FINAL REPORT
8 January 1999

LAND COVER MAP FOR THE PROPOSED NORTHWEST EILEEN DEVELOPMENT AREA

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ABSTRACT

Proposed construction for the Northwest (NW) Eileen Development includes gravel placement at one or two drill site pads, an access road, and a processing facility pad. Vegetation within a minimum 1,300 foot buffer surrounding the proposed gravel placement sites was classified and mapped from aerial photographs in order to assist with placement of facilities and assess vegetation impacts from gravel placement. Land cover/vegetation in the NW Eileen area was classified using a hierarchical classification scheme designed specifically for the North Slope of Alaska. Vegetation type, soil moisture regime, and landform data collected from 70 sites between 24 July and 7 August 1998 were used to construct the map. Cover types were identified and delineated from 1:7,200-scale color infrared aerial photographs taken by Aeromap U.S., Inc. on 10 August 1995. Overlays were projected, scaled and fit to 1:6,000-scale basemaps. A total area of 3,867 acres was mapped. Gravel placement for all potential sites will cover 49.4 acres, of which 32% is moist sedge, dwarf shrub/wet graminoid tundra complex; 31% is moist sedge, dwarf shrub tundra; 10% is moist tussock sedge, dwarf shrub tundra; and 9% is wet sedge tundra.

Key Words: land cover map, hierarchical classification system, polygonal habitat map, tundra vegetation, arctic tundra, Prudhoe Bay, Alaska

INTRODUCTION

Proposed construction for the Northwest (NW) Eileen Development includes gravel placement at one or two drill site pads, NW Eileen No. 1 and/or NW Eileen No. 2 sites; an access road to the NW Eileen No. 1 drill pad; and a processing facility pad, either along the Spine Road or as an enlargement of Z Pad (Fig. 1). The NW Eileen No. 1 drill pad will not be developed at this time. Mapping and information obtained during this study at NW Eileen No. 1 is presented should NW Eileen No. 1 be developed at a later date. The vegetation within a minimum 1,300 foot buffer surrounding the proposed gravel placement sites was classified and mapped from aerial photographs in order to assist with facilities placement and assess vegetation impacts from gravel placement. Land cover/vegetation in the NW Eileen area was classified using a hierarchical classification scheme designed specifically for the North Slope of Alaska (Walker 1983). Ground-reference vegetation data collected between 24 July and 7 August 1998 was used to construct the map.

METHODS

Walker's (1983) vegetation and land cover classification scheme describes vegetation at four levels: Level A--for very small scale maps, Level B--for cover units that can be consistently classified from LANDSAT data, Level C--for photo-interpreted maps with ground truth data, and Level D--for individual plant communities as determined by ground surveys (Table 1). Sites are categorized with respect to site moisture regime and dominant plant growth forms (landform type is used when plant cover is sparse or non-existent). The site moisture terms (dry, moist, wet, or aquatic) are subjective categories based on soil moisture at the end of the growing season. Dominant plant growth forms are relatively straightforward and are dependent to a great degree on the site moisture regime and landform type. Many areas on the North Slope consist of complexes of landforms, which result in complexes of site moisture and vegetation types. In areas such as these the classification scheme calls for combining site moisture and plant growth form terms to more accurately describe the character of the area.

Vegetation for the NW Eileen Development area was mapped within a minimum 1,300 foot buffer zone surrounding the proposed gravel placement sites (Fig. 1 to Fig. 4). Vegetation types were identified and delineated from 1:7,200-scale color infrared aerial photographs taken by Aeromap U.S., Inc. on 10 August 1995. Natural-color 20 July 1997 1:18,000-scale aerial photography, also taken by Aeromap U.S., was used to assist with classification. Cover types were delineated on acetate overlays of the photos, then projected and scaled to basemaps using a Kargl Reflecting Projector (Keuffel & Esser Co.). Delineations were transferred to acetate overlays referenced to 1:6,000-scale basemaps. Polygons and line work for lakes, ponds and streams were copied from the digital basemaps, which were augmented or corrected where necessary. Cover types were then digitized, polygons and regions were constructed, and classifications were added to a Geographic Information System (GIS) database. Areas covered by developments were calculated with the GIS.

Ground-reference data were collected in the project area between 24 July and 7 August 1998. Ground-reference data included three cover estimates of dominant plant taxa within a 1 m^2 area circle (Mueller-Dombois and Ellenberg 1974), descriptions of site moisture regime, and landform description. Bryophyte and lichen taxa were identified to genus when possible (Vitt et al. 1988). Plant nomenclature follows Hultén (1968), except for *Salix planifolia* sp. *pulchra*. For continuity with Walker's classifications, *Dryas integrifolia* is considered a shrub, although it is more correctly categorized as a forb. All areas to be mapped were crossed and reference sites were positioned near the center of vegetation communities. Global positioning system (GPS) locations were recorded with a minimum objective of 300 locations. GPS locations were

differentially corrected by post-processing using base station data from either the Central, Alaska or Fairbanks, Alaska, Continuously Operating Reference Station (CORS), National Geodetic Survey, National Oceanic and Atmospheric Administration (NOAA).

Ground-reference data was compared to color infrared and natural color photographs to assist in photo-interpretation. Land cover categories were determined by fitting field descriptions of plant communities and landforms into the land cover/vegetation categories described for the North Slope as a whole by Walker (1983; 1985a,b) and Walker and Acevedo (1987). Land cover types were mapped and labeled at Level C (Table 1).

RESULTS

Seventeen Level C categories were identified and delineated (Fig. 2 to Fig. 4; Tables 1 and 2). Tussock tundra occurs within the map area, but was not consistently distinguishable on the color infrared, or natural color photography. Tussock tundra was delineated based on photo-interpretation combined with ground-reference data. A total area of 3,867 acres was mapped. The map includes three discontinuous areas; a 634 acre area around the proposed NW Eileen No. 2 pad site, a 2,325 acre area around the proposed NW Eileen No. 1 pad and the proposed access road (which includes the area around a proposed processing facility pad), and a 908 acre area around the existing Prudhoe Bay Unit Z Pad (an alternative processing facility site).

Vegetation type, soil moisture regime, and landform data were collected from 70 sites within the mapped area between 24 July and 7 August 1998 (Fig. 1, Table A-1 to A-4). Ground-reference locations and the currently proposed development structures are shown in Figure 1. Descriptions of the land cover categories and dominant vascular plant taxa found in each category as mapped for the NW Eileen Development area are given below.

Ia. Water

The water category depicts all the water bodies that could be reasonably mapped at the 1:7,200 scale, including ponds, lakes, and streams. This category includes water of all depths, usually without emergent vegetation (see IIb below). Polygons designated as water cover on 1:6,000-scale digital basemaps were reviewed for completeness and classified as either Ia, IIa, IIb, or XIa as appropriate. A total of 909 acres or 24% of the mapped area is water (Table 2).

IIa. Shallow Water

This category includes small ponds, which may or may not dry entirely by the end of the growing season. These ponds probably contained water but were light colored indicating water was shallow. This classification usually does not contain emergent vegetation. A total of 4 acres or 0.1% of the mapped area is shallow water (Table 2).

IIb. Aquatic Graminoid Tundra

This category depicts areas of permanent fresh water where there is emergent vegetation. In deeper water these simple plant communities are dominated by *Arctophila fulva* (see 5A, Fig. 5), and in shallower water by *Carex aquatilis* with lesser amounts of *Eriophorum angustifolium* and *E. scheuchzeri*. This category grades continuously into wet sedge tundra vegetation (IIIa), but is distinguished by the presence of permanent water. Aquatic graminoid tundra is common in the shallow waters of ponds and lakes, and slow-moving streams, and it is especially common in lakes and ponds with complex, irregular shorelines. It also occurs in very wet low-centered polygon basins. On aerial photographs, aquatic graminoid tundra is often difficult to distinguish from both open water (when the density of plants is low), and from very wet, wet sedge tundra (at the edges of ponds and lakes). For this reason only the relatively obvious, ground-referenced, and large occurrences of this vegetation type were mapped. A total of 37 acres or 0.9% of the map area is aquatic graminoid tundra.

IIIa. Wet Sedge Tundra

This category depicts tundra areas which have poor drainage and retain standing water during the early part of the summer that drains or evaporates by the end of the season leaving saturated soils. Some standing water may persist throughout the growing season in abnormally wet summers. These areas are dominated by sedges such as *Carex aquatilis*, *Eriophorum angustifolium*, *E. russeolum* and *E. scheuchzeri* (see 5B, Fig. 5). Common forbs include *Pedicularis sudetica*, *Saxifraga hirculus*, and *S. cernua*. Wet sedge tundra commonly occurs on non-patterned ground, in low-centered polygon basins, and in troughs between strangmoor ridges. It is common at the edges of ponds and lakes, along streams, in drained lake basins, and on river terraces. As a mapped unit, wet sedge tundra was used only in areas where patterned ground was non-existent or poorly developed (i.e. where moist microsites were not prominent in the unit). A total of 272 acres or 7% of the map area is wet sedge tundra.

IIIc. Wet Sedge Tundra/Water Complex

This category depicts areas where ponds or lakes are interconnected to form a complex of water and intervening tundra. Water (Ia) and wet sedge tundra (IIIa) are the dominant land cover types. There may or may not be emergent vegetation (IIb). Intervening tundra is primarily wet, but moist sites also occur. Plant communities are similar to those listed in (IIIa), but lesser amounts of those listed in (Va) also occur. A total of 116 acres or 3% of the map area is wet sedge tundra/water complex.

IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex

This category depicts areas dominated by wet sedge tundra (IIIa), but because of prominent patterned ground features such as low-centered polygons and strangmoor there are abundant moist microsites within the unit (see 5C, Fig. 5). The moist sites are well-drained polygons rims and strangmoor ridges, which are dominated by moist sedge, dwarf shrub tundra (Va). Poorly drained polygon centers and strangmoor troughs may contain small patches of aquatic graminoid tundra (IIb). This vegetation type is very common in drained lake basins and around pond margins. A total of 471 acres or 12% of the map area is wet sedge/moist sedge, dwarf shrub tundra complex.

IVa. Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex

This category depicts areas of significant ground patterning which are dominated by moist sedge, dwarf shrub tundra (Va), but abundant low lying areas dominated by wet sedge tundra (IIIa) are also present. In the NW Eileen area, this category describes areas of mixed high- and low-centered polygons often with extensively thermokarsted polygon troughs, and often occurring amidst numerous small ponds and lakes. As in category IIId there are also occasionally small patches of aquatic graminoid tundra (IIb). A total of 642 acres or 17% of the map area is moist sedge, dwarf shrub/wet graminoid tundra complex.

Va. Moist Sedge, Dwarf Shrub Tundra

This category depicts areas of typical high-centered polygons with distinct polygon troughs, as well as areas of rather subtle high-centered and low-centered polygons with very little development of the polygon troughs (i.e. flat-topped polygons). There are often wet microsites in the polygon troughs, but overall drainage is good throughout the entire unit and the dominant landform is the moist polygon centers (see 5D, Fig. 5). In the NW Eileen area these sites are

dominated by the sedges *Eriophorum angustifolium*, *Carex misandra*, *C. aquatilis*, and *C. bigelowii*. The common dwarf shrubs are *Salix arctica*, *S. reticulata*, *S. rotundifolia*, and *Dryas integrifolia*. Common forbs include *Polygonum bistorta*, *Pedicularis sudetica*, *Papaver* sp., *Pyrola grandiflora*, *Saussurea angustifolia*, and *Saxifraga hirculus*. Moist sedge, dwarf shrub tundra typically occurs along ridges above the level of water bodies and drained lake basins. A total of 583 acres or 15% of the map area is moist sedge, dwarf shrub tundra.

Vb. Moist Tussock Sedge, Dwarf Shrub Tundra

This category depicts areas with better drainage, between lake basins and on the sides of pingos, with the tussock forming *Eriophorum vaginatum* (see 5E, Fig. 5). Tussock tundra was not consistently distinguishable from non-tussock tundra on either color infrared or natural color photographs. Delineations are based on a combination of photo-interpretation and ground-reference data. Tussocks were generally 10 inches or less in diameter. In areas where the ice road, which followed the proposed gravel access road corridor, to the NW Eileen No. 1 site crossed tussock tundra, some tussocks were flattened or pushed over. Common sedges include *E. vaginatum*, *E. angustifolium*, *C. bigelowii*, and *C. misandra*. Common shrubs include *Dryas integrifolia*, *Salix reticulata*, *S. planifolia* sp. *pulchra*; and forbs include *Cassiope tetragona*, and *Polygonum viviparum*. A total of 385 acres or 10% of the map area is moist tussock sedge, dwarf shrub tundra.

Vc. Dry Dwarf Shrub, Crustose Lichen Tundra

This category depicts areas of very good drainage which are often blown free of snow during the winter. This vegetation type occurs along creek terraces, ridges between thaw lake basins, and near the tops of some pingos. Vegetation is forms a conspicuous mat of *Dryas integrifolia*, with other dominants such as *Salix rotundifolia*, *S. reticulata*, *Carex misandra*, and *Papaver* sp. (see 5F, Fig. 5). There are many other common forbs and graminoids giving this vegetation type high species diversity. There is also typically a large portion of exposed mineral soil covered with crustose lichens. A total of 69 acres or 2% of the map area is dry dwarf shrub, crustose lichen tundra.

Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex

This category depicts areas of typical moist sedge, dwarf shrub tundra (Va) in which there is a preponderance of frost boils or frost scars (see 5G. Fig. 5). Plant taxa are similar to those in category (Va), but within the frost boils there are either completely barren areas or partially

vegetated communities dominated by species such as *Eriophorum angustifolium*, *Saxifraga oppositifolia*, *Dryas integrifolia*, *Salix arctica*, *S. reticulata*, and *Dupontia fischeri*. A total of 242 acres or 6% of the map area is moist graminoid, dwarf shrub tundra/barren complex.

IXb. Dry Barren/Dwarf Shrub, Forb Grass Complex

This category depicts dry or moist disturbed areas next to gravel roads and pads within the map area. Some gravel and accumulations of road dust are common. Dominant plant taxa include *Carex misandra*, *Dryas integrifolia*, *Salix reticulata*, and *Festuca vivipara*. A total of 7 acres or 0.2% of the map area is dry barren/dwarf shrub, forb grass complex.

IXg. Dry Barren/Low Shrub Complex

This category depicts the sand dune area to the east of the proposed processing facility pad (Fig. 1 and Fig. 3). This dune area grades into the side of a pingo. Dominant plant taxa are *Dryas integrifolia*, *Salix arctica*, *Papaver* sp., *Polygonum bistorta*, and *Festuca vivpara* (see 5H, Fig. 5). A total of 5 acres or 0.1% of the map area is dry barren/low shrub complex.

Xb. Sand Dunes

This category depicts the lake margin east of the proposed processing facility pad (see 5I, Fig. 5; Fig. 1 and Fig. 3). This area is covered by moist sand with small dune deposits which are essentially devoid of vegetation. A total of 13 acres or 0.3% of the map area is sand dunes.

Xc. Barren Gravel Outcrops

This category depicts gravel spill areas likely to have some vegetation, but ground cover is less than 30%. Class Xc includes areas with abandoned road beds, washout areas next to the airstrip and Z Pad, and reserve pits at Z Pad (Fig. 2 to Fig. 4). A total of 21 acres or 0.6% of the map area is barren gravel outcrops.

Xe. Gravel Roads and Pads

This category refers to the Milne Point Road, Spine Road, various exploratory and production pads and the abandoned airstrip along the proposed road corridor (Fig. 2 to Fig. 4). These areas are generally devoid of vegetation. A total of 41 acres or 1% of the map area is gravel roads and pads.

XIa. Wet Mud

This category depicts drained lakes and ponds. In some areas the mud surface is actually dry. These areas are usually unvegetated but there can be scattered individuals of species such as *Deschampsia caespitosa* and *Senecio congestus*. A total of 49 acres or 1% of the map area is wet mud.

Gravel placement for all the proposed facilities will cover 49.4 acres of tundra (Table 3). The access road to the NW Eileen No. 1 pad covers 17.8 acres, 69% of which is moist or dry tundra (Class V; Table 3). This class accounts for 757 acres or 33% of the NW Eileen No. 1 map area (Table 2). The NW Eileen No. 1 pad covers 9.1 acres, 68% of this area is moist or dry tundra (Class V). The processing facility site along the Spine Road covers 14.3 acres, 71% of which is moist sedge/wet sedge complex (IVa). This category covers 405 acres or 17% of the NW Eileen No. 1 map area. The NW Eileen No. 2 pad covers 8.2 acres, 49% of which is wet tundra (Class II and III), which is 184 acres or 29% of the NW Eileen No. 2 map area.

DISCUSSION

The NW Eileen Development area (Fig. 1) is part of the Arctic coastal thaw-lake plain. It is within what has been termed a gently rolling thaw-lake plain landscape (Walker and Acevedo, 1987) with oriented thaw lakes and ponds, irregular pond complexes, and large drained lake basins alternating with broad, slightly elevated areas giving the region a gently rolling aspect. Soils do not receive loess fallout from the Sagavanirktok River and, therefore, are probably more acidic than those at Prudhoe Bay. This is indicated by the presence of acidophilic taxa, specifically *Pyrola gandiflora* and *Vaccinium vitis-idaea* (both uncommon species at Prudhoe Bay). Terrain is characterized by moist, well-drained elevated areas dominated by high-centered polygons and tussock tundra, and lower wet areas dominated by drained lake basins with low-centered polygons, strangmoor, frost boils, and non-patterned ground.

The NW Eileen Development land cover map is based on photo-interpretation supported by ground-reference data. Tussock tundra was not consistently distinguishable from moist sedge, dwarf shrub tundra on aerial photography. Occurrences of this map unit were determined primarily by ground-reference data. The accuracy of this vegetation map has not been assessed, all ground-reference data was used to construct and correct the current map. Independent ground-reference data are required to assess map accuracy. In a few cases (five sites), a combination of narrow polygon delineations and inaccurate GPS positions (suspected reflectance

interference in one case) led to discrepancies between the ground-reference site and the map classification. These sites were repositioned.

AKNOWLEDGEMENTS

This study was funded by BP Exploration (Alaska) Inc. (BPXA). I thank Ray Jakubczak and Dave Trudgen for their support. Dale Funk and Kristen Brown helped collect ground-reference data (often in adverse weather) and Dale reviewed delineations and provided comments on the draft report. Craig Perham compiled and prepared photo-documentation for presentation in the final report. Thanks to all.

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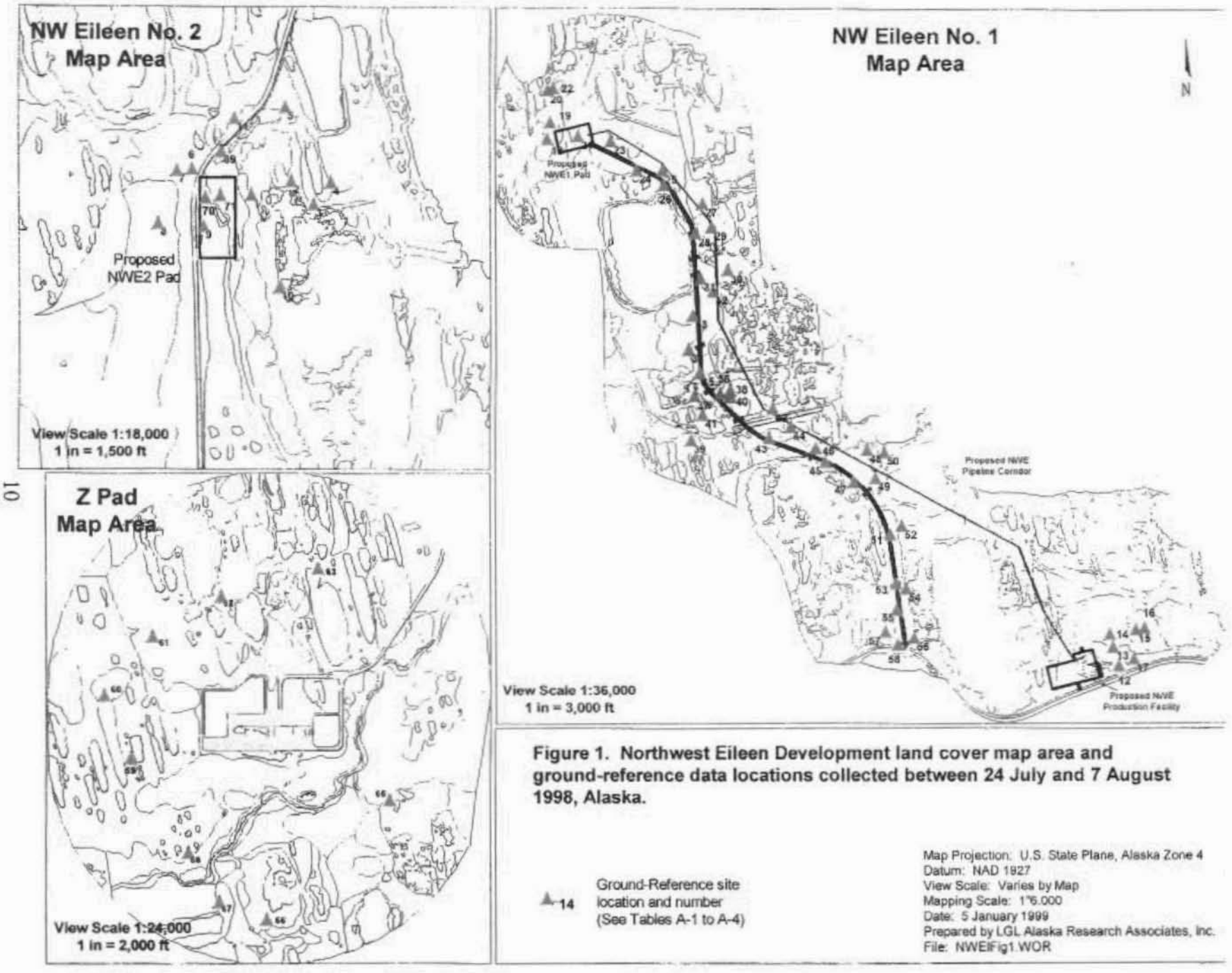
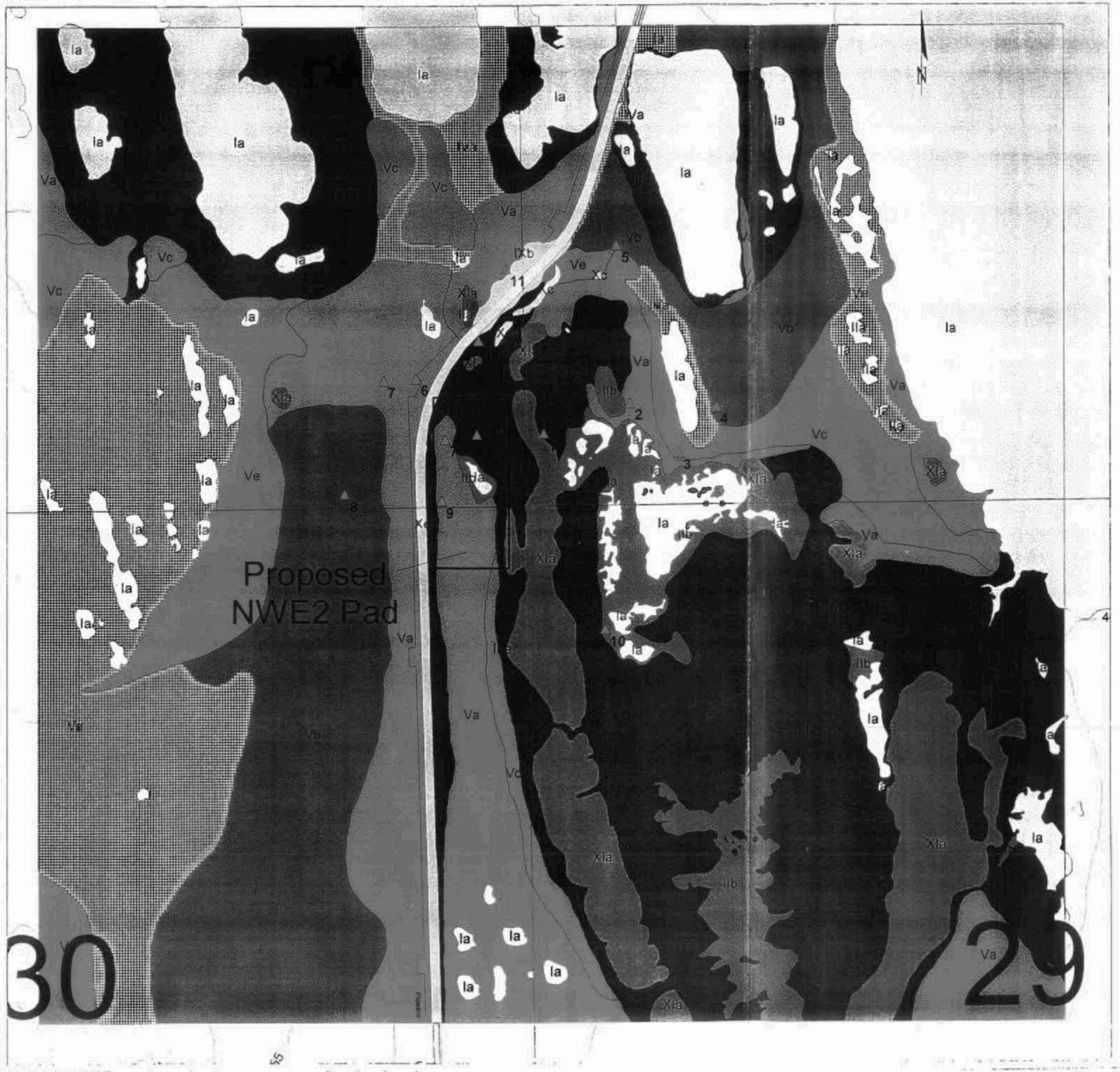


Figure 1. Northwest Eileen Development land cover map area and ground-reference data locations collected between 24 July and 7 August 1998, Alaska.

Figure 2. NW Eileen No. 2 Area Land Cover Map.



Land Cover Types [1]

Level B Land Cover Units		Level C Photo-interpreted Map Units
I. Water	Ia	Ia. Water (ponds, lakes, rivers, streams, saltwater)
	IIa	IIa. Water (shallow ponds)
II. Very Wet Tundra	IIb	IIb. Aquatic Graminoid Tundra (emergent vegetation)
III. Wet Tundra	IIIa	IIIa. Wet Sedge Tundra
	IIIc	IIIc. Wet Sedge Tundra/Water Complex (inter-connected ponds with no emergent vegetation)
	IIId	IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned-ground complex)
IV. Moist/Wet Tundra	IVa	IVa. Moist Sedge, Dwarf Shrub/ Wet Graminoid Tundra Complex (moist patterned-ground complex)
V. Moist or Dry Tundra	Va	Va. Moist Sedge, Dwarf Shrub Tundra
	Vb	Vb. Moist Tussock Sedge, Dwarf Shrub Tundra
	Vc	Vc. Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)
	Ve	Ve. Moist Graminoid, Dwarf Shrub Tundra/ Barren Complex (frost-scar tundra)
IX. Partially Vegetated	IXb	IXb. Dry Barren/Dwarf Shrub, Forb, Grass Complex (forb rich river bars)
	IXg	IXg. Dry Barren/Low Shrub Complex
X. Light Colored Barrens (<30% cover)	Xb	Xb. Sand Dunes
	Xc	Xc. Barren Gravel Outcrops
	Xe	Xe. Gravel Roads and Pads
X. Dark Colored Barrens (<30% cover)	XIa	XIa. Wet Mud

[1] Adapted from: Walker, D.A. 1983. A hierarchical tundra vegetation classification especially designed for mapping in northern Alaska. Pages 1332-1337 in Proceedings of the Fourth International Conference on Permafrost. July 17-22, 1983, Fairbanks, AK.

▲ 14 Ground-Reference Site Location and Number (See Tables A-1 to A-4)

Scale: 1 in = 550 ft
1 in = 168 m

Map Projection: U.S. State Plane, Alaska Zone 4
Datum: NAD 1927
View Scale: 1:19,200
Mapping Scale: 1:6,000
Date: 5 January 1999
Prepared by: I.GL Alaska Research Associates
File: NWEIVegFinal.WOR

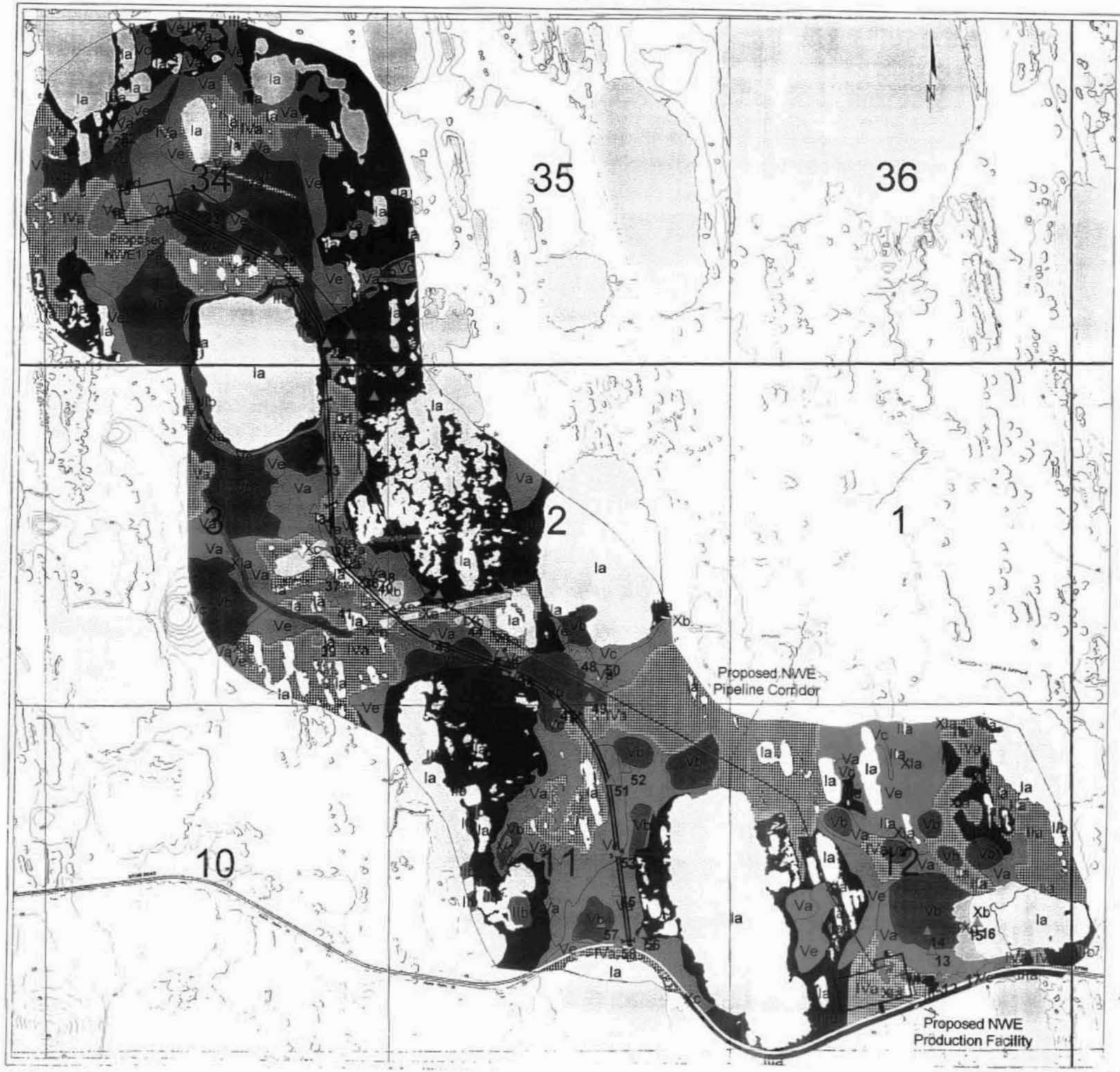


Figure 3. NW Eileen No. 1 Area Land Cover Map.

Level B Land Cover Units		Land Cover Types[1] Level C Photo-interpreted Map Units
I. Water	Ia	Ia. Water (ponds, lakes, rivers, streams, saltwater)
	IIa	IIa. Water (shallow ponds)
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V. Moist or Dry Tundra	Va	Va. Moist Sedge, Dwarf Shrub Tundra
	Vb	Vb. Moist Tussock Sedge, Dwarf Shrub Tundra
	Vc	Vc. Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)
	Ve	Ve. Moist Graminoid, Dwarf Shrub Tundra/ Barren Complex (frost-scar tundra)
IX. Partially Vegetated	IXb	IXb. Dry Barren/Dwarf Shrub, Forb, Grass Complex (forb rich river bars)
	IXg	IXg. Dry Barren/Low Shrub Complex
X. Light Colored Barrens (<30% cover)	Xb	Xb. Sand Dunes
	Xc	Xc. Barren Gravel Outcrops
	Xe	Xe. Gravel Roads and Pads
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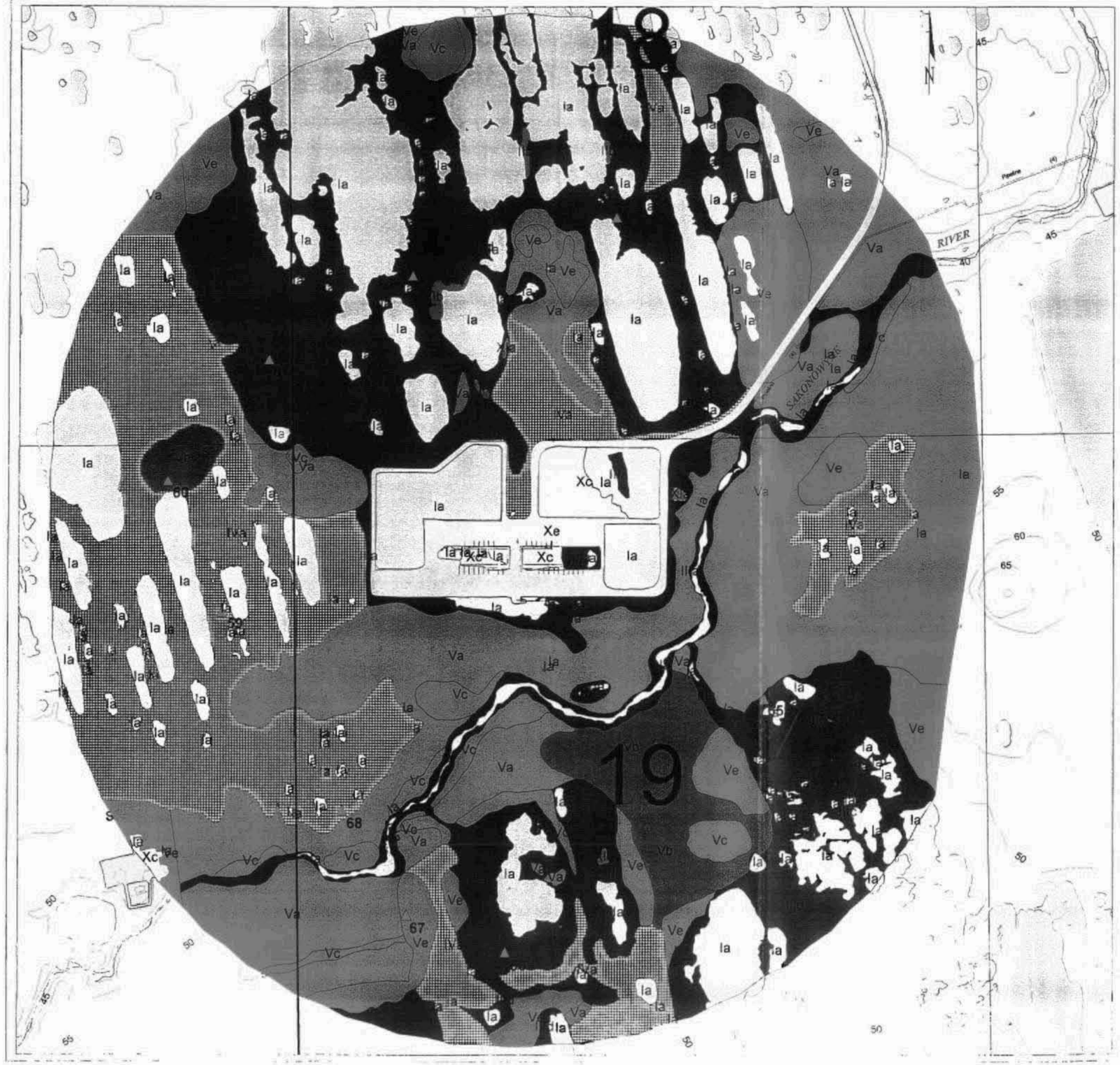
▲ 14 Ground-Reference Site Location and Number (See Tables A-1 to A-4)

Scale: 1 in = 1,600 ft
1 in = 488 m

Map Projection: U.S. State Plane, Alaska Zone 4
Datum: NAD 1927
View Scale: 1:19,200
Mapping Scale: 1:6,000
Date: 5 January 1999
Prepared by: LGL Alaska Research Associates
File: NWEIVegFinal.WOR

Figure 4. NW Eileen Area Z Pad Processing Facilities Land Cover Map.



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	Vb	Vb. Moist Tussock Sedge, Dwarf Shrub Tundra
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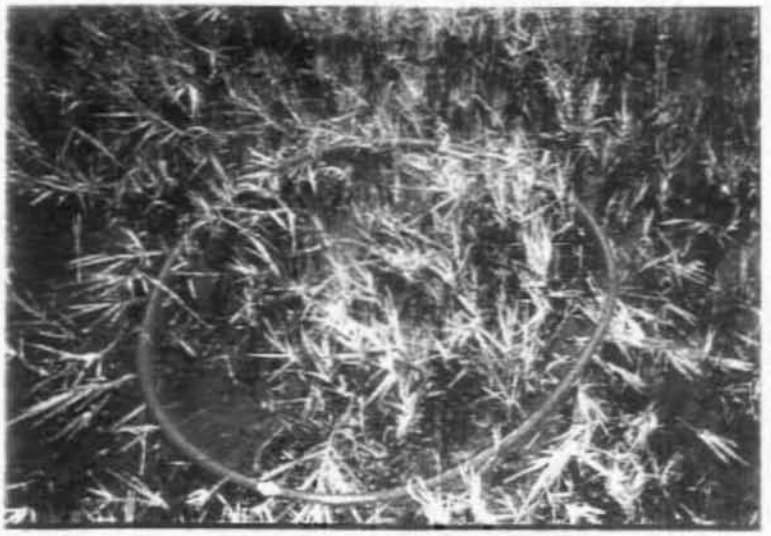
Prepared by: LGL Alaska Research Associates
File: NWEIVegFinal.WOR



5A.

Class IIb. Aquatic Graminoid Tundra (*Arctophilla fulva*).

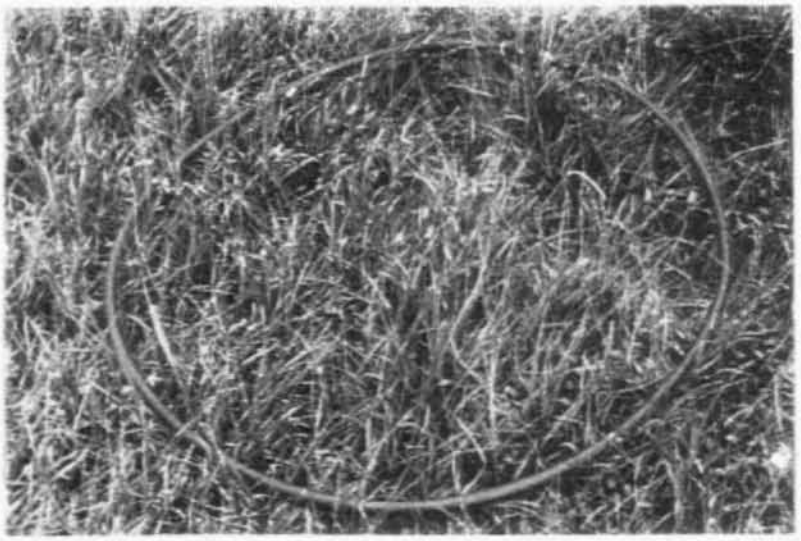
5B.

Class IIIa. Wet Sedge Tundra

5C.

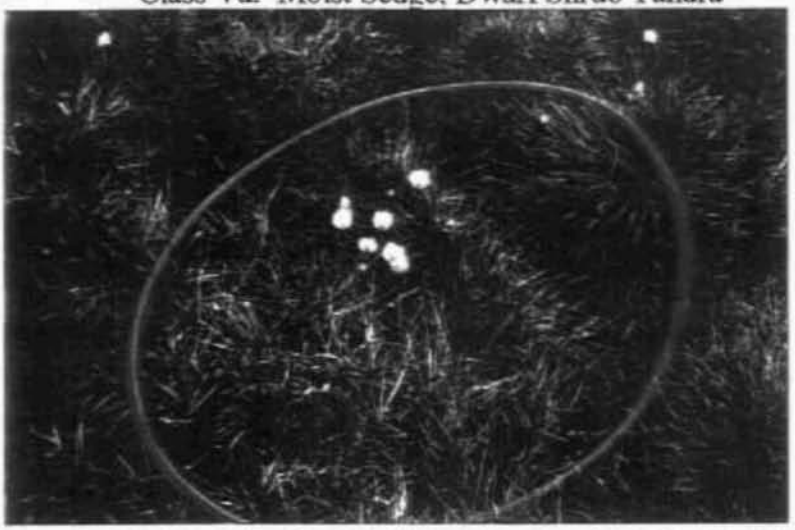
Class IIId. Wet Sedge/Moist Sedge Dwarf Shrub Tundra Complex (strangmoor)

Figure 5. Examples of vegetation within Level C land cover classes (Table 1, Walker 1983) for the Northwest Eileen Development area, Prudhoe Bay, Alaska.



5D.

Class Va. Moist Sedge, Dwarf Shrub Tundra



5E.

Class Vb. Moist Tussock Sedge, Dwarf Shrub Tundra

5F.

Class Vc. Dry Dwarf Shrub, Crustose Lichen Tundra (*Dryas* Tundra)

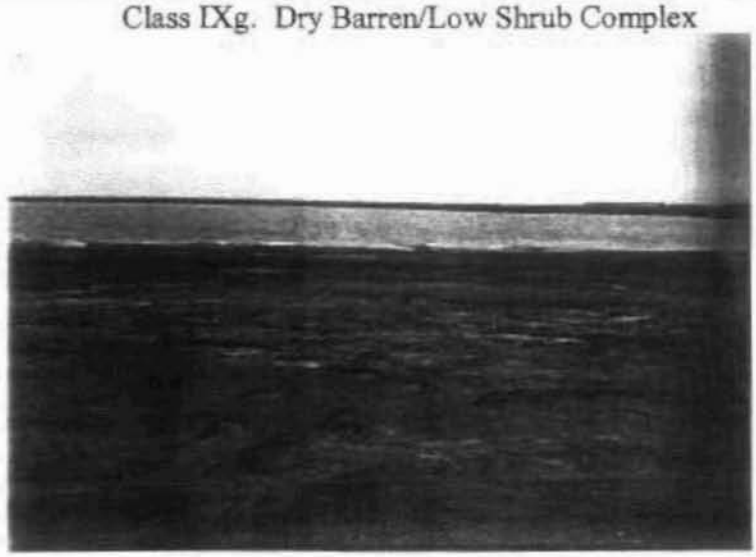
Figure 5. Continued.

5G.

Class Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra)

5H.

Class IXg. Dry Barren/Low Shrub Complex



5I.

Class Xb. Sand Dunes

Figure 5. Continued.

Table 1. Hierarchical classifications for the Northwest Eileen Development land cover map,Prudhoe Bay, Alaska based on Walker (1983). Land cover was mapped at Level C (boldface).

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
A. Water	I. Water	**Ia. Water (ponds, lakes, rivers, streams, saltwater)**	No vegetation
B. Wet Tundra	II. Very Wet Tundra	**IIa. Shallow Water (pond margins)**	No vegetation
		IIb. Aquatic Graminoid Tundra (emergent vegetation)	Aquatic *Arctophila fulva* Grass Tundra
			Aquatic *Carex aquatilis* Sedge Tundra
	III. Wet Tundra	**IIIa. Wet Sedge Tundra**	Wet *Carex aquatilis, Scorpidium scorpioides* Sedge Tundra (wettest facies of wet alkaline tundra)
			Wet *Carex aquatilis, Eriophorum angustifolium, Pedicularis sudetica, Drepanocladus brevifolius* Sedge Tundra (wet alkaline tundra)
			Wet *Eriophorum angustifolium, Dupontia fisheri, Campylium stellatum* Graminoid Tundra (wet acidic tundra, coastal areas)
		IIIc. Wet Sedge Tundra/Water Complex (pond complex, no emergent vegetation)	Typical communities listed in IIIa and Va
		IIId. Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned-ground complex)	Typical communities listed in IIIa and Va, and sometimes IIb
C. Moist Tundra	IV. Moist/Wet Tundra Complex	**IVa. Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex (moist patterned ground complex)**	Typical communities listed in IIIa and Va
	V. Moist or Dry Tundra	**Va. Moist Sedge, Dwarf Shrub Tundra**	Moist *Carex bigelowii, Eriophorum angustifolium, Dryas integrifolia, Salix reticulata, Tomenthypnum nitens, Thamnolia subuliformis* Sedge, Dwarf Shrub Tundra (moist alkaline tundra)
			Moist *Luzula arctica, Poa arctica, Saxifraga cernua, Salix planifolia, Dicranum elongatum, Ochrolechia frigida* Graminoid, Dwarf Shrub, Crustose Lichen Tundra (moist coastal acidic tundra)
			Moist *Carex aquatilis, Eriophorum angustifolium, Salix planifolia, Campylium stellatum* Sedge, Dwarf Shrub Tundra (moist acidic tundra, wetter facies)

Table 1. Continued.

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
C. Moist Tundra (CONT'D)	V. Moist or Dry Tundra (CONT'D)	**Vb. Moist Tussock Sedge, Dwarf Shrub Tundra**	Moist *Eriophorum vaginatum, Dryas integrifolia, Salix reticulata, S. arctica, Tomenthypnum nitens, Thamnolia subuliformis*, Tussock Sedge, Dwarf Shrub Tundra (alkaline tussock tundra)
			Moist *Eriophorum vaginatum, Dryas integrifolia, Salix planifolia* ssp. *pulchra, Salix reticulata, Hylocomium splendens, Ptilidium ciliare, Cetraria cucullata* Tussock Sedge, Dwarf Shrub Tundra (neutral to slightly acidic tussock tundra)
		Vc. Dry, Dwarf Shrub, Crustose Lichen Tundra (*Dryas* tundra, pingos, river bars)	Dry *Dryas integrifolia, Carex rupestris, Oxytropis nigrescens, Salix reticulata, Ditrichum flexicaule, Lecanora epibyron* Dwarf Shrub, Forb, Crustose Lichen Tundra (*Dryas* tundra, pingos)
			Dry *Dryas integrifolia, Astragalus alpinus, Oxytropis borealis, Salix reticulata, Distichium capillaceum, Lecanora epibyron* Dwarf Shrub, Forb, Crustose Lichen Tundra (*Dryas* tundra, river bars)
		Ve. Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	Typical communities listed in Va plus either completely barren frost scars or communities such as:
			Dry *Saxifraga oppositifolia, Dryas integrifolia, Chrysanthemum integrifolium, Juncus biglumis, Arctagrostis latifolia, Ochrolechia frigida* Barren (alkaline frost scars)
E. Partially Vegetated and Barren	IX. Partially Vegetated	**IXb. Dry Barren/Dwarf Shrub, Forb Grass Complex (forb rich river bars)**	Typical communities listed in Vc, and mixed forb, grass and dwarf shrub communities such as:
			Dry *Bromus pumpellianus, Festuca rubra, Astragalus alpinus, Androsace chamaejasme, Salix ovalifolia* Grass, Forb, Dwarf Shrub Tundra (forb rich river bars)
			Dry *Dryas integrifolia, Artemisia borealis, A. glomerata, Salix ovalifolia, Androsace chamaejasme* Dwarf Shrub, Forb Tundra (*Dryas* river bars near arctic coast)
		IXg. Dry Barren/Low Shrub, Grass Complex (sand dune scrub)	Dry *Salix alaskensis, S. glauca, Elymus arenarius, Carex obtusata, Dryas integrifolia* Low Shrub, Tundra (sand dune scrub)

Table 1. Continued.

LEVEL A SMALL-SCALE UNITS	LEVEL B LANDSAT-SCALE UNITS	LEVEL C PHOTO-INTERPRETED MAP UNITS	LEVEL D TYPICAL PLANT COMMUNITIES
E. Partially Vegetated and Barren (CONT'D)	X. Light- colored Barrens (ground cover <30%)	**Xb. Sand Dunes**	Typical communities listed under IXe, IXf, IXg
		Xc. Barren gravel outcrops	Typical communities listed under Vd or IXe following, among many other;
			Dry *Dryas octopetala*, *Lupinus arcticus*, *Potentilla biflora*, *Smelowski calycina*, *Saxifraga tricusoidata*, *Salix phlebophylla*, *Silene acaulis* Dwarf Shrub, Forb Barren (gravel outcrops)
		Xe. Gravel Roads and Pads	Completely barren or partially vegetated with communities similar to IXb and IXc.
	XI. Dark-colored Barrens (ground cover <30%)	**XIa. Wet Mud (drained lakes and ponds)**	Completely barren or occasionally wtih colonizing species such as *Deschampsia caespitosa* and *Senecio congestus*.

Table 2. Area (acres) covered by land cover classification for Northwest Eileen map sections, Prudhoe Bay, Alaska, with percent occurrence and a combined summary of the three map areas.

Class	NW Eileen #1 (acres)	Area Percent	NW Eileen #2 (acres)	Area Percent	Z Pad Expansion (area)	Area Percent	Map Total	Area Percent
Ia	608.15	26.2	116.27	18.4	184.25	20.3	908.67	23.5
IIa	3.27	0.1	0.76	0.1	0.24	0.0	4.27	0.1
IIb	13.63	0.6	21.76	3.4	1.14	0.1	36.54	0.9
IIIa	92.16	4.0	126.72	20.0	53.43	5.9	272.32	7.0
IIIc	99.75	4.3	0.00	0.0	16.31	1.8	116.05	3.0
IIId	286.45	12.3	34.69	5.5	150.06	16.5	471.20	12.2
IVa	405.35	17.4	79.90	12.6	157.24	17.3	642.49	16.6
Va	284.62	12.2	87.52	13.8	210.50	23.2	582.64	15.1
Vb	279.02	12.0	76.12	12.0	30.29	3.3	385.43	10.0
Vc	22.41	1.0	26.94	4.3	20.00	2.2	69.34	1.8
Ve	170.69	7.3	18.73	3.0	52.63	5.8	242.05	6.3
IXb	6.26	0.3	1.13	0.2	0.00	0.0	7.38	0.2
IXg	5.19	0.2	0.00	0.0	0.00	0.0	5.19	0.1
Xb	12.77	0.5	0.00	0.0	0.00	0.0	12.77	0.3
Xc	13.08	0.6	0.44	0.1	7.76	0.9	21.28	0.6
Xe	10.45	0.4	6.55	1.0	23.53	2.6	40.53	1.0
XIa	12.08	0.5	35.97	5.7	0.56	0.1	48.62	1.3
Map Total	2325.33	100.0	633.51	100.0	907.93	100.0	3866.78	100.0

Table 3. Area (acres) covered by gravel for the proposed Northwest Eileen Development, Prudhoe Bay, Alaska, for each land cover classification.

Class	Access Road (acres)	Area Percent	NW Eileen #1 Pad (acres)	Area Percent	NW Eileen #2 Pad (acres)	Area Percent	Process Facility (acres)	Area Percent	Facilities Total (acres)	Area Percent
Ia	0.07	0.4	0.0	0.0	0.23	2.8	0.41	2.8	0.71	1.4
IIb	0.00	0.0	0.0	0.0	0.40	4.9	0.00	0.0	0.40	0.8
IIIa	1.01	5.7	0.0	0.0	3.58	43.6	0.00	0.0	4.59	9.3
IIId	0.00	0.0	0.0	0.0	0.00	0.0	1.86	13.0	1.86	3.8
IVa	3.01	16.9	2.9	31.8	0.00	0.0	10.14	71.0	16.05	32.5
Va	4.66	26.1	6.0	66.0	3.81	46.4	1.06	7.4	15.53	31.4
Vb	4.94	27.7	0.2	2.1	0.00	0.0	0.00	0.0	5.14	10.4
Vc	0.58	3.3	0.0	0.0	0.04	0.4	0.00	0.0	0.62	1.3
Ve	2.09	11.7	0.0	0.0	0.00	0.0	0.00	0.0	2.09	4.2
IXb	0.05	0.3	0.0	0.0	0.00	0.0	0.00	0.0	0.05	0.1
Xc	0.07	0.4	0.0	0.0	0.00	0.0	0.01	0.1	0.09	0.2
Xe	1.27	7.1	0.0	0.0	0.01	0.2	0.00	0.0	1.28	2.6
XIa	0.09	0.5	0.0	0.0	0.14	1.7	0.81	5.7	1.03	2.1
Total	17.84	100.0	9.1	100.0	8.20	100.0	14.29	100.0	49.45	100.0

Table A-1. Ground-reference site descriptions collected July and August 1998 in the vicintiy of the Northwest Eileen Development area, Alaska. See Figure 1 for site locations and Table A-2 for plant taxa.

Site Number	Field Classification	Map Classification	Site Description
1	IIIa	IIIa	Moist, unpatterned ground.
2	Va	Va	Moist, unpatterned ground below old lake basin margin.
3	Vc	Vc	Dry HCP's.
4	Vb	Vb	Dry soil site. Hill with tussocks.
5	Vb	Vb	Tussocks north of well pad; dry soil site.
6	Va	Va	Moist soil.
7	Va	Va	Moist/dry soil; some tussocks in area.
8	Vb	Vb	Moist tussock tundra.
9	Va	IIIa	HCP's with moist soil.
10	IIb	IIb	Aquatic site - edge of *Arctophila fulva* patch.
11	Va	Va	Site next to road with excessive dust accumulation; moist soil.
12	IVa	IVa	HCP's with wet troughs and moist/wet soil. Some trough areas densely vegetated with Carex aquatilis.
13	Va	Va	Mid-slope pingo north of Spine Road; moist soil.
14	Vb	Vb	Top of pingo with scattered tussocks; moist soil.
15	IXg	IXg	Dry sand dunes.
16	Xb	Xb	Barren lake margin with moist soil.
17	Va	Va	Moist soil site.
18	Va	Va	Moist soil site.
19	Vb	Vb	Moist tussock tundra.
20	IIIa	IIIa	Wet sedge tundra - almost strangmoor.
21	Va	Va	Moist sedge, dwarf shrub/wet graminoid tundra complex.
22	Va	Va	Strang-like hummocks; moist soil.
23	Vb	Vb	Some tussocks flattened and broken off, possibly where ice road came through.
24	Vb	Vb	Moist tussock tundra.
25	Vb	Vb	Moist tussock tundra.
26	IVa	IVa	Moist/wet soil - wetter than neighboring tussock areas, but not extremely wet.
27	Ve	Ve	FTP/strangs with frost boils between. Moist/wet soils.
28	IIIa	IIIa	Wet sedge tundra - along road corridor.
29	IIId	IIId	Saturated wet/moist tundra.
30	IIIa	IIIc	Wet sedge tundra - along road corridor.
31	IVa	IVa	Moist-wet/dry soils.
32	IVa	IVa	Moist sedge, dwarf shrub tundra with old strangs and moist troughs along road corridor.
33	Vb	Vb	Moist tussock sedge, dwarf shrub tundra on slope of hill.
34	Va	Va	Moist sedge, dwarf shrub tundra.
35	Va	Va	Moist sedge, dwarf shrub tundra.
36	Va	Va	Moist sedge meadow. (airstrip access road)
37	IVa	IVa	Moist/wet HCP's with deep troughs just south of Kuparuk pad near impound; disturbed vegetation.

Table A-1. Continued.

Site Number	Field Classification	Map Classification	Site Description
38	Va	Va	Dry/moist sedge with strangmoor. Dense *Dryas integrofolia* on tops of strangs; trough areas wetter with more sedges.
39	IVa	IVa	Moist/wet LCP's between two ponds - no standing water in centers.
40	IXb	IXb	Dry/disturbed site.
41	Va	Va	Dry/moist HCP's with deep troughs - possibly disturbed site. More grasses than sedges.
42	IIIa	IIIa	Wet sedge meadow.
43	Va	Va	Moist/dry HCP's.
44	IXb	IXb	Dry, disturbed tussocks.
45	Vc	Vc	Dry soil site.
46	IIIa	IIIa	Wet sedge meadow.
47	Vb	Vb	HCP's with tussocks broken where ice road crossed.
48	Va	Va	Moist sedge meadow.
49	Vb	Vb	FTP with tussocks - moist.
50	Vc	Vc	Dry polygon tops with deep troughs and high centers with frost heave. Large areas of mostly bare ground.
51	Ve	Ve	Moist/wet soils. Pock marked area.
52	Va	Va	Moist sedge meadow with some tussocks.
53	Ve	Ve	Irregular frost boils - moist soils.
54	Vb	Vb	Moist tussock tundra.
55	Va	Va	FTP - moist soils.
56	IIId	IIId	Wet sedge meadow. No *scorpidium* present - just mud.
57	Vb	Vb	Moist soil site.
58	Va	Va	Moist sedge meadow, somewhat disturbed by road. Polygonized, but not deeply. Some gravel present - soild is drier in gravel affected areas.
59	IVa	IVa	Moist sedge meadow
60	Vb	Vb	Moist tussock tundra.
61	IIId	IIId	Wet meadow - probably strangmoor.
62	IIId	IIId	Wet strangmoor.
63	IIId	IIId	Wet sedge grass meadow.
64	Va		Moist sedge meadow with some scattered tussocks. (No GPS, point location on photo overlay inaccurate, point not used.)
65	IIIb	IIId	Wet sedge meadow with strangmoor.
66	IIIa	IIIa	Moist/wet sedge meadow basin complex with many wet sites dominated by *Carex aquatilis*.
67	Ve	Ve	Moist sedge meadow with frost scars.
68	IVa	IVa	Moist sedge meadow with HCP's.
69		Va	See NW Eileen #2 transect data Table A-3.
70		IIIa	See NW Eileen #2 transect data Table A-3.
71		IIIa	See NW Eileen #2 transect data Table A-3.

Table A-2. Estimated percent vegetation cover at ground-reference sites for the Northwest Eileen Development area land cover map, July-August 1998, Alaska. (* = presence, <1% cover)

		Site Number																							
Plant Taxa & Misc.	Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Field Classification		IIIa	Va	Vc	Vb	Vb	Va	Va	Vb	Va	IIb	Va	IVa	Va	Vb	IXg	Xb	Va	Va	Vb	IIIa	Va	Va	Vb	Vb
Alopecurus sp.	ALSP											*													
Arctophila fulva	ARFU										48														
Artemisia arctica	ARLA			1	1	*			3	*		*		13	*					2					
Astragalus alpinus	ASAL														*										
Aulacomnium sp.	AULA																			2					
Bare Canopy or Ground	BARE	2		2	1			3			7	14		2		64	100				24				
Bryum pseudotriquetrum	BRPS		*																						
Carex aquatilis	CAAQ	76	67	1			*	2		24			3											3	
Carex atrofusca	CAAT													1						*	15	*			
Carex bigelowii	CABI																		3						
Carex membranacea	CAME				6	5																			
Carex misandra	CAMI						43	17				30	10										7		
Carex saxatilis	CASA																								
Carex sp.	CASP												3		2										
Cassiope tetragona	CATE			17	2	10		8	10	25			1		*			2		7		3		3	1
Cerastium beeringianum	CEBE																								
Cetraria sp.	CETR			*	*		*						*	*	*			*		*		*	*		
Cladonea sp.	CLAD			*	*															*			*		
Cochlearia officinalis	COOF											*													
Crustose Lichen	CRLI																								
Distichium sp.	DIST																								
Drepanocladus sp.	DREP	5																				*			
Dryas integrifolia	DRIN		2	56	2		4	15	30	19		20	5	30	13	19		15		3		15	16	7	13
Dupontia fischeri	DUFI	3	5																						
Equisetum sp.	EQSP										1														
Equisetum variegatum	EQVA		1																						
Eriophorum angustifoliu	ERAN						3	1	5	7			50	22	40			35	70	7	58	57	28	23	
Eriophorum russeolum	ERRU	6																							
Eriophorum scheuchzeri	ERSC										1														
Eriophorum vaginatum	ERVA				53	30	18	17	30					12	30			10		47		2		27	43
Festuca vivipara	FEVI											*				*									
Geum rossii	GERO																								
Grass	GRAS															5	*								
Hypnum bambergeri	HYBA									10															
Juncus biglumis	JUBI														*										
Kobresia sp.	KOBR																								
Lepraria sp.	LEPR			7		*																			
Lichens	LICH						*																5		
Litter	LITT	8												5				3							2

Table A-2. Continued.

Plant Taxa & Misc.	Code	Site Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Field Classification		IIIa	Va	Vc	Vb	Vb	Va	Va	Vb	Va	IIb	Va	IVa	Va	Vb	IXg	Xb	Va	Va	Vb	IIIa	Va	Va	Vb	Vb
Luzula sp.	LUSP																								
Melandrium apetalum	MEAP																								
Minuarta sp.	MISP															3									
Moss	MOSS		1								22		*												
Oxytropis sp.	OXSP																								
Papavier sp.	PASP													3	*	5									
Pedicularis sudetica	PESU	*				*				1		2							1	*					
Poa arctica	POAR																			*					
Polygonum bistorta	POBI					5			2	2				*		2									
Polytrichum sp.	POLY																								
Polygonum viviparum	POVI	*	*			*		2				1	2		2					*			1	*	1
Puccinellia arctica	PUAR																*								
Puccinellia langeana	PULA											*													
Puccinellia phryganodes	PUPH																								
Pyrola grandiflora	PYGR			*																					1
Ranunculus sp.	RASP										1														
Salix arctica	SAAR									*						2				*			20		12
Saxifraga cernua	SACE																								
Salix lanata	SALA																								
Saxifraga hirculus	SAHI	*					2	6											*						
Saxifraga oppositifolia	SAOP																								
Salix ovalifolia	SAOV																								
Salix phlebophylla	SAPH			10		35		3																	3
Salix pulchra	SAPU		19	1	7		14	8		3		3	3	6	10			8	4	10		3		17	
Salix reticulata	SARE		4	5	22		12	8	15	5		30	19	3				22	5	13		20	20	13	17
Salix rotundifolia	SARO																			2					
Sasauria sp.	SASA						2			3										*					
Salix sp.	SASP																								
Scorpidium scorpioides	SCSC										20										3				
Silene acaulis	SIAC																								
Standing Dead	STDE							8											15						
Stellaria humifusa	STHU																								
Thamnolia sp.	THAM			*	*			*				*	*	*	*			*					*		
Tomentypnum nitens	TONI		1		3	5	2	2	5	1		*	4	3	3			5	2	5		*	3	7	7
Vaccinium vitis-idea	VAVI				3	10														2					

Table A-2. Continued.

Plant Taxa & Misc	Code	Site Number 25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Field Classification		Vb	IVa	Vc	IIIa	IIId	IIIa	IVa	IVa	Vb	Va	Va	Va	IVa	Va	IVa	IXb	Va	IIIa	Va	IXb	Vc	IIIa	Vb	Va
Alopecurus sp	ALSP																								
Arctophila fulva	ARFU																								
Artemisia arctica	ARLA			3						2				2			*	3		2				1	
Astragalus alpinus	ASAL																			*		3			
Aulacomnium sp.	AULA											2													
Bare Canopy or Ground	BARE		3	43		13	10	17	7					13		18	3		5		54		10		
Bryum pseudotriquetrum	BRPS																								
Carex aquatilis	CAAQ		2	3	74	8	32					25	*	13					42		1				1
Carex atrofusca	CAAT		15	1	3	3	*	3		*	7					*			5				40		
Carex bigelowii	CABI									*			22												
Carex membranacea	CAME																								
Carex misandra	CAMI	3		8		10		7	35						33			10		13	8				28
Carex saxatilis	CASA					23	*	15										15							
Carex sp.	CASP					1		*													*			3	
Cassiope tetragona	CATE	*															5			2		10		27	
Cerastium beeringianum	CEBE																								
Cetraria sp.	CETR							*		*		3					2					1			
Cladonea sp.	CLAD														*										
Cochlearia officinalis	COOF													5											
Crustose Lichen	CRLI			3				*						2			31					5			
Distichium sp.	DIST																								
Drepanocladus sp.	DREP	2				13																			
Dryas integrifolia	DRIN	1		12		*		23	30	25	10	3			20		43	11		27	2	63		13	
Dupontia fischeri	DUFI																								
Equisetum sp.	EQSP																								
Equisetum variegatum	EQVA			1		*						5													
Eriophorum angustifoliu	ERAN	19	60	10	8	10	45	8		25	40	15	55	43	18	70	3		32	8	7	4	37	*	14
Eriophorum russeolum	ERRU																								
Eriophorum scheuchzeri	ERSC																								
Eriophorum vaginatum	ERVA	20								40	27													33	
Festuca vivipara	FEVI											11		13						10					
Geum rossii	GERO																								
Grass	GRAS																			1					
Hypnum bambergeri	HYBA																								
Juncus biglumis	JUBI					6																			
Kobresia sp.	KOBR																								
Lepraria sp.	LEPR																								
Lichens	LICH							3																	
Litter	LITT	5	4						4			5	10		3	12				6			8	2	22

Table A-2. Continued.

Plant Taxa & Misc.	Code	Site Number 25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Field Classification		Vb	IVa	Ve	IIIa	IIId	IIIa	IVa	IVa	Vb	Va	Va	Va	IVa	Va	IVa	IXb	Va	IIIa	Va	IXb	Vc	IIIa	Vb	Va
Luzula sp.	LUSP																								
Melandrium apetalum	MEAP				*	*														1					
Minuarta sp.	MISP																	3							
Moss	MOSS		8		15			2				2						3	1		12				
Oxytropis sp.	OXSP																								
Papavier sp.	PASP																						*		
Pedicularis sudetica	PESU	*	*			*		*				*	1				*						1		
Poa arctica	POAR	3										5		4				20							
Polygonum bistorta	POBI																								
Polytrichum sp.	POLY													1				5				1			8
Polygonum viviparum	POVI	*							2		*	2	*	2			1	10		3	2	1		2	*	
Puccinellia arctica	PUAR													*				12							
Puccinellia langeana	PULA																								
Puccinellia phryganodes	PUPH													1											
Pyrola grandiflora	PYGR											*											*		
Ranunculus sp.	RASP																								
Salix arctica	SAAR		1						2			10	12		8		7			23	10				15
Saxifraga cernua	SACE											5													
Salix lanata	SALA																		*						
Saxifraga hirculus	SAHI		*			*						7								1	*				
Saxifraga oppositifolia	SAOP																2								
Salix ovalifolia	SAOV																								
Salix phlebophylla	SAPH																					7		*	
Salix pulchra	SAPU	17		4		*		8		2								1						2	
Salix reticulata	SARE	20		7		3			20	5	14				18		3				4	*		7	5
Salix rotundifolia	SARO																	7		3		*			
Sasauria sp.	SASA																								
Salix sp.	SASP																					*		2	
Scorpidium scorpioides	SCSC					2	13	7											15				4		
Silene acaulis	SIAC			2														*							
Standing Dead	STDE																								
Stellaria humifusa	STHU													1											
Thamnolia sp.	THAM							*							*										
Tomentypnum nitens	TONI	10	7	3		8		7		1	2											5		6	7
Vaccinium vitis-idea	VAVI																							2	

Table A-2. Continued.

Plant Taxa & Misc.	Code	Site Number 49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Field Classification		Vb	Vc	Ve	Va	Ve	Vb	Va	IIId	Vb	Va	IVa	Vb	IIId	IIId	IIId	Va	IIIb	IIIa	Ve	IVa
Alopecurus sp.	ALSP																				
Arctophila fulva	ARFU																				
Artemisia arctica	ARLA									12											
Astragalus alpinus	ASAL									3											
Aulacomnium sp.	AULA	*																			
Bare Canopy or Ground	BARE		11	22		27	5		20		23			5				23	3		1
Bryum pseudotriquetrum	BRPS																				
Carex aquatilis	CAAQ	2							62		17	3		62	22	27	2	53	12		12
Carex atrofusca	CAAT																				
Carex bigelowii	CABI									2		2		12	12	15	20	2	10	22	32
Carex membranacea	CAME																				
Carex misandra	CAMI	3	27			2		12				30			1						10
Carex saxatilis	CASA			5								18			2						
Carex sp.	CASP					23															
Cassiope tetragona	CATE	3	5		4		22			10			3								
Cerastium beeringianum	CEBE												*								
Cetraria sp.	CETR	*	*										*								
Cladonea sp.	CLAD		*										*								
Cochlearia officinalis	COOF																				
Crustose Lichen	CRLI																				
Distichium sp.	DIST																				
Drepanocladus sp.	DREP										7		5								
Dryas integrifolia	DRIN	13	20		13	2	20	20		25		2	27				2			7	5
Dupontia fischeri	DUFI											28		3	33	28	32		28	33	32
Equisetum sp.	EQSP																				
Equisetum variegatum	EQVA			1										*							
Eriophorum angustifolia	ERAN	30	5	53	40	12		30	18	7	33	5	10	5	15	22	17	9	30	15	8
Eriophorum russeolum	ERRU																				
Eriophorum scheuchzeri	ERSC																				
Eriophorum vaginatum	ERVA	17			10	2	28	3		30			40								
Festuca vivipara	FEVI																				
Geum rossii	GERO																				
Grass	GRAS																				
Hypnum bambergeri	HYBA																				
Juncus biglumis	JUBI					3															
Kobresia sp.	KOBR		10																		
Lepraria sp.	LEPR																				
Lichens	LICH									*											
Litter	LITT	8		13	12	7					13	5			10	8	5			8	

Table A-2. Continued.

Plant Taxa & Misc.	Code	Site Number																			
		49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
Field Classification		Vb	Vc	Ve	Va	Ve	Vb	Va	IIId	Vb	Va	IVa	Vb	IIId	IIId	IIId	Va	IIIb	IIIa	Ve	IVa
Luzula sp.	LUSP																				
Melandrium apetalum	MEAP																				
Minuarta sp.	MISP																				
Moss	MOSS			1			2														
Oxytropis sp.	OXSP												3								
Papavier sp.	PASP																				
Pedicularis sudetica	PESU	•										•			•						•
Poa arctica	POAR																				
Polygonum bistorta	POBI						2			•											
Polytrichum sp.	POLY																				
Polygonum viviparum	POVI		4				3					•			•					•	
Puccinellia arctica	PUAR					2															
Puccinellia langeana	PULA																				
Puccinellia phryganodes	PUPH																				
Pyrola grandiflora	PYGR																				
Ranunculus sp.	RASP																				
Salix arctica	SAAR			3	12	7	3			8	5	5	7		5		22		12	10	•
Saxifraga cernua	SACE																				
Salix lanata	SALA																				
Saxifraga hirculus	SAHI			•				•							•						
Saxifraga oppositifolia	SAOP																				
Salix ovalifolia	SAOV																				
Salix phlebophylla	SAPH		1																		
Salix pulchra	SAPU	8						12													
Salix reticulata	SARE	13	17		4	13	13	20			2	2	5						5	5	•
Salix rotundifolia	SARO																				
Sasauria sp.	SASA																				
Salix sp.	SASP				5		2														
Scorpidium scorpioides	SCSC													13				13			
Silene acaulis	SIAC					•															
Standing Dead	STDE																				
Stellaria humifusa	STHU																				
Thamnolia sp.	THAM				•								•								•
Tomentypnum nitens	TONI	3		2				3		3											
Vaccinium vitis-idea	VAVI																				

Table A-3. Walking-point transect percent cover data for the Northwest Eileen No. 2 site along the Milne Point Road, Prudhoe Bay, Alaska. Each transect consists of 100 points.

	Canopy Transect Number			Basal Transect Number			Species Compositon Transect Number		
Category	1	2	3	1	2	3	1	2	3
Non-Living									
Bare Canopy or Ground	28	16	25	0	0	0	16	1	0
Litter	0	0	0	44	71	31	0	0	0
Standing Dead	18	25	1	30	3	23	0	0	0
Total Non-Living	18	25	1	74	74	54	0	0	0
Graminoids									
Arctagrostis latifolia	0	0	1	0	0	0	0	0	1
Carex aquatilis	10	9	31	2	0	3	10	14	33
Carex sp.	1	2	0	0	0	0	1	1	0
Dupontia fishceri	0	0	1	0	0	0	0	0	2
Eriophorum angustifolium	28	25	5	1	0	0	55	26	5
Eriophorum russeolum	0	0	17	0	0	0	0	0	27
Eriophorum scheuchzeri	1	0	0	0	0	0	1	0	0
Grass	0	0	7	0	0	0	0	0	6
Juncus biglumis	1	2	1	0	0	0	1	1	2
Luzula sp.	0	0	1	0	0	0	0	0	1
Total Graminoid	41	38	64	3	0	3	68	42	77
Forbs									
Equisetum variegatum	2	3	2	1	1	1	3	4	2
Pedicularis sudetica	1	0	0	0	0	0	1	2	2
Polygonum viviparum	1	0	0	0	0	0	2	1	0
Total Forb	4	3	2	1	1	1	6	7	4
Shrubs									
Dryas integrifolia	5	5	0	0	2	1	8	18	0
Salix lanata	0	0	5	0	0	3	0	0	13
Salix ovalifolia	2	1	0	0	1	0	2	1	0
Salix pulchra	1	3	3	0	5	1	0	13	6
Salix reticulata	1	8	0	0	5	0	0	17	0
Salix sp.	0	1	0	0	0	0	0	1	0
Total Shrub	9	18	8	0	13	5	10	50	19
Non-Vascular									
Bryum pseudotriquetrum	0	0	0	2	1	0	0	0	0
Crustose Lichen	0	0	0	0	1	2	0	0	0
Distichium sp.	0	0	0	4	1	3	0	0	0
Drepanocladus sp.	0	0	0	8	3	8	0	0	0
Moss	0	0	0	0	0	24	0	0	0
Scorpidium scorpioides	0	0	0	7	0	0	0	0	0
Thamnolia subuliformis	0	0	0	1	0	0	0	0	0
Tomenthypnum nitens	0	0	0	0	6	0	0	0	0
Total Non-Vascular	0	0	0	22	12	37	0	0	0

Table A-4. Coordinates and precision for Northwest Eileen Development area ground-reference data. Positions are decimal degrees, datum is WGS 1984.

Site	Longitude (W)	Latitude (N)	Number of Corrected Positions	Correction Type	Date	Time (ADST)	SD	Elevation	Horizontal Precision (m)	Vertical Precision (m)
1	-149.425586	70.373251	328	Differential	7/24/98	04:47:42PM	0.964	26.0	1.381	2.361
2	-149.421914	70.373666	742	Differential	7/24/98	05:13:54PM	1.057	27.3	0.876	1.844
3	-149.420379	70.372897	560	Repositioned	7/24/98	05:34:57PM	1.057	26.8	0.980	1.817
4	-149.418232	70.373604	350	Differential	7/24/98	06:01:07PM	2.022	28.2	1.454	2.293
5	-149.422401	70.375930	83	Differential	7/24/98	06:34:10PM	0.860	24.6	1.120	1.648
6	-149.431020	70.374052	315	Differential	7/25/98	08:35:36AM	0.939	29.3	1.176	1.932
7	-149.432385	70.374028	322	Differential	7/25/98	08:50:02AM	1.028	27.8	1.197	1.984
8	-149.434095	70.372410	230	Differential	7/25/98	09:16:51AM	2.299	26.0	1.167	1.734
9	-149.430421	70.372335	400	Repositioned	7/25/98	09:30:29AM	1.860	28.6	1.230	2.376
10	-149.423102	70.370420	39	Differential	7/25/98	09:57:19AM	2.966	20.1	1.228	2.350
11	-149.427098	70.375606	317	Differential	7/25/98	10:27:47AM	1.249	26.5	1.287	2.766
12	-149.228365	70.317557	866	Differential	7/25/98	11:40:09AM	1.215	28.5	0.758	1.466
13	-149.229315	70.318698	304	Differential	7/25/98	12:01:32PM	1.392	30.4	1.116	1.764
14	-149.229919	70.319506	630	Differential	7/25/98	12:22:12PM	0.961	33.3	1.005	2.250
15	-149.225176	70.319746	642	Differential	7/25/98	12:44:53PM	3.455	32.2	1.337	2.723
16	-149.223587	70.319850	290	Differential	7/25/98	01:00:13PM	2.120	32.5	1.567	2.906
17	-149.225590	70.317955	183	Differential	7/25/98	01:12:51PM	3.236	34.8	1.683	2.605
18	-149.332577	70.350194	539	Differential	7/25/98	05:42:33PM	1.165	8.6	1.018	1.786
19	-149.331944	70.351230	1551	Differential	7/25/98	05:43:22PM	0.912	9.1	0.828	1.353
20	-149.332336	70.353224	406	Differential	7/25/98	06:06:20PM	1.058	6.7	1.129	1.770
21	-149.326758	70.350357		No GPS	7/25/98	06:15PM				
22	-149.331324	70.353374	262	Differential	7/25/98	06:17:12PM	2.199	9.6	1.586	2.613
23	-149.320680	70.350038	866	Differential	7/25/98	06:50:44PM	0.521	4.6	1.104	2.203
24	-149.315885	70.348238	316	Differential	7/25/98	06:59:26PM	1.144	6.0	1.455	2.571
25	-149.311146	70.348197	999	Differential	7/25/98	07:27:44PM	0.847	12.5	1.146	2.725
26	-149.310863	70.347343	203	Differential	7/25/98	07:28:49PM	1.239	7.1	1.662	2.961
27	-149.303717	70.346141	962	Differential	7/25/98	07:55:23PM	1.030	8.4	1.212	2.526
28	-149.305134	70.344324	503	Differential	7/25/98	07:57:25PM	1.536	11.9	1.212	2.559
29	-149.302099	70.344680	1009	Differential	7/25/98	08:20:46PM	1.046	8.0	1.201	2.460
30	-149.299230	70.342065	296	Differential	7/25/98	08:28:47PM	0.787	6.0	1.367	2.163
31	-149.304242	70.341574	881	Differential	7/25/98	08:48:44PM	0.941	8.6	1.153	2.288
32	-149.302038	70.340768	582	Differential	7/25/98	08:41:59PM	1.782	5.6	1.111	1.858
33	-149.305810	70.339330	599	Differential	7/25/98	09:07:49PM	1.066	10.0	1.243	2.237
34	-149.306674	70.337272	355	Differential	7/25/98	09:23:19PM	1.217	10.9	1.740	4.456
35	-149.304643	70.335872	1456	Differential	7/25/98	09:36:28PM	1.046	10.3	0.880	2.032
36	-149.300851	70.334590	348	Differential	7/26/98	10:36:38AM	1.093	8.2	1.171	1.849
37	-149.305659	70.334465	713	Differential	7/26/98	10:34:57AM	1.252	10.2	1.247	2.274
38	-149.299006	70.334803	541	Differential	7/26/98	10:45:52AM	1.450	6.8	0.924	1.510
39	-149.306317	70.331732	603	Differential	7/26/98	11:23:17AM	1.234	10.6	1.266	2.468
40	-149.299036	70.334376	392	Differential	7/26/98	10:59:15AM	0.840	7.4	1.079	1.778
41	-149.304155	70.333316	349	Differential	7/26/98	10:54:14AM	1.989	9.8	1.939	3.662
42	-149.291167	70.333641	360	Differential	7/26/98	11:20:32AM	0.866	7.5	1.115	2.283
43	-149.291853	70.331865	839	Differential	7/26/98	11:45:25AM	1.024	10.8	1.112	2.046
44	-149.287895	70.332528	642	Differential	7/26/98	11:41:28AM	0.924	8.2	0.891	1.678
45	-149.281579	70.330293	1316	Differential	7/26/98	12:28:55PM	0.681	6.1	0.928	2.817

Table A-4. Continued.

Site	Longitude (W)	Latitude (N)	Number of Corrected Positions	Correction Type	Date	Time (ADST)	SD	Elevation	Horizontal Precision (m)	Vertical Precision (m)
46	-149.283334	70.331154	164	Differential	7/26/98	12:17:17PM	0.638	6.6	1.683	3.728
47	-149.276366	70.328998	402	Differential	7/26/98	01:12:15PM	0.861	11.0	1.791	2.720
48	-149.273836	70.331008	29	Differential	7/26/98	01:01:15PM	1.221	10.6	1.354	2.262
49	-149.272334	70.329265	684	Differential	7/26/98	01:29:30PM	0.740	4.7	1.279	2.631
50	-149.270695	70.330844	366	Differential	7/26/98	01:18:45PM	3.226	7.6	1.272	2.225
51	-149.269665	70.325764	563	Differential	7/26/98	02:09:45PM	1.327	8.2	1.341	2.599
52	-149.267581	70.326285	339	Differential	7/26/98	02:08:07PM	1.786	8.8	1.219	2.058
53	-149.268875	70.322785	678	Differential	7/26/98	02:29:16PM	0.722	11.6	1.275	3.212
54	-149.267000	70.322434	375	Differential	7/26/98	02:30:45PM	0.919	10.1	1.163	2.454
55	-149.268851	70.321159	451	Differential	7/26/98	02:46:15PM	1.736	7.8	1.574	3.750
56	-149.265647	70.319440	311	Differential	7/26/98	02:47:54PM	1.133	11.0	1.239	2.828
57	-149.270864	70.319832	807	Differential	7/26/98	03:00:45PM	0.469	13.7	1.093	2.342
58	-149.268660	70.319037	370	Differential	7/26/98	03:01:12PM	1.067	10.8	1.131	2.793
59	-149.215955	70.296765	276	Uncorrected	8/7/98	09:08:23AM	19.131	24.6		
60	-149.219022	70.299373	222	Differential	8/7/98	09:21:54AM	1.402	-39.0	1.762	3.978
61	-149.213092	70.301746	332	Differential	8/7/98	09:30:44AM	1.450	-43.6	1.562	3.420
62	-149.204738	70.303357	307	Differential	8/7/98	09:43:44AM	2.926	-44.1	2.085	3.162
63	-149.192845	70.304431	383	Differential	8/7/98	09:55:45AM	1.900	-45.0	1.479	2.330
64				No GPS						
65	-149.184833	70.295095	245	Repositioned	8/7/98	10:29:17AM	1.024	-39.6	1.690	2.891
66	-149.199724	70.290078	324	Differential	8/7/98	10:46:51AM	1.642	-41.3	1.840	3.630
67	-149.206498	70.290775	334	Repositioned	8/7/98	10:55:48AM	1.788	-38.6	1.865	3.214
68	-149.209151	70.292855	318	Differential	8/7/98	11:04:54AM	0.960	-40.4	1.712	3.020
69	-149.428836	70.374953	1875	Repositioned	7/24/98	11:23:23AM	2.017	-3.8	0.468	0.923
70	-149.429795	70.373179	235	Differential	7/24/98	12:28:12PM	1.705	-4.7	1.383	2.347
71	-149.428434	70.373241	1243	Differential	7/24/98	12:45:43PM	1.329	0.5	0.883	1.938