 | |
| Open low scrub, dryas dwarf scrub (II C 2, II D 1) | 6.1 | - | 6.1 | |
| Open low scrub, ericaceous dwarf scrub (II C 2, II D 2) | 16.0 | - | 16.0 | |
| Open low scrub, dry graminoid herbaceous (II C 2, III A 1) | 10.0 | 1,854.2 | 1,864.2 | |
| Open low scrub, mesic graminoid herbaceous (II C 2, III A 2) | 4,414.0 | 109.5 | 4,523.5 | |
| Open low scrub, wet graminoid herbaceous (emergent) (II C 2, III A 3) | 311.6 | - | 311.6 | |
| Open low scrub, dry forb herbaceous (II C 2, III B 1) | - | 59.6 | 59.6 | |
| Dryas dwarf scrub (II D 1) | 1.0 | - | 1.0 | |
| Ericaceous dwarf scrub (II D 2) | 310.3 | 6.4 | 316.7 | |
| Ericaceous dwarf scrub, needleleaf (conifer) woodland (II D 2, I A 3) | - | 0.5 | 0.5 | |
| Ericaceous dwarf scrub, open dwarf tree scrub (II D 2, II A 2) | 8.2 | - | 8.2 | |
| Ericaceous dwarf scrub, dwarf tree scrub woodland (II D 2, II A 3) | 3.2 | - | 3.2 | |
| Ericaceous dwarf scrub, open tall scrub (II D 2, II B 2) | - | 44.3 | 44.3 | |
| Ericaceous dwarf scrub, open low scrub (II D 2, II C 2) | 271.9 | - | 271.9 | |
| Ericaceous dwarf scrub, dry graminoid herbaceous (II D 2, III A 1) | - | 144.2 | 144.2 | |
| Ericaceous dwarf scrub, mesic graminoid herbaceous (II D 2, III A 2) | 354.4 | - | 354.4 | |
| Ericaceous dwarf scrub, wet graminoid herbaceous (emergent) (II D 2, III A 3) | 0.4 | 1.6 | 2.0 | |
| Dwarf scrub, dry graminoid herbaceous (II D, III A 1)* | - | 118.9 | 118.9 | |
| Dwarf scrub, mesic graminoid herbaceous (II D, III A 2)* | 194.7 | - | 194.7 | |
| No vegetation, open tall scrub (NONE, II B 2)[5] | 2.8 | - | 2.8 | |
| No vegetation, open low scrub (NONE, II C 2)[5] | 1.0 | - | 1.0 | |
| No vegetation, dryas dwarf scrub (NONE, II D 1)[5] | 12.8 | - | 12.8 | |
| **Subtotal** | **18,532.3** | **7,399.0** | **25,931.3** | **38.8%** |
| **Herbaceous** | | | | |
| Dry graminoid herbaceous (III A 1) | 0.7 | 95.1 | 95.8 | |
| Dry graminoid herbaceous, open dwarf tree scrub (III A 1, II A 2) | - | 8.2 | 8.2 | |
| Dry graminoid herbaceous, open tall scrub (III A 1, II B 2) | - | 82.1 | 82.1 | |
| Dry graminoid herbaceous, open low scrub (III A 1, II C 2) | - | 1,140.8 | 1,140.8 | |
| Dry graminoid herbaceous, dry forb herbaceous (III A 1, III B 1) | - | 267.1 | 267.1 | |
| Mesic graminoid herbaceous (III A 2) | 218.0 | 18.3 | 236.3 | |
| Mesic graminoid herbaceous, broadleaf woodland (III A 2, I B 3) | 0.4 | - | 0.4 | |
| Mesic graminoid herbaceous, mixed woodland (III A 2, I C 3) | 0.1 | - | 0.1 | |
| Mesic graminoid herbaceous, dwarf tree scrub woodland (III A 2, II A 3) | 19.6 | - | 19.6 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Mesic graminoid herbaceous, open tall scrub (III A 2, II B 2) | 13.8 | 0.9 | 14.7 | |
| Mesic graminoid herbaceous, closed low scrub (III A 2, II C 1) | 0.5 | - | 0.5 | |
| Mesic graminoid herbaceous, open low scrub (III A 2, II C 2) | 1,111.5 | 4.4 | 1,115.9 | |
| Mesic graminoid herbaceous, ericaceous dwarf scrub (III A 2, II D 2) | 486.6 | - | 486.6 | |
| Mesic graminoid herbaceous, wet graminoid herbaceous (emergent) (III A 2, III A 3) | 0.3 | - | 0.3 | |
| Wet graminoid herbaceous (emergent) (III A 3) | 314.1 | - | 314.1 | |
| Wet graminoid herbaceous (emergent), open tall scrub (III A 3, II B 2) | 9.4 | - | 9.4 | |
| Wet graminoid herbaceous (emergent), closed low scrub (III A 3, II C 1) | 2.8 | - | 2.8 | |
| Wet graminoid herbaceous (emergent), open low scrub (III A 3, II C 2) | 157.4 | - | 157.4 | |
| Wet graminoid herbaceous (emergent), dwarf scrub (III A 3, II D)* | 6.7 | - | 6.7 | |
| Wet graminoid herbaceous (emergent), ericaceous dwarf scrub (III A 3, II D 2) | 3.3 | - | 3.3 | |
| Wet graminoid herbaceous (emergent), willow dwarf scrub (III A 3, II D 3) | 0.1 | - | 0.1 | |
| Wet graminoid herbaceous (emergent), mesic graminoid herbaceous (III A 3, III A 2) | 6.2 | - | 6.2 | |
| Wet graminoid herbaceous (emergent), mosses (III A 3, III C 1) | 0.1 | - | 0.1 | |
| Wet graminoid herbaceous (emergent), freshwater aquatic herbaceous (III A 3, III D 1) | 3.3 | - | 3.3 | |
| Dry forb herbaceous (III B 1) | - | 71.1 | 71.1 | |
| Dry forb herbaceous, dwarf tree scrub woodland (III B 1, II A 3) | - | 170.3 | 170.3 | |
| Dry forb herbaceous, dry graminoid herbaceous (III B 1, III A 1) | - | 444.7 | 444.7 | |
| Freshwater aquatic herbaceous (III D 1) | 16.9 | - | 16.9 | |
| Freshwater aquatic herbaceous, wet graminoid herbaceous (emergent) (III D 1, III A 3) | 20.5 | - | 20.5 | |
| No vegetation, mesic graminoid herbaceous (NONE, III A 2)[5] | 1.9 | - | 1.9 | |
| No vegetation, wet graminoid herbaceous (emergent) (NONE, III A 3)[5] | 6.8 | - | 6.8 | |
| No vegetation, freshwater aquatic herbaceous (NONE, III D 1)[5] | 13.3 | - | 13.3 | |
| **Subtotal** | **2,414.3** | **2,303.0** | **4,717.3** | **7.1%** |
| **No Vegetation** | | | | |
| Disturbed | | | 2,282.4 | |
| Lacustrine unconsolidated bottom (L1UB/L2UB) | | | 50.9 | |
| Palustrine unconsolidated bottom (PUB) | | | 115.6 | |
| Palustrine unconsolidated shore (PUS) | | | 7.2 | |
| Riverine lower perennial (R2) | | | 296.5 | |
| Riverine upper perennial (R3) | | | 163.5 | |
| Riverine intermittent streambed (R4SB) | | | 9.7 | |
| Upland | | | 8.6 | |
| **Subtotal** | | | **2,934.4** | **4.4%** |
| | | | | |
| **TOTAL[4]** | **28,413.7** | **35,504.2** | **66,852.3** | **100%** |

1- The corridor is comprised of a 2000-foot-wide corridor (1000-feet on either side of the proposed centerline). Also included are the off-ROW areas (added prior to 9/9/15) with a 300-foot corridor (150-feet on either side).
2- Vegetation types from Alaska Classification System (Viereck et al., 1992).
3- Areas are rounded to the nearest 1/10$^{th}$ acre. GIS data can be consulted for more accurate numbers.
4- Total wetland and upland acres do include partially vegetated areas but do not include areas devoid of any vegetation.
5- Mapped polygon is a mosaic of bare ground and partial vegetation cover.
*In some instances, dwarf scrub vegetation could only be classified to Viereck Level II.

The Arctic Tundra Ecoregion (Table 3-5) consists primarily of scrub (45.6 percent) and herbaceous (38.4 percent) communities. Forested communities account for only 6.4 percent cover.

**Table 3-5. Vegetation Cover by Types along the Project Corridor[1], within the Arctic Tundra Ecoregion**

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| **Forest** | | | | |
| Closed needleleaf (conifer) forest (I A 1) | - | 4.9 | 4.9 | |
| Closed needleleaf (conifer) forest, open low scrub (I A 1, II C 2) | - | 131.2 | 131.2 | |
| Open needleleaf (conifer) forest (I A 2) | 57.3 | 934.1 | 991.4 | |
| Open needleleaf (conifer) forest, open tall scrub (I A 2, II B 2) | 146.4 | 48.6 | 195.0 | |
| Open needleleaf (conifer) forest, open low scrub (I A 2, II C 2) | 232.7 | 1,039.5 | 1,272.2 | |
| Open needleleaf (conifer) forest, dwarf scrub (I A 2, II D)* | - | 67.4 | 67.4 | |
| Open needleleaf (conifer) forest, dry graminoid herbaceous (I A 2, III A 1) | - | 18.2 | 18.2 | |
| Needleleaf (conifer) woodland, dwarf tree scrub woodland (I A 3, II A 3) | - | 102.5 | 102.5 | |
| Needleleaf (conifer) woodland, open tall scrub (I A 3, II B 2) | 123.1 | 156.6 | 279.7 | |
| Needleleaf (conifer) woodland, open low scrub (I A 3, II C 2) | 101.8 | 360.1 | 461.9 | |
| Needleleaf (conifer) woodland, dwarf scrub (I A 3, II D )* | - | 115.7 | 115.7 | |
| Needleleaf (conifer) woodland, dryas dwarf scrub (I A 3, II D 1) | - | 15.9 | 15.9 | |
| Closed broadleaf forest (I B 1) | - | 2.1 | 2.1 | |
| Open broadleaf forest (I B 2) | - | 6.2 | 6.2 | |
| Open broadleaf forest, dry graminoid herbaceous (I B 2, III A 1) | - | 0.0 | 0.0 | |
| Closed mixed forest (I C 1) | 50.6 | 817.6 | 868.2 | |
| Open mixed forest, open tall scrub (I C 2, II B 2) | 35.9 | 16.6 | 52.5 | |
| Open mixed forest, open low scrub (I C 2, II C 2) | 2.9 | 152.5 | 155.4 | |
| Mixed woodland (I C 3) | - | 46.9 | 46.9 | |
| Mixed woodland, open low scrub (I C 3, II C 2) | - | 325.4 | 325.4 | |
| **Subtotal** | **750.7** | **4,362.0** | **5,112.7** | **6.4%** |
| **Scrub** | | | | |
| Open dwarf tree scrub (II A 2) | 185.3 | - | 185.3 | |
| Open dwarf tree scrub, open mixed forest (II A 2, I C 2) | 3.7 | - | 3.7 | |
| Open dwarf tree scrub, open tall scrub (II A 2, II B 2) | 20.5 | - | 20.5 | |
| Open dwarf tree scrub, open low scrub (II A 2, II C 2) | 1,626.7 | 189.3 | 1,816.0 | |
| Open dwarf tree scrub, dwarf scrub (II A 2, II D)* | 9,096.9 | 44.7 | 9,141.6 | |
| Open dwarf tree scrub, mesic forb herbaceous (II A 2, III B 2) | 43.6 | - | 43.6 | |
| Dwarf tree scrub woodland, open low scrub (II A 3, II C 2) | 215.5 | 260.3 | 475.8 | |
| Dwarf tree scrub woodland, willow dwarf scrub (II A 3, II D 3) | - | 19.6 | 19.6 | |
| Dwarf tree scrub woodland, mesic graminoid herbaceous (II A 3, III A 2) | 34.0 | - | 34.0 | |
| Dwarf tree scrub woodland, mesic graminoid herbaceous, ericaceous dwarf scrub (II A 3, III A 2, II D 2) | 14.1 | - | 14.1 | |
| Closed tall scrub (II B 1) | 25.5 | 13.6 | 39.1 | |
| Closed tall scrub, dwarf tree scrub woodland (II B 1, II A 3) | 26.8 | - | 26.8 | |
| Closed tall scrub, open low scrub (II B 1, II C 2) | 15.8 | 17.6 | 33.4 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Open tall scrub (II B 2) | 160.1 | 130.1 | 290.2 | |
| Open tall scrub, needleleaf (conifer) woodland (II B 2, I A 3) | 2.2 | - | 2.2 | |
| Open tall scrub, open dwarf tree scrub (II B 2, II A 2) | 144.4 | - | 144.4 | |
| Open tall scrub, dwarf tree scrub woodland (II B 2, II A 3) | 44.6 | - | 44.6 | |
| Open tall scrub, closed low scrub (II B 2, II C 1) | - | 31.8 | 31.8 | |
| Open tall scrub, open low scrub (II B 2, II C 2) | 615.6 | 151.1 | 766.7 | |
| Open tall scrub, dry graminoid herbaceous (II B 2, III A 1) | 74.3 | - | 74.3 | |
| Open tall scrub, mesic graminoid herbaceous (II B 2, III A 2) | 6.0 | - | 6.0 | |
| Open tall scrub, wet graminoid herbaceous (emergent) (II B 2, III A 3) | 6.2 | - | 6.2 | |
| Open tall scrub, no vegetation (II B 2, NONE)[5] | 1.1 | - | 1.1 | |
| Closed low scrub (II C 1) | 68.2 | 2.7 | 70.9 | |
| Closed low scrub, open low scrub, (II C 1, II C 2) | 17.9 | - | 17.9 | |
| Closed low scrub, mesic graminoid herbaceous (II C 1, III A 2) | 132.2 | - | 132.2 | |
| Open low scrub (II C 2) | 1,656.9 | 671.5 | 2,328.4 | |
| Open low scrub, open needleleaf (conifer) forest (II C 2, I A 2) | 16.7 | 26.3 | 43.0 | |
| Open low scrub, needleleaf (conifer) woodland (II C 2, I A 3) | 26.5 | 55.1 | 81.6 | |
| Open low scrub, closed dwarf tree scrub (II C 2, II A 1) | 33.7 | - | 33.7 | |
| Open low scrub, open dwarf tree scrub (II C 2, II A 2) | 1,785.2 | 42.8 | 1,828.0 | |
| Open low scrub, dwarf tree scrub woodland (II C 2, II A 3) | 1,557.0 | 5.0 | 1,562.0 | |
| Open low scrub, closed broadleaf forest (II C 2, I B 1) | 18.8 | - | 18.8 | |
| Open low scrub, open tall scrub (II C 2, II B 2) | 193.7 | 278.4 | 472.1 | |
| Open low scrub, dwarf scrub (II C 2, II D)* | 45.3 | 318.4 | 363.7 | |
| Open low scrub, dryas dwarf scrub (II C 2, II D 1) | 22.0 | 10.7 | 32.7 | |
| Open low scrub, ericaceous dwarf scrub (II C 2, II D 2) | | 25.7 | 25.7 | |
| Open low scrub, willow dwarf scrub (II C 2, II D 3) | 138.9 | - | 138.9 | |
| Open low scrub, dry graminoid herbaceous (II C 2, III A 1) | 309.0 | 51.1 | 360.1 | |
| Open low scrub, mesic graminoid herbaceous (II C 2, III A 2) | 6,531.1 | 158.2 | 6,689.3 | |
| Open low scrub, wet graminoid herbaceous (emergent) (II C 2, III A 3) | 526.8 | - | 526.8 | |
| Open low scrub, dry forb herbaceous (II C 2, III B 1) | - | 237.8 | 237.8 | |
| Dwarf scrub (II D)* | 89.2 | 1,482.5 | 1,571.7 | |
| Dryas dwarf scrub (II D 1) | 8.0 | 48.5 | 56.5 | |
| Dryas dwarf scrub, open low scrub (II D 1, II C 2) | 26.1 | 40.0 | 66.1 | |
| Dryas dwarf scrub, dry graminoid herbaceous (II D 1, III A 1) | 1.4 | 93.6 | 95.0 | |
| Dryas dwarf scrub, mesic graminoid herbaceous (II D 1, III A 2) | 103.9 | 239.1 | 343.0 | |
| Ericaceous dwarf scrub (II D 2) | 0.5 | - | 0.5 | |
| Ericaceous dwarf scrub, open tall scrub (II D 2, II B 2) | - | 109.6 | 109.6 | |
| Ericaceous dwarf scrub, dry graminoid herbaceous (II D 2, III A 1) | - | 1.1 | 1.1 | |
| Ericaceous dwarf scrub, mesic graminoid herbaceous (II D 2, III A 2) | 428.2 | 1.1 | 429.3 | |
| Ericaceous dwarf scrub, wet graminoid herbaceous (emergent) (II D 2, III A 3) | 216.1 | - | 216.1 | |
| Willow dwarf scrub (II D 3) | 141.1 | 9.2 | 150.3 | |
| Willow dwarf scrub , open low scrub (II D 3, II C 2) | 9.3 | - | 9.3 | |
| Willow dwarf scrub, mesic graminoid herbaceous (II D 3, III A 2) | 2,658.8 | 18.9 | 2,677.7 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Willow dwarf scrub, wet graminoid herbaceous (emergent) (II D 3, III A 3) | 7.0 | - | 7.0 | |
| Dwarf scrub, open dwarf tree scrub (II D, II A 2) * | 94.3 | - | 94.3 | |
| Dwarf scrub, dwarf tree scrub woodland (II D, II A 3) * | 364.9 | - | 364.9 | |
| Dwarf scrub, open low scrub (II D, II C 2) * | - | 365.4 | 365.4 | |
| Dwarf scrub, dry graminoid herbaceous (II D, III A 1) * | 2.8 | 106.3 | 109.1 | |
| Dwarf scrub, mesic graminoid herbaceous (II D, III A 2) * | 404.6 | - | 404.6 | |
| Dwarf scrub, wet graminoid herbaceous (emergent) (II D, III A 3)* | 693.4 | - | 693.4 | |
| No vegetation, dryas dwarf scrub (NONE, II D 1)[5] | 326.6 | - | 326.6 | |
| **Subtotal** | **31,019.0** | **5,257.1** | **36,276.1** | **45.6%** |
| **Herbaceous** | | | | |
| Dry graminoid herbaceous (III A 1) | 6.6 | 31.8 | 38.4 | |
| Dry graminoid herbaceous, needleleaf (conifer) woodland (III A 1, I A 3) | - | 44.0 | 44.0 | |
| Dry graminoid herbaceous, open low scrub (III A 1, II C 2) | 21.7 | 4.8 | 26.5 | |
| Dry graminoid herbaceous, dwarf scrub (III A 1, II D)* | 0.6 | 164.4 | 165.0 | |
| Dry graminoid herbaceous, dryas dwarf scrub (III A 1, II D 1) | 5.0 | 26.8 | 31.8 | |
| Mesic graminoid herbaceous (III A 2) | 1,140.5 | 1.3 | 1,141.8 | |
| Mesic graminoid herbaceous, open dwarf tree scrub (III A 2, II A 2) | 38.6 | - | 38.6 | |
| Mesic graminoid herbaceous, open tall scrub (III A 2, II B 2) | - | 4.3 | 4.3 | |
| Mesic graminoid herbaceous, open low scrub (III A 2, II C 2) | 3,561.9 | 6.6 | 3,568.5 | |
| Mesic graminoid herbaceous, dryas dwarf scrub (III A 2, II D 1) | 118.8 | 33.0 | 151.8 | |
| Mesic graminoid herbaceous, ericaceous dwarf scrub (III A 2, II D 2) | 7,814.3 | 27.1 | 7,841.4 | |
| Mesic graminoid herbaceous, willow dwarf scrub (III A 2, II D 3) | 4,676.9 | 11.0 | 4,687.9 | |
| Wet graminoid herbaceous (emergent) (III A 3) | 4,300.7 | - | 4,300.7 | |
| Wet graminoid herbaceous (emergent), open dwarf tree scrub (III A 3, II A 2) | 1.3 | - | 1.3 | |
| Wet graminoid herbaceous (emergent), open low scrub (III A 3, II C 2) | 692.1 | - | 692.1 | |
| Wet graminoid herbaceous (emergent), dwarf scrub (III A 3, II D)* | 3,231.2 | - | 3,231.2 | |
| Wet graminoid herbaceous (emergent), dryas dwarf scrub (III A 3, II D 1) | 17.0 | - | 17.0 | |
| Wet graminoid herbaceous (emergent), ericaceous dwarf scrub (III A 3, II D 2) | 2,526.2 | - | 2,526.2 | |
| Wet graminoid herbaceous (emergent), willow dwarf scrub (III A 3, II D 3) | 1,320.8 | - | 1,320.8 | |
| Wet graminoid herbaceous (emergent), mesic graminoid herbaceous (III A 3, III A 2) | 12.8 | - | 12.8 | |
| Wet graminoid herbaceous (emergent), no vegetation (III A 3, NONE)[5] | 18.8 | - | 18.8 | |
| Lichens (III C 2) | 5.5 | - | 5.5 | |
| Freshwater aquatic herbaceous (III D 1) | 688.5 | - | 688.5 | |
| Brackish water aquatic herbaceous (III D 2) | 11.3 | - | 11.3 | |
| Marine aquatic herbaceous, mesic graminoid herbaceous (III D 3, III A 2) | - | 0.4 | 0.4 | |
| No vegetation, wet graminoid herbaceous (emergent) (NONE, III A 3)[5] | 8.9 | - | 8.9 | |
| **Subtotal** | **30,220.0** | **355.5** | **30,575.5** | **38.4%** |
| **No Vegetation** | | | | |
| Disturbed | | | 2,620.8 | |
| Estuarine (E1/E2) | | | 196.9 | |
| Lacustrine unconsolidated bottom (L1UB/L2UB) | | | 1,160.4 | |
| Palustrine unconsolidated bottom (PUB) | | | 1,539.6 | |

| Vegetation Type[2] | Acres[3] (Wetlands) | Acres[3] (Uplands) | Total Acres[3] | % of Grand Total |
|---|---|---|---|---|
| Palustrine unconsolidated shore (PUS) | | | 1.3 | |
| Riverine tidal unconsolidated bottom (R1UB) | | | 24.1 | |
| Riverine lower perennial (R2) | | | 346.2 | |
| Riverine upper perennial (R3) | | | 1,382.7 | |
| Riverine intermittent streambed (R4SB) | | | 265.5 | |
| Upland | | | 131.2 | |
| | | **Subtotal** | **7,668.7** | **9.6%** |
| | | | | |
| **TOTAL[4]** | **61,989.7** | **9,974.6** | **79,633.0** | **100%** |

1- The corridor is comprised of a 2000-foot-wide corridor (1000-feet on either side of the proposed centerline). Also included are the off-ROW areas (added prior to 9/9/15) with a 300-foot corridor (150-feet on either side).
2- Vegetation types from Alaska Classification System (Viereck et al., 1992).
3- Areas are rounded to the nearest 1/10$^{th}$ acre. GIS data can be consulted for more accurate numbers.
4- Total wetland and upland acres do include partially vegetated areas but do not include areas devoid of any vegetation.
5- Mapped polygon is a mosaic of bare ground and partial vegetation cover.
*In some instances, dwarf scrub vegetation could only be classified to Viereck Level II.

## 3.3 TIMBER RESOURCES

The definition of merchantable timber varies widely based on location and stand types. Most of the merchantable timber along the route is within the Mainline corridor south of Livengood, and is restricted to white spruce stands (either pure or mixed with balsam poplar, aspen, tamarack, or birch) on well-drained sites. Such stands are scattered throughout the corridor, but are most prevalent where the corridor crosses the Tanana Valley State Forest, and within the lower Susitna River basin south of MP 647. Acres of merchantable timber in the Mainline corridor will be calculated and published in the 2016 Vegetation Study Report.

# 4.0 ACRONYMS AND TERMS

| | |
|---|---|
| ADNR | Alaska Department of Natural Resources |
| APP | Alaska Pipeline Project |
| DP | Determination Point |
| EIS | Environmental Impact Statement |
| FERC | Federal Energy Regulatory Commission |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| LIDAR | Light Detection and Ranging |
| LNG | liquefied natural gas |
| MP | milepost |
| NEPA | National Environmental Policy Act |
| NWI | National Wetland Inventory |
| OP | Observation Point |
| QA/QC | Quality Assurance/Quality Control |
| Rev | Revision |
| ROW | Right-of-Way |
| U.S. | United States |

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# 6.0 APPENDICES

# APPENDIX A – 2015 VEGETATION FIELD SURVEY PROTOCOLS

Alaska LNG

# 2015 VEGETATION SURVEY FIELD STUDY PROTOCOLS

## USAI-UR-SPFLD-00-000001-000

| Rev | Date | Revision Description | Originator | Reviewer / Endorser | Response Code | Approver |
|---|---|---|---|---|---|---|
| A | 3/21/15 | Issued for Review and Comment | J. Brownlee | | | |
| 0 | 3/24/15 | Issued for Use | V. Watkins | | | |
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| Document Control No. | Country | Facility | Originator | Discipline | Type | Sub-Type | Location | Sequence | Identifier |
|---|---|---|---|---|---|---|---|---|---|
| | US | AI | UR | S | P | FLD | 00 | 000001 | 000 |

## AUTHORIZATION

**APPROVED BY:** **DATE: APRIL 23, 2015**
**NAME: MIKE GRAY**
**TITLE: PROJECT MANAGER**

## REVIEW

**REVIEWED BY:** **DATE: APRIL 23, 2015**
**NAME: VALERIE WATKINS**
**TITLE: ENVIRONMENTAL SCIENTIST/BIOLOGIST**

## PREPARATION

**PREPARED BY:** **DATE: APRIL 23, 2015**
**NAME: JESSIE BROWNLEE**
**TITLE: WILDLIFE SCIENTIST**

# REVISION MODIFICATION LOG

| Revision | Section | Description |
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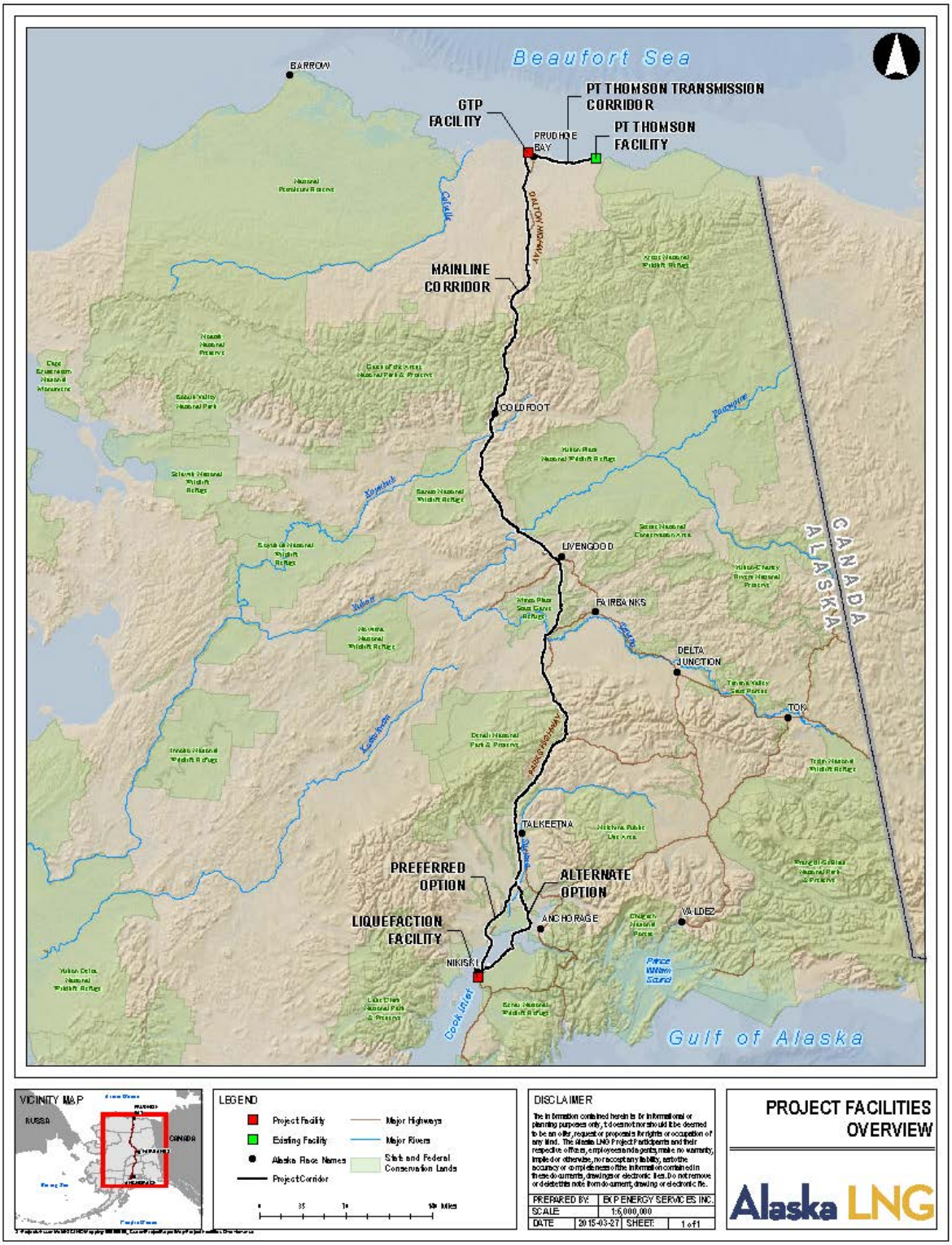
**Note – All pipeline routing and/or facility siting information described in this document should be considered preliminary and subject to change.**

# 1.0 PURPOSE AND SCOPE

## 1.1 PROJECT DESCRIPTION

Please see Project Description at the beginning of this Resource Report.

**Figure 1: Proposed Alaska LNG Route Rev B Alignment (Released 2/25/15)**



# 2.0 INTRODUCTION

Alaska LNG will conduct vegetation studies to identify and describe vegetative cover types, and to verify the pre-field vegetation mapping within specific areas along the Project route. The 2015 field surveys will focus on rerouted sections of the Rev B alignment as well as previously unmapped or field verified areas where aerial imagery has recently been acquired. Field targets are anticipated along the entire length of the Project route from Prudhoe Bay to Nikiski, Alaska.

Results of the vegetation survey will facilitate the eventual evaluation of project-related direct, indirect, and cumulative impacts under the Federal Energy Regulatory Commission (FERC) Resource Report 3 (Fish, Wildlife, and Vegetation), and the National Environmental Policy Act (NEPA).

This document presents the vegetation survey field protocols that will be used during the 2015 field season. It discusses the protocols used in both the field and office for classifying vegetation cover types that may be impacted by the proposed project.

## 2.1 OBJECTIVES

The primary objective of the 2015 vegetation survey is to identify and describe vegetative cover types along select areas of the Project route.

Specific objectives include:

- Complete vegetation surveys in the vicinity of the pre-selected field targets;
- Collect data at field-selected observation points and at additional vegetation points where necessary to adequately update the field maps;
- Update the pre-field vegetation mapping based on results of the field data; and
- Complete a desktop analysis to document merchantable timber within the Project area.

## 2.2 PROJECT AREA

The Alaska LNG Project route passes through three ecoregions with nine sub-ecoregions, as described by Nowacki et al. (2001). Ecoregions are defined as a unit of land or water with a geographically distinct compilation of species, communities, and environmental conditions.

- Arctic Tundra Ecoregion
  - Beaufort Coastal Plain Sub-Ecoregion (Milepost [MP] 0 to 62) (PMP MP 0 to 58)
  - Brooks Foothills Sub-Ecoregion (MP 62 to 143)
  - Brooks Range Sub-Ecoregion (MP 143 to 252)
- Intermontane Boreal Ecoregion
  - Kobuk Ridges and Valleys (MP 252 to 257)
  - Ray Mountains Sub-Ecoregion (MP 257 to 430)
  - Tanana-Kuskokwim Lowlands Sub-Ecoregion (MP 430 to 443; 455 to 517)
  - Yukon-Tanana Uplands Sub-Ecoregion (MP 443 to 455)
- Alaska Range Transition Ecoregion
  - Alaska Range Sub-Ecoregion (MP 517 to 616)
  - Cook Inlet Basin Sub-Ecoregion (MP 616 to 804)

The Alaska LNG Corridor crosses the Beaufort Coastal Plain Sub-Ecoregion along the Point Thomson Pipeline route and the northern portion of Alaska Mainline south of Prudhoe Bay. The route then traverses the Brooks Foothills Sub-Ecoregion before it winds though the Brooks Range Sub-Ecoregion. South of the Brooks Range, the route crossed into the Intermontane Boreal Ecoregion, where it briefly traverses the Kobuk Ridges and Valleys Sub-Ecoregion; before entering into the Ray Mountains Sub-Ecoregion, continues south and passes through the Tanana-Kuskokwim Lowlands, briefly passing through the Yukon-Tanana Uplands to the Alaska Range Sub-Ecoregion. South of the Alaska Range, the route traverses though the very large Cook Inlet Basin Sub-Ecoregion south to its terminus at the LNG Facility at Nikiski, on the Kenai Peninsula.

The 2015 Alaska LNG Vegetation Survey will focus on classifying vegetation at pre-selected target sites along the length of the mainline corridor from Prudhoe Bay to Nikiski, Alaska. Field work will be concentrated within a 300-foot field survey corridor (150-feet on each side of the proposed alignment centerline), ensuring that the vegetation field work occurs near areas most likely to be disturbed by the proposed project The mapping effort will include all the lands and waters within a 2000-foot wide corridor – 1000 feet on either side of the proposed Alaska LNG mainline centerline.

The Alaska LNG field survey area is divided into eight geographic spreads for planning purposes:

1. Point Thomson to Prudhoe Bay, PT Pipeline milepost (MP) 0 to 58
2. Prudhoe Bay to Atigun Pass, MP 0 to 170
3. Atigun Pass to Yukon River, MP 170 to 358
4. Yukon River to Livengood, MP 358 to 401
5. Livengood to Healy, MP 401 to 525
6. Healy to Trapper Creek, MP 525 to 665
7. Trapper Creek to Cook Inlet, MP 665 to 764
8. Cook Inlet to Nikiski, MP 764 to 804

# 3.0 METHODS

## 3.1 OVERVIEW

Vegetation is classified using Level III of the Alaska Vegetation Classification System (Viereck et al. 1992), which is a hierarchical system based on dominant growth forms (tree, shrub, herb), canopy height and closure, general soil moisture and salinity, and dominant plants. Classification to Level III of the Viereck system provides the detail necessary to characterize plant communities for the purpose of assessing habitat in the survey area.

Standard methods are used to delineate wetlands and vegetation for large linear projects in Alaska. The protocols comprise a three-phased iterative approach, including: 1) vegetation pre-mapping relying primarily on aerial photo interpretation; 2) collection of ground reference data at pre-determined field targets; and 3) revision of vegetation pre-mapping based on results of field efforts. The vegetation survey will be completed in conjunction with the wetland surveys.

## 3.2 VEGETATION PRE-MAPPING

The vegetation pre-mapping has been completed for the preliminary Alaska LNG route corridor. Vegetation classes were delineated on digital ortho-rectified and geo-referenced true color aerial photography with 1.6-foot pixel resolution using the following aerial imagery:

- BP Exploration Alaska Inc. aerial imagery for Prudhoe Bay, Endicott, and Badami (1.0-foot pixel resolution; July 2012) (BPX 2012a, BPX 2012b, BPX 2012c);
- ExxonMobil aerial imagery for Point Thomson (2.0 and 0.5-foot pixel resolution; July 2001/2006, and July 2009) (ExxonMobil 2001-6, ExxonMobil 2009a);
- ExxonMobil aerial imagery for the Alaska Pipeline Project (0.5-meter pixel resolution; summer 2008, 2009, 2010, and 2011) (ExxonMobil 2008, ExxonMobil 2009b, ExxonMobil 2011);
- Healy Area Orthophoto (United States [U.S.] Census Bureau 2006);
- Digital Orthophoto Quarter Quadrangles - Anderson Area (Natural Resources Conservation Service [NRCS] 2006);
- Northern Central Corridor Ortho Mosaic (Digital Globe 2013a);
- Southern Corridor Ortho Mosaic (Digital Globe 2013b);
- Talkeetna Aerial Orthophoto (Matanuska Susitna Borough [MSB] 2011a);
- Caswell Aerial Orthophoto (MSB 2011b);
- Willow Aerial Orthophoto (MSB 2011c);
- Point MacKenzie Aerial Orthophoto (MSB 2011d); and
- Nikiski Area Aerial Orthophoto (Kenai Peninsula Borough 2006).

Data from the following sources was also used during the mapping process:

- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) digital datasets and hardcopy maps;
- NRCS Soil Survey digital datasets and hardcopy maps;
- Light Detection and Ranging generated topographic contours (TransCanada 2011, MSB 2011e);
- Kenai Watershed Forum – Cook Inlet Wetlands for the Kenai Peninsula and the Matanuska Susitna Boroughs (Gracz 2011);

- Pertinent previous studies, such as Terrestrial and Aquatic Habitat Mapping Along the Alaska Natural Gas Pipeline System (USFWS 1980), the Denali Pipeline Project, the instate Alaska Stand Alone Pipeline Project, and the Alaska Pipeline Project;
- U.S. Geological Survey Digital Raster Graphics (e.g., topographic maps);
- Existing Geographic Information System (GIS) layers including waterbodies, contours, and roads; and
- Existing Land Status GIS layers including: State of Alaska, U.S. Bureau of Land Management, and Native allotments.

All vegetation mapping was created in a GIS geodatabase, using a "heads-up" digitizing effort. This "heads-up" process applies aerial image interpretation to delineate vector polygons of ground features. Data sources were overlain on aerial photography and non-wetland vegetation communities were identified by interpreting color, texture, and landscape position, among other elements. The wetland mapping effort resulted in the classification of mapping polygons as either wetland (meeting the U.S. Army Corps of Engineers [USACE] wetland delineation criteria as a wetland) or non-wetland. The dominant vegetation structure (trees, shrubs, herbaceous vegetation) in wetland polygons was classified using the Cowardin (1979) classification system, while vegetation within non-wetland polygons was classified using the Alaska Vegetation Classification System (Viereck et al., 1992). For completeness, wetland polygons were also assigned a Viereck classification code. It should be noted that although a polygon was classified as "upland" during wetland mapping, that does not mean that the vegetation within the polygon is upland vegetation. Mesic vegetation communities are common in polygons that do not meet the three criteria of a wetland under USACE methods. Vegetation was mapped at a scale of 1:2,400 (1 inch to 200 feet) or finer.

## 3.3 FIELD TARGET SELECTION

Field targets for the vegetation survey will be the same as those selected for the wetland survey, although vegetation points will be taken in adjacent uplands as well as wetlands. Vegetation observation points will also be established in representative cover types as reference sites. The field targets were selected within the current higher confidence portions of the Alaska LNG route corridor.

Field targets may be re-evaluated based on the status of land access permissions. When necessary, new field targets will be located on nearby accessible parcels in areas with similar aerial photography vegetation signatures and site conditions as the original field targets.

## 3.4 VEGETATION FIELD DATA COLLECTION

Vegetation field surveys will be conducted at the same time as the wetland field surveys and by the same field crew. Field targets will be accessed via existing highways and secondary roads where available. A helicopter will be required to access remote sites. A Global Positioning System (GPS) device will be used to locate sites and to collect coordinates. Field crews will collect vegetation data at each field target using the Vegetation Classification Data Form (**Appendix A**). The GPS device will also be used to collect limited field data on an electronic form that will be developed for the Project.

Regional vegetation guides will be used to identify plants including: Flora of Alaska and Neighboring Territories (Hulten 1968), Wetland Sedges of Alaska (Tande and Lipkin 2003), Field Guide to Alaska Grasses (Skinner et al. 2012), Alaska Trees and Shrubs (Viereck and Little 2007), and Willows of Interior and Southcentral Alaska (Collet 2004, 2010). Non-vascular plants (lichens, mosses, liverworts) and fungi will not be surveyed or recorded as part of this effort. Rare and sensitive plants will also be recorded with photos and GPS locations when encountered, but

there will be no specific effort to search for them. Invasive species will also be noted when encountered, but because these species are often very widespread, the exact location would not be recorded for each observation.

Field crews will also collect qualitative vegetation data at observation points and establish additional field targets and complete Vegetation Classification Data Forms where necessary, and will not be limited by the pre-selected field targets. Field crews will use their best professional judgment and collect appropriate field data to adequately revise the wetland pre-mapping. A detailed wetland and vegetation field survey gear list is provided in **Appendix B**.

## 3.5 MAP REVISIONS

As vegetation field data (i.e., GPS data, Vegetation Classification Forms for upland sites, site photographs, logbooks, and field maps) become available, this data will be downloaded in the office and plotted on the base maps of the route. The location of each plot will be attributed with the information collected in the field. This allows the creation of a reference dataset linking an aerial photography signature to a vegetation type. This reference dataset will be used to finalize the mapping of the 2,000-foot corridor.

Generally, the pre-mapping revision process involves:

- Exporting spatial data for all field targets and photo points from the Alaska LNG database;
- Compiling electronic copies of all notes, sketches, and photographs associated with above points; and
- Using these data in a GIS platform to update files through heads-up digitizing, or modifying the initial map on screen as described in Section 3.2 of the Vegetation Survey Field Survey Protocols.

## 3.6 MERCHANTABLE TIMBER

Existing data will be analyzed to identify timber management areas within the 300-foot mapping corridor. If timber production areas are identified within the mapping corridor, volumetric data will be acquired from the Bureau of Land Management (BLM) or the state, and will be used to determine the approximate board feet of merchantable timber. No field work is proposed for analysis of merchantable timber.

## 3.7 DATA RECORDING AND PROCESSING

Data will be recorded on hardcopy field forms (**Appendix A**), and some of the data will also be entered into an electronic data form. Electronic data files will be uploaded to a Project website through an internet connection or by a satellite link, and will include GPS locations, electronic data form, site photos, site sketches, and field notes.

## 3.8 QUALITY ASSURANCE / QUALITY CONTROL

The wetlands and vegetation technical lead will conduct quality audits during the first week of each deployment. These audits will ensure data quality and consistency between teams, and will provide an opportunity for any problems to be corrected immediately.

Each crew member is responsible for collecting clear and accurate data according to the field survey protocol. The field crew chief will review all hardcopy and electronic data forms and complete a quality assurance/quality control (QA/QC) checklist (**Appendix C**) before leaving each site.

The field crew manager will ensure that all data files are uploaded to the Project website. These transmitted files will then be downloaded and reviewed by office-based data management staff. The wetlands and vegetation technical lead will check each hardcopy data sheet and electronic data form for quality and consistency, as it is received. If problems arise, the field crew will be notified promptly to ensure that any data quality issues are corrected immediately.

## 3.9 REPORTING

Results will be compiled into a Vegetation Survey Report, and will include project background, methodologies, and results and analysis. A GIS dataset consisting of vegetation communities and locations of areas with merchantable timber will also be compiled.

Results of this survey will eventually be provided in the FERC Resource Report 3 and provided to other resource agencies to assist in overall Project permitting.

# 4.0 FIELD STUDIES EXECUTION

Field study execution details are currently in the process of being developed and will include: field crew composition, schedule and march charts, field target maps, and general project-wide permits and approvals. Field safety will also be discussed and a specific Job Safety Analysis (JSA) developed for wetland surveys will be included.

# 5.0 ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| BLM | Bureau of Land Management |
| FERC | Federal Energy Regulatory Commission |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GTP | Gas Treatment Plant |
| JSA | Job Safety Analysis |
| LNG | liquefied natural gas |
| MP | milepost |
| MSB | Matanuska Susitna Borough |
| NEPA | National Environmental Policy Act |
| NRCS | Natural Resources Conservation Service |
| PBU | Prudhoe Bay Unit |
| PTU | Point Thomson Unit |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |

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# 7.0 APPENDICES

# APPENDIX A – VEGETATION CLASSIFICATION DATA FORM

| **Vegetation Classification Data Form** | | | |
|---|---|---|---|
| Date: | Project Name & No.:<br>Alaska LNG 26221163 | | Field Target: |
| Investigators: | | | Feature ID: |
| Latitude: | | Longitude: | Datum: |
| Picture No.: | | Logbook No: | Logbook Page No: |
| **Location Description:** | | | |
| | | | |
| **Common Species Observed (Scientific Name)** | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Percent Cover of Dominant Structure Level: | | | |
| **Habitat Description:** | | | |
| | | | |
| **Alaska Vegetation Classification: Level I, Level II, Level III** | | | |
| | | | |
| **Notes:** | | | |
| | | | |

Field Crew Chief: _____ Field Scientist/Technician_____

Technical Lead: _____

**Table I-Alaska vegetation classification to level III**

| Level I | Level II | Level III |
|---|---|---|
| I. Forest | A. Needleleaf (conifer) forest | (1) Closed needleleaf (conifer) forest<br>(2) Open needleleaf (conifer) forest<br>(3) Needleleaf (conifer) woodland |
| | B. Broadleaf forest | (1) Closed broadleaf forest<br>(2) Open broadleaf forest<br>(3) Broadleaf woodland |
| | C. Mixed forest | (1) Closed mixed forest<br>(2) Open mixed forest<br>(3) Mixed woodland |
| II. Scrub | A. Dwarf tree scrub | (1) Closed dwarf tree scrub<br>(2) Open dwarf tree scrub<br>(3) Dwarf tree scrub woodland |
| | B. Tall scrub | (1) Closed tall scrub<br>(2) Open tall scrub |
| | C. Low scrub | (1) Closed low scrub<br>(2) Open low scrub |
| | D. Dwarf scrub | (1) Dryas dwarf scrub<br>(2) Ericaceous dwarf scrub<br>(3) Willow dwarf scrub |
| III. Herbaceous | A. Graminoid herbaceous | (1) Dry graminoid herbaceous<br>(2) Mesic graminoid herbaceous<br>(3) Wet graminoid herbaceous (emergent) |
| | B. Forb herbaceous | (1) Dry forb herbaceous<br>(2) Mesic forb herbaceous<br>(3) Wet forb herbaceous (emergent) |
| | C. Bryoid herbaceous | (1) Mosses<br>(2) Lichens |
| | D. Aquatic (nonemergent) herbaceous | (1) Freshwater aquatic herbaceous<br>(2) Brackish water aquatic herbaceous<br>(3) Marine aquatic herbaceous |

Descriptions of levels I, II, III, and IV follow the classification table.

1a. Trees over 3 meters (10 ft) tall are present and have a canopy cover of 10 percent or more . . . . . I. Forest 2

1b. Trees over 3 meters (10 ft) tall are absent or nearly so, Less than 10 percent cover. (Dwarf trees, less than 3 meters [10 ft] tall may be present and abundant . . . . . 7

I. Forest

2a. Over 75 percent of tree cover contributed by needleleaf (conifer) species . . . . . I.A Needleleaf forest 3

2b. Less than 75 percent of tree cover contributed by needleleaf (conifer) species . . . . . 4

3a. Tree canopy of 60-100 percent cover . . . . . I.A.1 Closed needleleaf forest

3b. Tree canopy of 25-59 percent cover . . . . . I.A.2 Open needleleaf forest

3c. Tree canopy of 10-24 percent cover . . . . . I.A.3 Needleleaf woodland

4a. Over 75 percent of tree cover contributed by broadleaf species . . . . . I.B Broadleaf forest 5

4b. Broadleaf or needleleaf species contribute 25 to 75 percent of the tree cover . . . . . 6

5a. Tree canopy of 60-100 percent cover . . . . . I.B.1 Closed broadleaf forest

5b. Tree canopy of 25-59 percent cover . . . . . I.B.2 Open broadleaf forest

5c. Tree canopy of 10-24 percent cover . . . . . I.B.3 Broadleaf woodland

6a. Tree canopy of 60-100 percent cover. . . . . I.C.1 Closed mixed forest

6b. **Tree canopy of 25-59 percent cover. . . . . I.C.2 Open mixed forest**

6c. Tree canopy of 10-24 percent cover . . . . . I.C.3 Mixed woodland

7a. Vegetation with at least 25 percent cover of erect to decumbent shrubs or with at least 10 percent cover of dwarf trees (less than 3 meters [10 ft] tall) . . . . . 8

7b. Vegetation herbaceous (may have up to 25 percent shrub cover) . . . . . 15

II. Scrub

8a. Vegetation with at least 10 percent cover of dwarf trees . . . . . II.A Dwarf tree scrub 9

8b. Vegetation with at least 25 percent **cover of shrubs and less than** 10 percent cover of dwarf trees . . . . . 10

9a. Dwarf tree canopy of 60-100 percent **cover . . . . . II.A.1 Closed dwarf tree scrub**

9b. Dwarf tree canopy of 25-59 percent **cover . . . . . II.A.2 Open dwarf tree scrub**

9c. Dwarf tree canopy of 10-24 percent cover . . . . . II.A.3 Dwarf tree scrub woodland

10a. Shrubs more than 1.5 meters (5 ft) tall . . . . . II.B Tall scrub 11

10b. Shrubs less than 1.5 meters **(5ft)tall** . . . . . 12

11 a. Shrub canopy cover greater than 75 percent. . . . . **II.8.1 Closed tall scrub**

11 b. Shrub canopy cover of 25-74 percent . . . . . II.B.2 Open tall scrub

12a. Shrubs 20 centimeters to 1.5 meters tall . . . . . II.C Low scrub 13

12b. Shrubs under 20 centimeters in height . . . . . II.D Dwarf scrub 14

13a. Shrub canopy cover greater than 75 percent . . . . . II.C.I Closed low scrub

13b. Shrub canopy cover of 25-74 percent, or as low as 2 percent if little or no other vegetation cover present . . . . . II.C.2 Open low scrub

14a. Dryas species dominant in the dwarf shrub layer . . . . . **II.D.1 Dryas dwarf scrub**

14b. Ericaceous species dominant in the dwarf shrub layer . . . . . II.D.2 Ericaceous dwarf scrub

14c. Willow species dominant in the dwarf scrub layer . . . . . II.D.2 Willow dwarf scrub

III. Herbaceous

15a. Terrestrial vegetation, or if growing in the water, dominated by emergent vegetation . . . . . 16

15b. Dominant vegetation growing submerged in water or floating on the water surface, but not emerging above the water . . . . . III.D Aquatic herbaceous 21

16a. Grasses, sedges, or rushes (graminoid) plants dominant . . . . . III.A Graminoid herbaceous 17

16b. Forbs or bryophytes dominant . . . . . 18

17a. Grasslands of well-drained, dry sites, such as south-facing bluffs, old beaches, and sand dunes. Typically (but not always) dominated by *Elymus* spp., *Festuca* spp., and *Deschampsia* spp. . . . . III.A.I Dry graminoid herbaceous

17b. On moist sites, but usually not with standing water. Usually dominated by *Calamagrostis* spp., *Carex* spp. or *Eriophorum* spp.; tussocks often present . . . . . III.A.2 Mesic graminoid herbaceous

17c. On wet sites, standing water present for part of the year; dominated by either sedges or grasses; includes wet tundra, bogs, marshes, and fens . . . . . III.A.3 Wet graminoid herbaceous

18a. Vegetation dominated by forbs (broadleaf herbs, ferns, or horsetails) . . . . . III.8 Forb herbaceous 19

18b. Vegetation dominated by mosses or lichens . . . . . III.C Bryoid herbaceous 20

19a. On dry sites, usually rocky and well drained; mostly tundra sites . . . . . III.B.1 Dry forb herbaceous

19b. On moist sites but without standing water, mostly within forested areas . . . . . III.B.2 Mesic forb herbaceous

19c. On wet sites, usually with standing water for part of the year . . . . . III.B.3 Wet forb herbaceous

20a. Vegetation cover dominated by mosses . . . . . III.C.1 Bryoid moss

20b. Vegetation cover dominated by lichens . . . . . III.C.2 Bryoid lichen

21a. Vegetation submerged or floating in fresh water. . . . . III.D.1 Freshwater aquatic herbaceous

21 b. Vegetation submerged or floating in brackish water . . . . . III.D.2 Brackish water aquatic herbaceous

21c. Vegetation submerged or floating in salt water . . . . . III.D.3 Marine aquatic herbaceous

# APPENDIX B – WETLAND AND VEGETATION SURVEY GEAR LIST

| Wetland and Vegetation Gear | Communication |
|---|---|
| 1 - Sharp shooter shovel (fiberglass, not wood handle) | 1 - VHF Radio |
| 1 - U-Dig-it (Hand shovel) | 1 - charger for vhf radio |
| 1 - Compass | 1 - Iridium Satellite Phone |
| 1 - Hand lens | 1 charger for satellite phone |
| 1 - Leatherman/sample knife (folding) 4" serrated | **Safety/Survival Pack (Need for 2 teams)** |
| 1 - Digital camera | 2 - Sleeping Bags |
| 1 - calculator | 1 - Tent |
| 1 - extra batteries for digital camera | 1 - Wilderness First Aid Kit |
| 1 - pH meter (pen kind) with storage solution | 1 - Flare gun kit |
| 1 - Pocket rod (measuring tape) | 1 - Emergency procedures Manual |
| 1 - Opaque small spray bottle filled with alpha-alpha dipyridyl | 1 - Iodine Tablets /Filter |
| 2 - packages – gallon Ziploc bags | 1 - 50' Nylon Rope/Parachute cord |
| 1 - package- pint Ziploc bags | 1 - small Flashlight/headlamp (for soil pit) |
| Squirt Water bottle (for moistening soil to color) | 2 - Space Blankets |
| 200+ - USACE Wetland Determination Form – Alaska Region (on Rite-in-the-Rain) with functional assessment | 1 - Bear Spray |
| 1 set - Field Maps on Rite-in-the-Rain | 1 - Tarp (10' x 12') |
| 4+ - Rite-in-the-Rain Field notebooks (spiral with lines) | 1 - Gloves – Work/Latex/Insulated rubber |
| 12+ - Mechanical Pencils w/ extra lead | matches |
| 12+ - Sharpies (red and black) | 1 - Roll of duct tape |
| 1 - Laptop Computer (for downloading data every night) | Flagging tape (1 bright color per team) |
| 2 - Clipboards | BPA-free water jug |
| Extra Rite-in-the-Rain paper | **Personal Gear** |
| 1 - 12 inch file (for shovel sharpening) with handle | 1 - Xtratuffs |
| 1 - scissors | 1 - Felt insoles for Xtratuffs |
| 1 - tape | 1 - Blaze Orange Surveyor Field Vest |
| 2 - post it notes | 1 - Mosquito Head Net |
| 2 - toilet paper | 1 - Rain Jacket/Pants |
| 1 - Roll of duct tape | 2 - Bug Spray |
| 1 - (see through) small dry bag for soil kit | 2 - Sunblock |
| 1 - (see through) medium dry bag for field reference materials | 1 - Sun Glasses |
| 1 - dry erase board (for pictures) | 1 - Water Bottle |
| 1 - plant press | 1 - Backpack |
| **Books** | 1 - Hat |
| 1 - Munsell Soil Color charts | Cell phone and charger |
| 1 - Flora of Alaska and Neighboring Territories – Eric Hulten | 1 - umbrella |
| 1 -Trees and Shrubs – Viereck | Boot dryers |
| 1 - Western Boreal Forest and Aspen Parkland – MacKinnon and Pojar | |
| 1 - Wetland Sedges of Alaska – Tande and Lipkin | |
| 1 - Willows of Interior Alaska – Collett | |
| 1 - National List of Plant Species that Occur in Wetlands – Alaska Region - Reed 1988 (print) | |
| 1 - Field Guide to Alaskan Wildflowers – Verna Pratt | |
| 1 - Wildflowers along the Alaskan Highway – Verna Pratt | |
| 1 - Rapid Procedure for Assessing Wetland Functional Capacity: Based on HGM Classification – Hollands and Magee (print) | |
| 1 - 1987 Wetland Delineation Manual (print) | |
| 1 - 2007 Regional Supplement to the Corps of Engineers Wetland Delineation Manual – Alaska Region (print) | |
| 1 - Classification of Wetlands and Deepwater Habitats – Cowardin (print) | |
| 1 - Hydric soils in Alaska (print) | |

# APPENDIX C – QA/QC CHECKLIST

## Vegetation Classification Data Form QA/QC Checklist

This form is to be completed before leaving the field site.

Feature ID:_____ Field Target:_____ Date:_____

*For all items not checked, please provide detailed explanation in the notes section of data form.*

1. **General Information**
   - ☐ Location data recorded?
   - ☐ Photo taken and photo number recorded?
2. **Location Description**
   - ☐ Location of site recorded with enough detail to help relocate?
3. **Common Species**
   - ☐ Scientific name of common species recorded?
   - ☐ Percent cover of dominant structure level noted?
4. **Habitat Description**
   - ☐ Habitat described?
5. **Classification**
   - ☐ All three levels of classification recorded?
6. **Field Log Book**
   - ☐ Field form entries consistent with log book?
   - ☐ Logbook clearly identifies the Field Target ID and Feature ID?

| | |
|---|---|
| X | X |
| Field Technician (print) | Signature |

| | |
|---|---|
| X | X |
| Field Crew Chief (print) | Signature |

# APPENDIX B – 2015 WETLAND AND VEGETATION FIELD DATA SUMMARY TABLE AND DATA FORMS DATA SHEETS AVAILABLE IN RR 2, APPENDIX G