# APPENDIX H

## WETLAND VERIFICATION REPORT

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<tr>
<td>Wetland Verification Report, 09/14/17</td>
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Kivalina Evacuation and School Site Access Road

Wetland Verification Report

Prepared for:
State of Alaska
Department of Transportation & Public Facilities
Northern Region
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September 14, 2017
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Executive Summary

The Alaska Department of Transportation and Public Facilities (DOT&PF) and the Federal Highway Administration (FHWA), in partnership with the Northwest Arctic Borough (NAB), Native Village of Kivalina, and the City of Kivalina, propose community safety improvements in Kivalina, Alaska by constructing an evacuation road between Kivalina Island and a site on Kisimigiuqtuq Hill (K-Hill) where a school planned for construction by the NAB would also serve as a safe emergency evacuate assembly site.

A desktop Wetland Delineation and Functions & Values Assessment was conducted by Arctic Slope Regional Corporation (ASRC) Energy Services in 2015 (ASRC 2015). This report updates that desktop delineation and functional assessment with ground observations and other information gathered during the following efforts:

- March/April 2015 Golder Associates geotechnical investigations (Golder Associates 2015)
- September 2016 Stantec site reconnaissance (Stantec 2016)
- October 2016 Stantec cultural resources investigation (Stantec 2017)
- August 2017 USACE wetland determination (USACE 2017)
- August 2017 Stantec site reconnaissance (this report)
- 2011 aerial imagery, updated LIDAR (Light Detection and Ranging)
- Agency coordination

The Study Area is a large wetland complex with a variety of emergent, dwarf, and low shrub habitat. Rivers, lakes, and ponds are common defining characteristics. Most of the subsurface data gathered found at least shallow soil saturation, and many field observations described seasonal or permanently flooded regimes.

There are a limited number of uplands scattered throughout the Study Area. K-Hill dominates the eastern end of the Study Area, and provides elevated upland topography with wetlands surrounding its base.

Vegetation consists of low and dwarf shrub, and wet and mesic herbaceous polygons. These provide a variety of wildlife habitat. Most importantly, in consultation with the US Fish and Wildlife Service (USFWS), low scrub habitat was identified as important bird nesting habitat.

Wetlands in the Study Area are high functioning and common. They are largely undisturbed, and operating in their natural state. Rivers, lakes, ponds, estuaries, ocean, and bird nesting habitat was increased to the highest functional value to aid project planners in avoiding these important features.

All wetlands and Waters of the United States were determined to be hydrologically connected to the Kivalina River, Wulik River, or Kivalina Lagoon, which are connected to the Chukchi Sea, a traditional navigable Water of the U.S. For this reason, wetlands and Waters of the U.S. in the Study Area are presumed jurisdictional by the USACE under Section 404 of the CWA and Section III.D.2 of the Jurisdictional Determination Form.
Abbreviations

ANSRAM  Arctic North Slope Rapid Assessment Method
ASRC   Arctic Slope Regional Corporation
AVC    Alaska Vegetation Classification
cm     centimeter
DOT&PF Department of Transportation and Public Facilities
E1UB    Estuarine, Subtidal, Unconsolidated Bottom
E2US    Estuarine, Intertidal, Unconsolidated Shore
FHWA    Federal Highway Administration
GPS    Global Positioning System
K-Hill Kisimigiuqtuq Hill
L1UB    Lacustrine, Limnetic, Unconsolidated Bottom
LiDAR  Light Detection and Ranging
m      meter
M1UB    Marine, Subtidal, Unconsolidated Bottom
M2US    Marine, Intertidal, Unconsolidated Shore
NA     Not Applicable
NAB    Northwest Arctic Borough
NWI    National Wetlands Inventory
OFS    Overall Functional Score
PEM1/SS1B Palustrine Persistent Emergent/ Broad-Leaved Deciduous Scrub Shrub, Saturated
PEM1/SS1C Palustrine Persistent Emergent/ Broad-Leaved Deciduous Scrub Shrub, Seasonally Flooded
PEM1/SS1F Palustrine Persistent Emergent/Broad-Leaved Deciduous Scrub Shrub, Semi-permanently Flooded
PEM1C   Palustrine Persistent Emergent, Seasonally Flooded
PEM1F   Palustrine Persistent Emergent, Semi-permanently Flooded
PSS1/EM1B Palustrine Broad-Leaved Deciduous Scrub Shrub/ Persistent Emergent, Saturated
PSS1/EM1C Palustrine Broad-Leaved Deciduous Scrub Shrub/ Persistent Emergent, Seasonally Flooded
PSS1/EM1E Palustrine Broad-Leaved Deciduous Scrub Shrub/ Persistent Emergent, Seasonally Flooded/Saturated
PSS1C   Palustrine Broad-Leaved Deciduous Scrub Shrub, Seasonally Flooded
PSS1J   Palustrine Broad-Leaved Deciduous Scrub Shrub, Intermittently Flooded
PUBH    Palustrine, Unconsolidated Bottom, Permanently Flooded
R2UB    Riverine, Lower Perennial, Unconsolidated Bottom
R2US    Riverine, Lower Perennial, Unconsolidated Shore
R3UB    Riverine, Upper Perennial, Unconsolidated Bottom
USACE  US Army Corps of Engineers
USFWS  US Fish and Wildlife Service
1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Alaska Department of Transportation and Public Facilities (DOT&PF) and the Federal Highway Administration (FHWA), in partnership with the Northwest Arctic Borough (NAB), Native Village of Kivalina, and the City of Kivalina, propose community safety improvements in Kivalina, Alaska, by constructing an evacuation road between Kivalina Island and a site on Kisimiguqtuq Hill (K-Hill) where a school planned for construction by the NAB would also serve as a safe emergency evacuee assembly site. Figure 1 (Appendix A) displays the location and vicinity of the proposed project.

1.2 SITE LOCATION

The proposed project origin is at the City of Kivalina, located on the southeast tip of the barrier island located between the Chukchi Sea (Arctic Ocean) and Kivalina Lagoon (Figure 1). The project terminus is located on the mainland across the Kivalina Lagoon approximately six-miles northeast at a community selected evacuation site on Kisimiguqtuq Hill (K-Hill). The Study Area encompasses the Kivalina barrier island, the southern portion of Kivalina Lagoon, and the lower Wulik and Kivalina River drainages.
2.0 BACKGROUND INFORMATION

A proposed inland access route in the Kivalina region has been the subject for study for many years. This wetland verification report is the compilation of at least three years of effort evaluating wetlands for the access alternatives. The intent of this report is to integrate the previous desktop and field efforts to provide one comprehensive wetlands resource.

A desktop only wetland delineation was conducted in 2015 (ASRC 2015) for a smaller Study Area, commissioned by the Northwest Arctic Borough (NAB). Subsequently, at least four field efforts (March/April 2015 [Golder Associates 2015], September 2016 [Stantec 2016], October 2016 [Stantec 2017], August 2017 [USACE 2017 and this report]) were conducted and provide on the ground verification for the initial desktop delineation.

This report updates and expands the ASRC (2015) desktop effort by compiling the field efforts, and generating USACE Wetland Datasheets and photo points. These points document the vegetation, soil, and hydrology characteristics of the area. This report also provides an updated functional assessment using the same method (updated with field data) as the previous desktop assessment. By compiling the previous efforts, this wetland verification report provides the best available information on wetlands in the Study Area.

2.1 EXISTING WETLAND INFORMATION

A desktop Wetland Delineation and Functions & Values Assessment was conducted in 2015 by ASRC Energy Services (ASRC 2015). ASRC conducted aerial photography interpretation, using information from:

- National Wetlands Inventory (NWI);
- U.S. Geological Survey (USGS) topographic maps;
- Kivalina Evacuation and School Access Road Reconnaissance Study (WHPacific 2014);
- Kivalina Evacuation Road Preliminary Environmental Report (WHPacific 2012a); and
- Kivalina Evacuation Route Significant Biotic Resources Baseline Report and Preliminary, Essential Fish Habitat Analysis (WHPacific 2012b).

ASRC produced wetland pdf maps with polygons classified by the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979). ASRC also conducted a desktop Functions and Values Assessment using a method they developed, ANSRAM (Arctic North Slope Rapid Assessment Method).

The ASRC wetland report found that the area was composed almost exclusively of high quality wetlands, and that little to no disturbance has taken place on the mainland. The wetlands were of such uniformly high quality, that certain features (e.g. waters and rivers) were elevated from a Category I to a Category I+. This allowed project planners to avoid features of inherent elevated importance when planning features across the landscape.
The lack of field data to support this desktop effort was addressed by at least four field efforts (March/April 2015 [Golder Associates 2015], September 2016 [Stantec 2016], October 2016 [Stantec 2017], August 2017 [USACE 2017 and this report]).

### 2.2 EXISTING VEGETATION INFORMATION

The Study Area has National Wetland Inventory Cowardin classification mapping available, which was used as a guide in classifications. The previous desktop Wetland Delineation effort also used the Alaska Vegetation Classification (AVC) System (Viereck 1992) to Level III. The Viereck classification system is an Alaskan specific habitat classification system, particularly useful for evaluating wildlife habitat. It is subtly different than Cowardin, and provides a greater level of detail in habitat classifications (e.g. tall, short, dwarf shrubs).

The Stantec site reconnaissance field efforts included vegetation photographs. This involved taking GPS-linked site photographs, and brief notes on wetlands, hydrology, and plant cover. These photographs provide key vegetation cover information for this wetland report. The photographs and notes allow vegetation to be classified on the Cowardin and Viereck systems. Species composition and percent cover can also be assigned from this effort, allowing the completion of USACE Wetland Datasheets.

### 2.3 EXISTING SOILS INFORMATION

The USDA Soil Survey does not have information available for the Study Area and no such information has been reported on in previous wetland reports.

We developed key soil information from multiple sources. The first soil field effort occurred in March and April of 2015. Golder Associates conducted spring geotechnical investigations primarily around gravel source exploration in the Study Area (Golder Associates 2015). The profiles provide evidence of deep organics and high levels of water content in the soils. This supports both wetland soil and hydrology characteristics.

Second, in October 2016 and August 2017, Stantec and the USACE conducted a cultural and wetland field efforts (Stantec 2016, 2017, USACE 2017). These efforts conducted site testing at multiple sites, providing logs of soil profiles. These soil profiles do not have Munsell color notations (Munsell 2010), but do provide valuable soil information (e.g. organic depths, colors, texture, saturation) about the organic layers in the Study Area.

Cultural resource investigations typically focus on rises, ridges, and uplands, which are common historic gathering places. Areas of standing water and similar polygonal tundra are not high probability landforms to find cultural materials within the region. As a result, soil profiles available from these efforts are most likely upland sites. This underscores their importance, as the relatively rare upland sites the wetland delineation is seeking are the most likely to have soil information available.
2.4 EXISTING HYDROLOGY INFORMATION

Hydrology information in the ASRC report was limited and interpreted solely from aerial photography and online databases. The subsequent field efforts provided important additional hydrology insights needed to map wetlands more accurately.

Site photographs and notes from the Stantec and USACE field efforts made evident that most of the Study Area is seasonally or permanently flooded, and provided evidence of subtle, but critical, hydrological differences (e.g. saturation, seasonally flooded, standing water). This information allowed aerial signatures to be groundtruthed, particularly on flooded low centered polygon complexes which are surrounded by seasonally flooded wetlands.

The Golder Geotechnical field effort (Golder Associates 2015) also had valuable hydrology notations collected during soil profiling (e.g. saturation, ice wedges). These notations allowed the USACE Standard Forms to be completed. Often a shallow water table was not specifically noted (this information is not typically collected during cultural and geotechnical investigations), and had to be assumed.

This report also uses new Light Detection and Ranging (LiDAR) and aerial imagery to understand the important topography and hydrology changes. These allow the tracing of topographic features that were not evident in the ASRC report.
3.0 METHODOLOGY

The wetland verification efforts compiled data from the ASRC wetland report (ASRC 2015); and field datasets: March/April 2015 [Golder Associates 2015], September 2016 [Stantec 2016], October 2016 [Stantec 2017], August 2017 [USACE 2017 and this report]. The data analysis was conducted and report written by Professional Wetland Scientists to provide a comprehensive groundtruthed analysis of wetlands in the Study Area.

Methodology for this wetland verification do not follow the transect methods outlined in the Corps of Engineers Wetlands Delineation Manual (USACE, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0) (USACE, 2007). Instead, this verification uses the general guidance of the regional supplement to provide a best available information compilation of knowledge of the Study Area.

Mapping in the Study Area is divided into two categories. National Wetlands mapping boundaries was used for the entire Study Area, and classifications were updated with results from the field efforts. Inside the core Study Area (the region studied by the NAB), mapping boundaries and classification was updated in fine scale resolution. This method allowed broad scale alternative evaluation on the entire Study Area, and fine scale mapping for proposed impacts.

3.1 WETLAND VERIFICATION

Digitizing Existing ASRC Data: The wetland shapefiles from the ASRC report were not available, but the pdfs in the ASRC wetland map had location information electronically embedded in them, allowing the creation of a mosaic of geoTiffs. These were brought into ArcGIS, and wetland polygons were digitized and attributed at 1:3,000 scale. While digitizing the maps, wetland boundaries and Cowardin classifications were updated for polygons as needed, using more recent and high resolution aerial imagery. In addition, field data (photos and soil profiles) were reviewed to further verify wetland boundaries and classifications where available.

Data Compilation: Standard USACE Wetland Determination Data Forms were completed at all locations where sufficient vegetation, soils, and hydrology information could be extrapolated from ground observations. Data forms were completed at 11 locations within the Study Area and are included in Appendix B. Each data form fully documents which field effort the vegetation, soils, and hydrology data came from.

Photo points (Appendix C) allow best professional judgment to apply wetland designations to specific habitats and were completed where vegetation, soils, and hydrology data were partially available, but did not give enough detail to complete full determination forms. Photo points are intended to provide ground observations to confirm desktop mapping for wetland indicators such as saturation, restrictive layers, and hydrophytic vegetation. Each standard and photo point location sampled during the field investigation was collected in a handheld global
positioning system (GPS) unit. Photo point forms were completed at 37 locations within the Study Area.

Wetland delineation data form and photo point locations are shown on maps included in Appendix A.

3.2 FUNCTIONAL ASSESSMENT

The ASRC (2015) methodology used a rapid desktop functional assessment (ANSRAM). The methodology and previous datasheets are included in the previous wetland report (ASRC 2015). The ASRC report found that almost all wetlands were Category I, with a few Category II saturated wetlands. For that report, under best professional judgement; all riverine, tidal, estuarine, and lacustrine water bodies, as well as flooded palustrine wetlands were elevated to Category I+. This was done to aid project planners in avoiding important wetlands.

For this report’s analysis, we had additional consultation with agencies to determine the functional rankings. Similar to the ASRC report; all ponds, riverine, tidal, estuarine, and lacustrine water bodies were elevated to the Category I+. All saturated wetlands (PSS1/EM1B) were ranked as a Category II, also similar to ASRC.

For this project, the USFWS has indicated that high quality shrub areas are important migratory bird habitat. This habitat was mapped and identified in this report as Closed Low Scrub habitat (II.C.I). This ‘low scrub’ habitat is the highest vegetation habitat in the region (taller than ‘dwarf shrub’). To accommodate this important function, all Closed Low Scrub habitat (II.C.I) was promoted one functional level. PSS1/EM1B wetlands that were bird habitat were upgraded to Category I, the rest of bird habitat was elevated to Category I+. The primary difference between the ASRC (2015) report and this method, was that we did not find all flooded palustrine wetlands to be I+. This value was overstated, when compared to the bird habitat.
4.0 RESULTS AND DISCUSSION

4.1 WETLANDS AND WATERS

Table 1 below summarizes the standard and photo data points.

**Table 1: Summary of Standard and Photo Data Points**

<table>
<thead>
<tr>
<th>Type</th>
<th>Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard (Appendix B)</td>
<td>HP40, P7, P12, P14, P16, P20, P27, P32, P37, P45, P56</td>
</tr>
<tr>
<td>Photo (Appendix C)</td>
<td>HP1, HP4, HP11, HP15, HP19, HP21, HP22, HP24, HP36, HP37, HP38, HP39, JAJ-17-009, JRH-17-12, P1, P2, P3, P4, P22, P24, P25, P30, P34B, P35, P36, P41A, P41B, P42, P48, P50, P54, P58, P59, USACE1, USACE2, USACE3, WC P1</td>
</tr>
</tbody>
</table>

The majority of habitat within the Study Area is comprised of wetlands (74%) or waters (23%) within the Wulik and Kivalina River drainages (Figure 2). K-Hill, an isolated hill in the northeastern section of the Study Area, is upland. Other uplands are scattered throughout the Study Area, including pingos, relic river banks, and large ice wedges that have been elevated above the surrounding topography.

In general, vegetation and hydrology determined key wetland characteristics. The Study Area is a mostly a pristine ecosystem (99.9% undeveloped lands) with a variety of emergent, dwarf, and low shrub habitats. Rivers, lakes, and ponds are common throughout the Study Area and are defining characteristics of the general landscape. The test pits found shallow saturation, and observations described saturated, seasonal, or permanently flooded regimes. It is important to note that field data were mostly collected in September and October.

4.2 COWARDIN CLASSIFICATIONS

Table 2 summarizes the different wetlands, Waters of the U.S., and upland habitat types found within the Study Area.
Table 2: Summary of Wetlands, Waters of the U.S., and Uplands

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Cowardin</th>
<th>Acres</th>
<th>% Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palustrine Saturated &amp; Seasonally Flooded</td>
<td>PEM1C</td>
<td>580.9</td>
<td>1.6%</td>
</tr>
<tr>
<td></td>
<td>PEM1/SS1B</td>
<td>296.2</td>
<td>0.7%</td>
</tr>
<tr>
<td></td>
<td>PEM1/SS1C</td>
<td>13,559.8</td>
<td>36.7%</td>
</tr>
<tr>
<td></td>
<td>PSS1/EM1B</td>
<td>6,023.8</td>
<td>16.3%</td>
</tr>
<tr>
<td></td>
<td>PSS1/EM1C</td>
<td>2,042.0</td>
<td>5.5%</td>
</tr>
<tr>
<td></td>
<td>PSS1C</td>
<td>1,391.3</td>
<td>3.8%</td>
</tr>
<tr>
<td>Total Wetlands</td>
<td></td>
<td>27434.1</td>
<td>74.2%</td>
</tr>
<tr>
<td>Waters of the U.S.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Estuarine</td>
<td>E1UB</td>
<td>3,686.9</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>E2US</td>
<td>135.1</td>
<td>0.4%</td>
</tr>
<tr>
<td>Lacustrine</td>
<td>L1UB</td>
<td>1,164.3</td>
<td>3.2%</td>
</tr>
<tr>
<td>Marine</td>
<td>M1UB</td>
<td>109.1</td>
<td>0.3%</td>
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<tr>
<td></td>
<td>M2US</td>
<td>73.7</td>
<td>0.2%</td>
</tr>
<tr>
<td>Pond</td>
<td>PUBH</td>
<td>949.5</td>
<td>2.6%</td>
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<tr>
<td>Riverine</td>
<td>R2UB</td>
<td>1,378.4</td>
<td>3.7%</td>
</tr>
<tr>
<td></td>
<td>R2US</td>
<td>737.8</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>R3UB</td>
<td>176.0</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total Waters of the US</td>
<td></td>
<td>8,410.8</td>
<td>22.9%</td>
</tr>
<tr>
<td>Uplands</td>
<td>Upland</td>
<td>1071.5</td>
<td>2.9%</td>
</tr>
<tr>
<td>Total Study Area</td>
<td></td>
<td>36,916.4</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

4.2.1 Palustrine Saturated & Seasonally Flooded

Palustrine Saturated & Seasonally Flooded areas consisted of saturated and seasonally flooded wetlands. Cowardin classification within this type include:

- PEM1C: Palustrine Persistent Emergent, Seasonally Flooded
- PEM1/SS1B: Palustrine Persistent Emergent/ Broad-Leaved Deciduous Scrub Shrub, Saturated
Vegetation in saturated wetlands include both shrub and emergent vegetation. Shrub species, such as cranberry (Vaccinium vitis-idaea), Labrador Tea (Rhododendron tomentosum), Blueberry (Vaccinium uliginosum), and small willows, provide limited structure in tundra ecosystems. Grasses and sedges are present, particularly on low centered polygons scattered through the area. Soils consists of Histic Epipedons, with shallow organic layers underlain by dark mineral soils (which have dense roots intermixed in the horizons).

Throughout the Study Area, saturated wetlands can be found on slight rises that border the lagoon or ponds, or are underlain by elevated ice wedges. Hydrology is the key characteristic for this wetland type, controlling the species present and relative ratios of shrubs and emergent plants.

Seasonally flooded wetlands usually have more emergent species (e.g. grasses, sedges, herbaceous plants) due to the soil conditions. Shrubs grow only on local high reliefs, with low points having grasses and sedges growing in standing water. Shrubs include blueberry and willows growing up to a few feet high. The topographic differences driving the hydrologic regime can be traced back to the braided nature of the Wulik and Kivalina River, and the interactions of relic channels and sediment deposits.

### 4.2.2 Palustrine Flooded

Palustrine flooded wetlands were grouped based on a gradient between permanently flooded and seasonally flooded/saturated Cowardin classifications, including:

- PEM1F: Palustrine Persistent Emergent, Semi-permanently Flooded
- PEM1/SS1F: Palustrine Persistent Emergent/Broad-Leaved Deciduous Scrub Shrub, Semi-permanently Flooded
- PSS1/EM1E: Palustrine Broad-Leaved Deciduous Scrub Shrub/ Persistent Emergent, Seasonally Flooded/Saturated
- PSS1J: Palustrine Broad-Leaved Deciduous Scrub Shrub, Intermittently Flooded
Palustrine flooded wetlands are dominated during the growing season by surface water and grass/sedge interspersion. Often tussocks have developed to elevate root zones above the water level. These can be important habitat for wildlife, providing forage and nesting habitat for shorebirds. Shrubs are rarer in these areas, and typically are the results of periodic flooding, as can be seen in the PEE1/EM1E and PSSIJ habitats.

The intermittently flooded scrub shrub (PSSIJ) habitat plays a unique ecosystem role in the Study Area, as they generally contain river sloughs that provide habitat for juvenile fishes. These wetlands border riverine areas, and are composed of low shrub as opposed to dwarf shrub species. These areas often have little emergent vegetation, and appear to be willow species of similar age classes. These habitats appear to be subject to spring seasonal floods, which scour the emergent vegetation.

### 4.2.3 Soils Discussion

For both Palustrine Saturated & Seasonally Flooded and Palustrine Flooded wetlands, soil profiles were the most difficult to evaluate for primary and secondary wetland characteristics. Munsell colors were not collected for any of the profiles; but descriptions on depth, organics, and texture were available. Soil profiles demonstrated a shallow layer of organics, underlain by a saturated mixture of ‘brown…loam’ and organic mixture. We interpreted these to be histic epipedons.

While the definition of a histic epipedon is ‘8-16 inches of organics, underlain by dark mineral soil with chroma of 2 or less,’ we included plots with only a few inches of organics. Our observation was that the cultural investigators often defined layers as ‘mineral with roots’ where wetland biologists would call them ‘organic’ (extending the thickness to 8 inches).

These wetlands determinations were also supported by the saturation observations. Due to the fact that shallow layers of saturation were described in October (well outside the June - August window), we believe these wetlands are at least saturated throughout the growing season. The USACE Alaska Supplement defines a hydric soil “as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.” It further states “a soil that meets the definition of a hydric soil is hydric whether or not it exhibits indicators” specifically described in the USACE Alaska Supplement. Because of this, we believe these shallower organics meet the definition of a hydric soil.

### 4.2.4 Marine and Estuarine

There are many types of Waters of the United States in the Study Area; consisting of Marine, Estuary, Lacustrine, Ponds, and Riverine habitat. Cowardin classifications include:

- **E1UB: Estuarine, Subtidal, Unconsolidated Bottom**
- **E2US: Estuarine, Intertidal, Unconsolidated Shore**
The Chukchi Sea provides the marine habitat west of Kivalina. The Chukchi Sea is listed as a traditional navigable water of the United States by the USACE. Separating Kivalina and the mainland is the estuarine habitat of the Kivalina Lagoon. The lagoon, adjacent estuarine wetlands, and Chukchi Sea are frequently used by local residents to engage in subsistence activities and to travel to other villages.

### 4.2.5 Riverine

Moving inland, the dominate feature within the Study Area is the Wulik and Kivalina River. The Wulik provides an important subsistence transportation route inland for local residents. The Wulik drains the western Brooks Range, and is a listed ADFG Anadromous Water for Chum Salmon, Coho Salmon, King Salmon, Pink Salmon, Sockeye Salmon, Dolly Varden, and Whitefish (ADFG 2017). Riverine Cowardin classifications include:

- **R2UB**: Riverine, Lower Perennial, Unconsolidated Bottom
- **R2US**: Riverine, Lower Perennial, Unconsolidated Shore
- **R3UB**: Riverine, Upper Perennial, Unconsolidated Bottom

### 4.2.6 Lacustrine and Ponds

As the Wulik and Kivalina Rivers have meandered throughout the landscape, they have formed many oxbow lakes and relic sloughs, which span the Study Area. These lacustrine environments are scattered throughout the Study Area, and provide important buffering of flood flows.

Lakes and ponds have also developed from the permafrost/ice wedge cycle. This cycle consists of water freezing and expanding cracks in the permafrost during the winter, and water filling in the cracks during the summer. If the ice wedges become exposed, they hold the summer heat, and cause ponds to form. These are present throughout the landscape in various stages of development, and provide important habitat heterogeneity.

Lacustrine and pond Cowardin classifications include:

Cowardin classifications include:

- **L1UB**: Lacustrine, Limnetic, Unconsolidated Bottom
- **PUBH**: Palustrine, Unconsolidated Bottom, Permanently Flooded
4.2.7 Uplands

There are a limited number of uplands (3% of the area) scattered throughout the Study Area. K-Hill is the most visually significant to the project, as the adjacent area is the destination for the road. This large cropping dominates the eastern end of the Study Area.

Outside of K-Hill, uplands are isolated, topographic rises above the surrounding wetlands with dryer soil regimes, often bordering lake or riverine systems. These uplands could be the result of relic depositions from the Wulik or Kivalina River, or geologic formations.

Other isolated uplands are scattered throughout the Study Area; including small pingos, which have risen above the surrounding wetlands, elevating the plant communities above the water table. Vegetation differences among uplands compared to wetlands included larger shrub species, and visible outcroppings or ridgelines. Confirmation of pingos was greatly improved through the LiDAR datasets now available.

4.3 Wildlife (Viereck) Habitat

Wildlife habitat within the Study Area, as defined by Viereck (1992), is summarized below. In addition, the USFWS found that II.C.1 (Closed Low Scrub) habitat is likely to hold important bird habitat.

Table 3: Summary of wildlife habitat

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Acres</th>
<th>% Study area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developed</td>
<td>64.8</td>
<td>0.2%</td>
</tr>
<tr>
<td>II.C.1 (Closed Low Scrub)</td>
<td>3,228.7</td>
<td>8.7%</td>
</tr>
<tr>
<td>II.D.2 (Willow Dwarf Shrub)</td>
<td>9,057.3</td>
<td>24.5%</td>
</tr>
<tr>
<td>III.A.2 (Mesic Graminoid Herbaceous)</td>
<td>14,348.7</td>
<td>38.9%</td>
</tr>
<tr>
<td>III.A.3 (Wet Graminoid Herbaceous)</td>
<td>1,877.6</td>
<td>5.1%</td>
</tr>
<tr>
<td>W (Water)</td>
<td>8,339.3</td>
<td>22.6%</td>
</tr>
<tr>
<td><strong>Total Study area</strong></td>
<td><strong>36,916.4</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

4.3.1 II.C.1 (Closed Low Scrub)

Closed Low Scrub is the classification for all important bird shrub habitat (Figure 3 and 4, Appendix A). These shrubs are 20 cm (centimeter) to 1.5 m (meter) tall, and are often found bordering waterways. They are the highest canopy vegetation available in the Study Area, and provide some of the only perching locations for birds in the area. These provide nesting habitat, elevated above predators, and locations for surveillance. Morning and evening song behavior from perching locations helps to establish territories, and attract mates. This habitat is less common in the Study Area, and was promoted from previous reports/assessments by one functional value (e.g. II to I or I to I+) to account for its local importance.
4.3.2 II.D.2 (Willow Dwarf Shrub)

Willow Dwarf Shrub is shrub dominated habitat (>25% shrub cover), with heights below 20 cm. Willows are the dominant species evident in the field data, although other species such and blueberry are present. The areas tend to have slightly dryer hydrologic regimes compared to emergent habitat allowing the growth of additional species. They can provide important ground nesting bird habitat, along with berry species to support omnivores.

4.3.3 III.A.2 (Mesic Graminoid Herbaceous)

Mesic Graminoid Herbaceous habitat has up to 25% shrub cover, and are moist sites, usually with seasonal flooding but without standing water. Tussocks are present, along with high centered polygons. This microtopographic relief can be used for nesting by shorebirds, and supports important sedges and grasses for herbivores. This habitat is common both in the Study Area and in the region as a whole.

4.3.4 III.A.3 (Wet Graminoid Herbaceous)

Wet Graminoid Herbaceous habitat has standing water present for most of the year, with up to 25% shrub cover. It tends to be dominated by obligate sedges and grasses. The sedges and grasses can provide important forage habitat for herbivores, and shorebirds often feed on invertebrates present in the standing water.

4.3.5 W (Water)

Viereck summarizes all ponds, lakes, rivers, estuaries, and ocean habitat as Water. This habitat comprises about 22% of the Study Area. Water habitats are important fish and wildlife habitat. In particular, deep pools provide overwintering locations for resident fish species.

4.4 FUNCTIONAL ASSESSMENT

This report’s functional assessment mirrored the methodology presented in ASRC (2015) to maintain a consistent approach. Similar to the last assessment, wetlands were found to be high ranking (Figure 5, Table 4). Waters of the United States (ponds, riverine, tidal, estuarine, and lacustrine) were promoted to Category I+ to indicate their intrinsic importance. Saturated wetlands (PSS1/EM1B) were ranked as Category II.

Important bird habitat was found to consist of Closed Low Scrub habitat (II.C.I). Upon consultation with the USFWS, all Closed Low Scrub (II.C.I) was promoted one functional level (e.g. II to I or I to I+).
Table 4: Final Functional Assessment Acreage

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>Acres</th>
<th>USFWS Bird Shrub Habitat? (II.C.I)</th>
<th>Functional Value/Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEM1/SS1B</td>
<td>296.2</td>
<td>No</td>
<td>II</td>
</tr>
<tr>
<td>PEM1/SS1C</td>
<td>71.1</td>
<td>Yes</td>
<td>I+</td>
</tr>
<tr>
<td>PEM1/SS1F</td>
<td>13488.7</td>
<td>No</td>
<td>I</td>
</tr>
<tr>
<td>PEM1C</td>
<td>581.0</td>
<td>No</td>
<td>I</td>
</tr>
<tr>
<td>PEM1F</td>
<td>17.1</td>
<td>Yes</td>
<td>I+</td>
</tr>
<tr>
<td>PSS1/EM1B</td>
<td>563.8</td>
<td>No</td>
<td>I</td>
</tr>
<tr>
<td>PSS1/EM1C</td>
<td>1296.6</td>
<td>No</td>
<td>I</td>
</tr>
<tr>
<td>PSS1/EM1F</td>
<td>195.0</td>
<td>Yes</td>
<td>I+</td>
</tr>
<tr>
<td>PSS1/EM1C</td>
<td>5873.5</td>
<td>No</td>
<td>II</td>
</tr>
<tr>
<td>Total Wetlands</td>
<td>27434.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waters of the U.S.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1UB</td>
<td>3686.9</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>E2US</td>
<td>135.1</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>L1UB</td>
<td>1164.3</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>M1UB</td>
<td>109.1</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>M2US</td>
<td>73.7</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>PUBH</td>
<td>949.5</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>R2UB</td>
<td>1378.4</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>R2US</td>
<td>737.8</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>R3UB</td>
<td>176.0</td>
<td>No</td>
<td>I+</td>
</tr>
<tr>
<td>Total Waters</td>
<td>8410.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uplands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Study Area</td>
<td>36916.4</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

4.4.1 Category I+

Category I+ polygons were reserved for ponds, rivers, lakes, oceans, estuaries, and elevated bird habitat (discussed below). These landscape features have a higher intrinsic value than neighboring wetlands due to their roles in the environment. To aid in project planning, it was determined to be important to raise these features above Category I.
4.4.2 **Category I**

67% of wetlands (which are not Waters of the US) in the Study Area are Category I. This is due to the low level of disturbance in the ecosystem. Wetlands are relatively pristine, and fully functioning within their natural environment. Few wetlands are providing unique functions or services, and instead work as a large interrelated network extending far beyond the Study Area boundaries.

4.4.3 **Category II**

Category II habitats comprised the smallest functional category. These were saturated shrub habitat, which provide relatively low levels of flood flow alteration and sediment removal. Saturated wetlands are the least wet, and it is common for them to be the lowest ranked due to their similarities with uplands. These often are on small ridges or pingos, bordering uplands and wetter wetlands.

4.4.4 **Bird Habitat**

The USFWS has indicated that Low Scrub Habitat (II.C.1) provides important bird habitat in the Study Area. The functional assessment promoted all Low Scrub Habitat one functional level (e.g. II to I, or I to I+) to incorporate these comments. These habitats tended to be near riverine systems.

Due to the slight differences in Viereck and Cowardin Classification systems, bird habitat (II.C.1) is found in a variety of wetland classifications (PEM1/SS1C, PEM1C, PSS1/EM1B, PSS1/EM1C, PSS1/EM1E, PSS1C, PSS1J).

This is particularly important to note, because not all Low Scrub Habitat is ranked as Category I+. The important bird habitat was elevated one level, which depending on the Cowardin classification elevated polygons from II to I or I to I+ (Table 4).

4.5 **CONCLUSION AND JURISDICTION**

Development activities from construction of the proposed project would likely impact wetlands and/or Waters of the U.S. under the jurisdiction of USACE. Based on the review of existing hydrology information, drainage within the Study Area flows into the Kivalina River, Wulik River, or directly into the Chukchi Sea, a traditional navigable Water of the U.S. The Kivalina River and Wulik River also flows into the Kivalina Lagoon, a tidal estuary of the Chukchi Sea.

Wetlands in the Study Area have a clear direct surface connection to the Kivalina River, Wulik River, Kivalina Lagoon, or Chukchi Sea. For this reason, wetlands and Waters of the U.S. in the Study Area are presumed jurisdictional by the USACE under Section 404 of the CWA and Section III.D.2 of the Jurisdictional Determination Form.
5.0 REFERENCES

ADFG. 2017. Anadromous Waters Catalog. 

ASRC. 2015. Wetland Delineation and Functions & Values Assessment. Prepared for Northwest Arctic Borough, Office 163 Lagoon Street, Kotzebue, AK 99752


Munsell Color (Firm). (2010). Munsell soil color charts with genuine Munsell color chips. Grand Rapids, MI: Munsell Color,


United States Army Corps of Engineers. 2007. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0). United States Army Engineer Research and Development Center, Vicksburg MS.

United States Army Corps of Engineers. 1987. Corps of Engineers Wetlands Delineation Manual. Environmental Laboratory, Waterways Experiment Station, Vicksburg MS.


Appendix A  SITE MAPS
Wetland mapping protocol: NWI boundaries were imported for the entire project. Then Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were modified as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013
Kivalina Evacuation and School Site Access Road - Wetlands Overview

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetlands
- Estuarine
- Lacustrine
- Marine
- Palustrine Flooded
- Palustrine Saturated & Seasonally Flooded
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol: All data points were required for the entire project. The
   ASRC/USACE-issued 2013 SMF data were included in the project, and
   updated during the project. The Required and Optional data were updated
   during the project. The SMF data included were updated to reflect any
   changes that were made to the wetland classification during project
   execution.

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient, their employees, contractors and agents, from any and all claims arising in any way from the content or provision of the data.
Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping products (2005) boundaries were imported for the entire project. The
   geographic bounding box (GBO) was derived from the ESRI Aqua Imagery Orthoimagery and
   wetland polygons were fixed in all fields in the ESRI mapping at a 1:18,400 scale.
3. Stantec used field data to update the wetland classification for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013
Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Kivalina Evacuation and School Site Access Road - Wetlands

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Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for the accuracy and completeness of the data. The recipient assumes responsibility for data supplied in electronic format for use in any and all applications not inconsistent with the intent or purpose of the data.
Kivalina Lagoon
Chukchi Sea
Kivalina Lagoon

Legend

Data Points (2016)
● Standard Data Point
■ Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols and 500 boundaries were updated for the island project. The
geopoint of the November 2015 ASRC wetland report was brought into GIS, and
wetland polygons were hand traced to be in the 500 mapping at 1:3000 scale.
3. Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN,
GeoBase, IGN, Kadaster NL,© OpenStreetMap contributors, © OpenStreetMap contributors
Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Appendix H Page 35
Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
3. Appendix H Page 36

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol, 500 base lines were imported for the whole project. The
geodatabase for the November 2015 ASRC wetland report was brought into the GIS and
wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
3. Field data was used to update the wetland classifications for the entire
area. The small ASRC area was refined as appropriate.

Study Area

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Kivalina Evacuation and School Site Access Road - Wetlands

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols used for this project. The geoTIFF of the November 2015 ASRC wetland report was brought into GIS and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Stantec used field data to update wetland classifications in the area. NWI boundaries were retained, except for the smaller ASRC area where they were re-drawn as appropriate.

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Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL

Kivalina Evacuation and School Site Access Road - Wetlands

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol GIS boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in the GIS mapping at 1:3000 scale. Then Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

Kivalina River

**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping polylines in blue were uploaded for the project. The geoTIFFs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the ASRC mapping at 1:3,000 scale. Stantec used 1:6,500 data to update the wetland map at 1:6,500 scale for the project area. Wetlands lower than 0.50 m ASL were included for regulation under Section 307 of the Water Pollution Act.

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**Orthoimagery:** Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

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Project Location: Kivalina River
Client/Project: Kivalina River
Figure No.: 2-

**Title:**

**Kivalina Evacuation and School Site Access Road - Wetlands

Sources:** Envi, HERE, DeLorme, Intermap, increment,
P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kartaker NL
Kivalina Lagoon

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Wetland Verification Report
Kivalina Evacuation and School Site Access Road

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Notes


2. Wetland mapping protocols and NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced and reviewed in the NWI mapping at 1:3000 scale. Stantec used the field data to update the wetland classifications for the entire area.


Project Location: Kivalina River

Client/Project: Kivalina River

Figure No.: 2-03

Title: Wetlands Verification Study

Source: Stantec, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Standard Data Point
- Photo Point

Wetland Type

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping协议和3000米边界被用于项目。项目外包商将ASRC湿地报告的正射影像图带入GIS，手工绘制湿地边界来代替NWI映射。然后Stantec使用现场数据更新整个区域的湿地分类。NWI边界被保留，除了ASRC区域的一部分，这些边界需要根据情况调整。

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Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013


---

**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**

2. Orthophoto: Combination OrthoMap Inc., 2011, Stantec Inc., 2013
3. Wetland mapping protocol 0.5% boundaries are used for the entire project. The
   geoTiffs of the November 2015 ASRC wetland report were brought into GIS and
   boundary polygons were hand traced to replace the NWI mapping at 1:3000 scale.
   Then Stantec used field data to updated the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

**Orthoimagery:** Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

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**Source:** Stantec.

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**Technical Review:**
Prepared by CDP on 2017-06-23
Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX

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**Appendix H Page 44**
Kivalina Evacuation and School Site
Access Road - Wetlands

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Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Edaphic
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols and ISD boundaries were imported for the entire project. The
geotiff of the November 2015 ASRC report was brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. The GIS was revised to incorporate field data, and the wetland polygons were adjusted

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Wetlands Verification Report
Kivalina Evacuation and School Site Access Road
Figure No. 2-11
Kivalina Evacuation and School Site Access Road - Wetlands

Project Origin: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Notes
2. Wetland mapping protocols were implemented for the entire project. The
geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and
wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
Stantec used field data to update the wetland classifications for the entire
area. NWI boundaries were retained, except for the smaller ASRC area where they
were refined as appropriate.

Legend
Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Appendix H Page 46
Wetland Type

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes:

3. Wetland mapping protocols: ESRI (2012), field data was used to update the wetlands map at 1:3000 scale. The wetland polygons were used to locate the Study Area. The wetland classification was updated using field data to identify the wetland types. The wetland polygons were used to locate the Study Area. The wetland classification was updated using field data to identify the wetland types.

Kivalina Evacuation and School Site Access Road - Wetlands

Project Location
Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian

State of Alaska, DOT & PF Northern Region
Wetlands Verification Report

Kivalina Evacuation and School Site Access Road

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols 1:500 boundaries were adopted for this project. The City of Kivalina (2015) 1:3000 scale, detailed report was brought into GIS, and wetland polygons were hand traced to match the NWI mapping at 1:3000 scale. Further, we used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were modified as appropriate.

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Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols used in this report were compiled for the entire project. The
   data from the November 2015 ASRC wetland report were brought into GIS, and
   wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
   Then Stantec used field data to update the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

Appendix H Page 49
Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Legend
- Data Points (2016)
- Standard Data Point
- Photo Point


Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTIFF of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Further, some land in wetland polygons was identified as wetland in the ASRC report and was removed from the final wetland classification at 1:3000 scale. Wetlands were updated at one-quarter of the ASRC scale for the winter study and the smaller ASRC area where they were refined as appropriate.

Statute, Title, & Section: Title 40, §§ 1801-1807, 40 CFR Part 230, 239

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Appendix H Page 50
Kivalina River

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Edgewater
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols were reviewed for the scope project. The use of the November 2015 ASRC, wetland report was adopted for the project, and wetland polygons were overlaid to create the wetland mapping at 1:3000 scale. Site specific, wetland data was added to correct the wetland classification of the project area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.


Source: Esri, HERE, DeLorme, Intermap, increment®
P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Page 22 of 87
Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Notes

Orthoimagery: Esri, HERE, DeLorme, Intermap, incrementP Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, ++


Data Points (2016)
- Standard Data Point
- Photo Point

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Kivalina Evacuation and School Site Access Road - Wetlands
Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Notes
2. Wetland mapping polygons at 1:3000 were used for the entire project. The
geodatabase of the November 2015 ASRC wetland report was brought into GIS and
wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
Then Stantec used field data to update the wetland classifications for the entire
area. NWI boundaries were retained, except for the smaller ASRC area where they
were refined as appropriate.
3. Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, GlobalImages Inc., 2013,

Appendix H Page 54
Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Notes
2. Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in the GIS mapping at 1:3000 scale. Stantec then field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
3. Wetland mapping protocols GIS boundaries were imported for the entire project. The
   geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and
ew wetland polygons were hand traced to the study area. The NWI mapping is at 1:3000 scale.
   Stantec used field data to updated the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

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Appendix H Page 56
Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol: 500 boundaries were imported for the study project. The
geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and
wetland polygons were hand traced in the GIS mapping at 1:3000 scale.
3. Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS
FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Orthoimagery: ©2014 Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,

Orthoimagery: ©2014 Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,

Orthoimagery: ©2014 Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Kivalina Evacuation and School Site Access Road - Wetlands

**Project Location**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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**Legend**

- **Data Points (2016)**
  - Standard Data Point
  - Photo Point

- **Wetland Type**
  - Estuarine
  - Lacustrine
  - Marine
  - Palustrine_Flooded
  - Palustrine_Saturated
  - Pond
  - Riverine
  - Upland
  - Study Area

---

**Notes**

2. Wetland mapping projects in 2015 boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC, wetland report were brought into GIS, and wetland polygons were hand traced. Study area boundaries were refined as appropriate.

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**Wetlands Verification Report**

Kivalina Evacuation and School Site Access Road

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**Orthoimagery**

- ©Kodiak Mapping Inc., 2011
- ©AeroMetric Inc., 2013

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**Sources:** Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, and the GIS User Community.
The Kivalina River is shown in the map with wetland types indicated. The wetland types include Estuarine, Lacustrine, Marine, Palustrine_Flooded, Palustrine_Saturated, Pond, Riverine, Upland, and Study Area.

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols and GIS boundaries were imported for the study project. The geoTiffs of the November 2015 ASRC report were brought into GIS, and wetland polygons were hand traced in the GIS mapping at 1:3000 scale. Stantec used field data to update the wetlands classifications for the entire area. Special care was taken for wetlands in the ASRC area where NWI boundaries were retained, except for the smaller ASRC area where they were refined if appropriate.
4. Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC report were brought into GIS, and wetland polygons were hand traced in the GIS mapping at 1:3000 scale. Stantec used field data to update the wetlands classifications for the entire area. Special care was taken for wetlands in the ASRC area where NWI boundaries were retained, except for the smaller ASRC area where they were refined if appropriate.
## Data Points (2016)

- **Standard Data Point**
- **Photo Point**

### Wetland Type

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

### Notes


2. Wetland mapping protocols in this manuscript were updated for the Arkona project. The
   only difference was in the wetland polygon names. All other polygon names remained
   the same. They were updated to reflect the Arkona project.

3. Wetlands verification report for the Arkona project. The Wetlands verification report for
   the Arkona project. The Wetlands verification report for the Arkona project. The Wetlands
   verification report for the Arkona project. The Wetlands verification report for the Arkona
   project.

### Orthoimagery


### Acknowledgements

- Combination: Orthoimagery Inc., 2011, Geobase Inc., 2013

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**File Information**

- Project/Origin: Kivalina, Alaska
- Section 21, Township 27N, Range 26W
- Kateel River Meridian
- State of Alaska, DOT & PF Northern Region
- Wetlands Verification Report
- Kivalina Evacuation and School Site Access Road

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**Figure No.** 2-10

**Map Title:** Kivalina Evacuation and School Site Access Road - Wetlands

---

**Legend**

- **Data Points (2016)**
  - Standard Data Point
  - Photo Point

- **Wetland Type**
  - Estuarine
  - Lacustrine
  - Marine
  - Palustrine_Flooded
  - Palustrine_Saturated
  - Pond
  - Riverine
  - Upland
  - Study Area

---

**Source:** Stantec 2017
Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols and mapping boundaries were imported for the entire project. The
   very high resolution (2020 and 2017) orthoimagery was brought into GIS, and
   wetland polygons were hand traced to replace the NBI mapping at 1:6,500 scale.
   Then Stantec updated the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

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Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes

2. Wetland mapping protocols used in this project were described in Section 2.1. Wetland polygons were imported from the NWI report at 1:3000 scale. The NWI polygons were then used to produce the 1:6,500 scale wetland mapping. Wetland polygons were hand traced at the 1:6,500 scale. Wetland polygons were then refined where necessary and the NWI polygons were retained except for the smaller ASRC area where they were refined as appropriate.


**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**

**Orthoimagery**
- ©Kodiak Mapping Inc., 2011
- ©AeroMetric Inc., 2013

**Wetland mapping protocol:** NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Then Stantec used field data to update wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

**Orthoimagery:** Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Kivalina Evacuation and School Site Access Road - Wetlands

**Source:** Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEGIS, IGN, and the GIS User Community

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**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping project at 500 boundaries were updated for this project. The
   geoTiffs of the November 2015, 2016, wetland report were brought into GIS, and
   wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
   Then Stantec used field data to update the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

---

**Appendix H Page 65**
Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
3. Wetland mapping protocols were revised for the whole project. The
geofence of the November 2015 ASRC wetland report was brought into GIS, and
wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
Wetland classes were then reviewed, and field data were used as needed to
correct the wetland mapping. NWI boundaries were retained, except for the
smaller ASRC area where they were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
"500 1,000 1,500 2,000 Feet
250 Feet
1:6,500 (At original document size of 11x17)

Appendix H Page 66
Kivalina Evacuation and School Site Access Road - Wetlands

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping project (2015-2016) boundaries were imported for the study project. The
geospatial data (ASRC 1998-2010) was updated in 2015-2016. Study project boundaries were
created from the imported data by adding the wetland polygons from the November 2015
ASRC data. Study project boundaries were created from the imported data by adding the
wetland polygons from the November 2015 ASRC data.

Orthoimagery: Combination

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEROGRAF, IGN, and the GIS
User Community

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expressly or impliedly, for the content or accuracy of the data.
Kivalina Evacuation and School Site Access Road - Wetlands

**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocol MOB boundaries were imported for the mobile project. The geoTIFF of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were loaded into the mobile in the MOB mapping at 1:3000 scale. During remote field work, the wetland polygons were hand-traced within the MOB mapping at 1:1,500 using a digital tablet and drawing tools. In the area where the native wetland polygons were refined, a graphic overlay for wetland types was added to the area to provide for a high level of accuracy for the final product, where wetland types were labeled as appropriate.

**Orthoimagery Credit**

- Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL.

- feet

**Appendix H Page 68**
Kivalina Lagoon

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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**Legend**

- **Data Points (2016)**
  - Standard Data Point
  - Photo Point

**Wetland Type**

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**

2. Wetland mapping protocols NWI boundaries were imported for the entire project. These included the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. These bounded and field data was imported into GIS at 1:6500 scale. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

**Appendix H Page 69**

**Figure No.**

Kivalina Evacuation and School Site Access Road - Wetlands

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**Technical Review by ABC on 2017-0X-XX**

**Independent Review by ABC on 2017-0X-XX**

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Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Study Area

Notes

Appendix H Page 70
Project Location
Client/Project
Figure No.
Title

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols MOE boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in to replace the MOE mapping at 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Kivalina Evacuation and School Site Access Road - Wetlands

Appendix H Page 72
Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced and modified in the GIS mapping at 1:3000 scale. Sources, field data, and field notes were input into the wetland database. Depending on the data source, wetland classifications were updated or refined. Depending on the wetland area, the boundary shape was exported as an appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

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Kivalina Evacuation and School Site Access Road - Wetlands
Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Stantec used field data to update the wetland categories only in the area of the project. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Notes:
2. Wetland mapping protocol 500 boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Stantec used field data to update the wetland categories only in the area of the project. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.
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**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocols: NWI boundaries were imported for the entire project. The geoTiff of the November 2015 ASRC report was brought into GIS, and wetland polygon data in the geoTiff is at 1:3000 scale. All wetland polygon data was imported into GIS mapping at 1:8000 scale.
3. Sources, GeoBase, IGN, Kadaster NL, DeLorme, Intermap, increment P Corp, GEBCO, USGS, FAO, NPS, NRCAN, CIA, GeoBase, IGN, Kadaster NL, OSM, MGI, LGM, UGM, IGM, IGU, IGN, IGP, USGS, AGRICOLA, NAVDAT, and the GIS User Community

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**PROJECT LOCATION**

**Client/Project**

**Figure No.**

**Title**

**Source:** Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX/GEOS, IGN, and the GIS User Community.

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**Kivalina Evacuation and School Site Access Road - Wetlands**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocols: NWI boundaries were imported for the entire project. The geoTiff of the November 2015 ASRC report was brought into GIS, and wetland polygon data in the geoTiff is at 1:3000 scale. All wetland polygon data was imported into GIS mapping at 1:8000 scale.
Kivalina Evacuation and School Site
Access Road - Wetlands

Project Location:
Kateel River Meridian
State of Alaska, DOT & PF Northern Region

Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

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Kivalina Evacuation and School Site Access Road - Wetlands

Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W

State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type:
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes:

Orthogonal Image Composition
- Stantec
- Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Kivalina Evacuation and School Site
Access Road - Wetlands

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Study Area

Notes
2. Wetland mapping project (NWI boundaries) were imported for the entire project. The
geodatabase of the November 2015 ASRC wetland report was brought into GIS, and
wetland polygons were then loaded in to the model. The NWI mapping at 1:3000 scale
then serves as the base data in addition to the updated polygons created by
Stantec.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS
User Community

Kivalina Evacuation and School Site
Access Road - Wetlands Verification Report

Prepared by CDP on 2017-06-23
Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX


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Appendix H Page 81
Wetland Type:
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes:
2. Wetland mapping protocol 1:3000 boundaries were impractical for the field project. The geoTiffs of the November 2015 ASRC wetland report were imported into the GIS and wetland polygons were matched to and stored in the Wetland mapping 1:3000 GIS. Stantec used field data to update the wetland classification and map the wetland polygons. These wetland polygons were refined as appropriate for the project area. A layer of wetland polygons was added to the GIS to coincide with the cartographic wetland polygons, and these polygons were retained except in the smaller ASRC area where they were refined as appropriate.

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Kivalina Evacuation and School Site Access Road - Wetlands
Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Study Area

Notes
2. Wetland mapping protocol (NWI boundaries were imported for the whole project. The
geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and
wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Stantec
then used field data to update wetland classifications for the entire
area. NWI boundaries were retained, except for the smaller ASRC area where they
were edited as appropriate.


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Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type


**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocols 2015 boundaries were updated for the study. The
   State of Alaska 2013, 2011, 2007, and 1:3000 scale GIS and
   wetland polygons were used to update the study for NWI mapping to 1:1,000 at
   the site. Existing and updated data is subject to interpretation and clarification.
   The map was created on the basis of survey data, which the map is a base map
   from any and all information is not from this natural image width.

**Project Origin:** Kivalina, Alaska  
**Section 21, Township 27N, Range 26W**  
**State of Alaska, DOT & PF Northern Region**  
**Wetlands Verification Report**  
**Kivalina Evacuation and School Site Access Road**  
**Access Road - Wetlands**  
**Appendix H Page 84**
Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Study Area

Notes
2. Wetland mapping polygons and boundary were imported for the entire project. The
   1:3000 ASRC wetland report was brought into GIS and wetland polygons were hand tracated in the GIS mapping at 1:3000 scale.
   Then Stantec used field data to updated the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, ©OpenStreetMap contributors

Orthophoto: ©Gina Homburg 2011, ©Gina Homburg 2013
Project Location: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Upland

Notes
2. Wetland mapping protocols used were refined for the entire project. The
net area of the November 2015 ASRC wetland report was brought into GIS, and
wetland polygons were updated to the standard ASRC mapping at 1:3000 scale.

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Kivalina Evacuation and School Site
Access Road - Wetlands

Legend

Data Points (2016)

- Standard Data Point
- Photo Point

Wetland Type

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes


2. Wetland mapping protocol for FHWA was employed for the entire project. The FS Office of the Governor (2012) airborne orthophoto map (at 1:3000 scale) and ASRC wetlandpermit was used to locate and identify the FHWA mapping at 1:1000 scale. Stantec used field data to complete wetland polygons on-site. The FHWA standards were followed as closely as possible.


Orthoimagery: https:// rollcallmap.com/

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Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols were updated for the study project. The
   geoTIFs from the November 2015 ASRC wetland report were brought into GIS, and
   wetland polygons were hand traced in the study area. The NWI mapping at 1:3000 scale
   was used, and field data was used to update the wetland attributes for the entire
   study area. Outliers in the existing wetland polygons were removed. NWI
   boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

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Kivalina Evacuation and School Site Access Road - Wetlands

2. Wetland mapping protocol: In general, the entire project area was mapped at 1:3000 scale. The wetland polygons were used to locate and visualize the 3,500 shallow water bodies in the ASRC wetland report, which were used in the final wetland report to outline the wetland polygons included in the project. The wetland polygons were then used to locate and visualize the ASRC wetland report, which were used in the final wetland report to outline the wetland polygons included in the project.
3. Wetland mapping protocol: NWI boundaries were imported for the entire project. The wetland polygons were used to locate and visualize the 3,500 shallow water bodies in the ASRC wetland report, which were used in the final wetland report to outline the wetland polygons included in the project. The wetland polygons were then used to locate and visualize the ASRC wetland report, which were used in the final wetland report to outline the wetland polygons included in the project.


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Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols: GIS boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to reflect the NWI mapping at 1:3000 scale. The study area was updated to reflect the wetland polygons for the wetland areas and were updated in the GIS model to reflect the reporting. The study area was updated to reflect the wetland mapping.
Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. However, small field data were added to replace the NWI mapping at 1:3000 scale. The wetland polygons were updated using field data. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013
Kivalina Evacuation and School Site Access Road - Wetlands

Project Origin: Kivalina, Alaska
Section 21, Township 27N, Range 26W
Kateel River Meridian
State of Alaska, DOT & PF Northern Region
Wetlands Verification Report
Kivalina Evacuation and School Site Access Road

Notes:
2. Wetland mapping protocols were developed for the project. The
   geoTIFF of the November 2015 ASRC wetland report was brought into GIS, and
   wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
   Field data was used to update the wetland classifications for the entire
   project. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.

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Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Source: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Prepared by CDP on 2017-06-23
Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX

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Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013
Wulik River

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend
Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes

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Prepared by CDP on 2017-06-23
Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX

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Figure No. 2-1

Project Location: Wulik River
Client/Project: HP37

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes

2. Wetland mapping protocols of NWI boundaries were imported for the entire project. The geoTIFF of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Field data was updated to include new wetlands and refine existing wetland boundaries. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.


Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, "1:6,500 (At original document size of 11x17)"

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**Legend**

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocol of NWI boundaries were imported for the entire project. The pre-existing boundaries (1:3000 scale) were refined to depict the NWI wetland polygons near the project area. Wetland polygons were hand-traced in the GIS for the NWI mapping @ 1:3000 scale. Areas were sampled for wetland polygons for each 100’ x 100’ cell. Wetland polygons were kept for cells where they were classified as appropriate.

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**Sources:** Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL.
Kivalina Evacuation and School Site Access Road - Wetlands

Data Points (2016)

- Standard Data Point
- Photo Point

Legend

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping previously done in 2015 was updated for the project. The
   change occurred in the boundary 2015 ASRC wetland report and the final report
   includes all boundary changes. The original 3,000 scale wetland report was
   used to determine the boundary changes. The NWI mapping at 1:3000 scale
   was used with field data to determine the boundary changes. The
   boundary changes were updated to include the study area.

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS,
GIS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,

Sources: ©2011 GOK and USGS

Stantec
Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTIFFs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in the GIS using a 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.


Notes:
2. Wetland mapping protocol NWI boundaries were imported for the entire project. The geoTIFFs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in the GIS using a 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.


Sources: Esri, HERE, Geodetics, Intermap, increment P Corp, iCorso, USDA, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL.
### Legend

- **Data Points (2016)**
  - Standard Data Point
  - Photo Point

### Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

### Notes

2. wetland mapping protocols were revised for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced in the GIS mapping at 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping polygons at 500 boundary were imported for the entire project. The
geodatabase for boundary (2015 ASRC, wetland report area) is at 1:3000, but
wetland polygons were imported at 1:1000 to allow for better alignment with other
map layers and analysis. Wetland polygons were processed to be 1:1000 for this
product. The major wetland types were refined to better match the refined
wetland classification. NWI boundaries were retained, except for the smaller
ASRC area where they were refined as appropriate.

Wetland mapping protocol: NWI boundaries were imported for the entire project. The
geodatabase for boundary (2015 ASRC, wetland report area) is at 1:3000, but
wetland polygons were imported at 1:1000 to allow for better alignment with other
map layers and analysis. Wetland polygons were processed to be 1:1000 for this
product. The major wetland types were refined to better match the refined
wetland classification. NWI boundaries were retained, except for the smaller
ASRC area where they were refined as appropriate.

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Legend

- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol 2016 boundaries were updated for the entire project. The
gap pylons of the boundaries (1:3000 scale) were imported as a shape file, and
wetland polygons were derived from the shape file for 1:1300 scale. The
wetland shapes were imported in ArcGIS, and the GIS shapes were updated
using the 1:1300 scale. Orthoimagery was used to determine the
wetland areas, and the wetland classification was updated for the entire
area. The wetland shapes were refined as appropriate.

Orthoimagery: Combination (Orthoimagery Inc., 2021, Sanefield Inc., 2021)
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Legend

- Standard Data Point
- Photo Point

Wetland Type

- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes

2. Wetland mapping protocols in GIS boundaries were imposed for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were imposed to and inside in the GIS mapping at 1:3000 scale. Stantec used field data to update wetland types for the ASRC area, and wetland classifications were revised for consistency with the GIS for the rest of the project area. The ASRC area was refined, except for the smaller ASRC boundary where they were used as appropriate.

Sources:
- Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
- Online Services.


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Kivalina Evacuation and School Site Access Road - Wetlands
Kivalina Evacuation and School Site Access Road - Wetlands

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Data Points (2016)
- Standard Data Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland

Study Area

Notes
2. Wetland mapping protocols SWAP boundaries were imported for the entire project. The geoTIFFs of the November 2015 ASRC wetland report were a single GeoTIFF and wetland polygons were hand traced into the small area SWAP mapping at 1:3000 scale.
3. Boundary, wetland, and field data is georeferenced using the geoTIFFs from the ASRC report as the base. The remaining areas were then built out, making the entire area wetland

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Wetland mapping protocol: NWI boundaries were imported for the entire project. The geopdf of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were hand drawn in the GIS for the NWI mapping at 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Legend
Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocol or SMD boundaries were updated for the entire project. The GIS Office for the Bureau of Land Management, wetland report was created at 1:3000 scale, with wetland polygons now hard and solid in the model as the SMD mapping at 1:1,800 is an overlay. Other edits, such as fault lines in general, are found in the model as the SMD mapping at 1:1,800 was used.

Appended: Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX

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Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Then Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

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Appendix H Page 109

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area
Kivalina Evacuation and School Site Access Road - Wetlands

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping polygons (ESRI boundaries) were imported for the initial project. These polygons were imported at 1:3000 scale, as per ASRC's request. For the November 2015 report, wetland polygons were based on the study area for the ASRC project. Wetland boundaries were then updated to reflect the 1:6,500 scale for the Kivalina School Site. Standard data points were retained or added as appropriate.


Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC report were brought into GIS, and wetland polygons were then hand traced to replace the NWI mapping at 1:3000 scale. Orthoimagery was used to update the study area for the ASRC project. NWI boundaries were then updated to reflect the 1:6,500 scale for the Kivalina School Site. Standard data points were retained or added as appropriate.


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## Data Points (2016)

- **Standard Data Point**
- **Photo Point**

### Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

### Notes
2. Wetland mapping protocol is 1:500 boundaries were imported for the entire project. The geoTIFF of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were used to create the map in the NWI mapping at 1:3000 scale. Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

### Map Description
- **Project Location:** Kivalina, Alaska
- **Study Area:** Kivalina Evacuation and School Site Access Road - Wetlands

### Wetland Verification Report
- Prepared by CDP on 2017-06-23
- Technical Review by ABC on 2017-0X-XX
- Independent Review by ABC on 2017-0X-XX

### Appendix H Page 111

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### Legend

Source: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL,
Legend

**Data Points (2016)**
- Standard Data Point
- Photo Point

**Wetland Type**
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

**Notes**
2. Wetland mapping protocols in 2015 boundaries were expanded for the entire project. The geodatabase for the coverage (19C 1508) contains the boundaries in the coverage at 1:3000 scale and wetland polygons were found and tied to the database in the 2015 report. The extent shown here is a subset of the entire project site. The boundaries were expanded for the 2015 report and the extent shown here is for the area of the access road.
4. Wetland mapping: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were found and tied to the database in the 2015 report. The extent shown here is a subset of the entire project site. The boundaries were expanded for the 2015 report and the extent shown here is for the area of the access road.

Appendix H Page 112
Wulik River

Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Notes
2. Wetland mapping protocols and NHD boundaries were imported for the entire project. Then, the Orthoimagery of the November 2015 ASRC wetland report was brought into GIS, and wetland polygons were hand traced to replace the NHD mapping at 1:3000 scale. Then, Stantec updated the wetland classification at 1:6,500 scale. The Orthoimagery was used for the wetland classification, except for the smaller ASRC area, where they were digitized as appropriate.


Source: Esri, DigitalGlobe, GeoEye, Airbus, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix H Page 113
Kivalina Evacuation and School Site Access Road - Wetlands

Wetland Type
- Estuarine
- Lacustrine
- Marine
- Palustrine_Flooded
- Palustrine_Saturated
- Pond
- Riverine
- Upland
- Study Area

Legend
- Standard Data Point
- Photo Point

Data Points (2016)

Notes
3. Wetland mapping protocol at 500 boundaries were imported for the entire project. The
   geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and
   wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale.
   Then Stantec used field data to updated the wetland classifications for the entire
   area. NWI boundaries were retained, except for the smaller ASRC area where they
   were refined as appropriate.


Source: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, end the GIS User Community

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for any and all claims arising in any way from the content or provision of the data.

Prepared by CDP on 2017-06-23
Technical Review by ABC on 2017-0X-XX
Independent Review by ABC on 2017-0X-XX

Appendix H Page 114
Kivalina Evacuation and School Site Access Road - Wildlife Overview

Coordinate System: NAD 1983 2011 StatePlane Alaska 8 FIPS 5008 Feet

Wetland mapping protocol: NWI boundaries were imported for the entire project. The geoTiffs of the November 2015 ASRC wetland report were brought into GIS, and wetland polygons were hand traced to replace the NWI mapping at 1:3000 scale. Then Stantec used field data to update the wetland classifications for the entire area. NWI boundaries were retained, except for the smaller ASRC area where they were refined as appropriate.

Orthoimagery: Combination ©Kodiak Mapping Inc., 2011, ©AeroMetric Inc., 2013

Notes


LEGEND

Data Points (2016)
- Standard Data Point
- Photo Point

Viereck
- Developed
- II.C.1: Closed Low Scrub*
- II.D.2: Willow Dwarf Shrub
- III.A.2: Mesic Graminoid Herbaceous
- III.A.3: Mesic Graminoid Herbaceous

W: Water

Study Area

* Closed Low Scrub is considered important bird habitat.

Appendix H Page 115
Kivalina Evacuation and School Site Access Road - Bird Overview

Appendix H Page 116
Legend

Data Points (2016)
- Standard Data Point
- Photo Point

Wetland Function
- I
- II
- Upland
- Study Area

Notes
2. Wetland mapping protocols: MDM boundary systems were imported for the entire project. The old ASCE boundary was updated, and a new ASCE boundary was created. A combination of ASCE and MDM boundary systems were used for the wetland project. The ASCE system was updated for the wetland boundary system. The wetland maps were updated. MDM boundary systems were used for the smaller ASCE units, where they were updated in appropriate.

Appendix H Page 117
Appendix B  STANDARD WETLAND DELINEATION DATA SHEETS
### WETLAND DETERMINATION DATA FORM - Alaska Region

**Project/Site:** Kivalina  
**Borough/City:** NW Arctic  
**Sampling Date:** Sept/Oct 2016  
**Applicant/Owner:** DOT&PF  
**Sampling Point:** HP40  
**Investigator(s):** Stantec  
**Landform (hillside, terrace, hummocks, etc):** Slight terrace  
**Local relief (concave, convex, none):** convex  
**Slope (%):** 0  
**Subregion:** Western Brooks Range Mts Foothills  
**Lat:** 67.803448  
**Long:** -164.409217  
**Datum:** NAD83  
**Soil Map Unit Name:** Not Available  
**NWI classification:** PSS1/EM1E  

**Are climatic / hydrologic conditions on the site typical for this time of year?** Yes [X] No  
(If no, explain in Remarks.)  
**Are Vegetation, Soil, or Hydrology significantly disturbed? Are 'Normal Circumstances' present?** Yes [X] No  
(If needed, explain any answers in Remarks.)  
**Are Vegetation, Soil, or Hydrology naturally problematic?** Yes [X] No  
(If needed, explain any answers in Remarks.)

#### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

<table>
<thead>
<tr>
<th>Hydrophytic Vegetation Present?</th>
<th>Yes [X] No</th>
<th>Is the Sampled Area within a Wetland?</th>
<th>Yes [X] No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydric Soil Present?</td>
<td>Yes [X] No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetland Hydrology Present?</td>
<td>Yes [X] No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks: Larger willows along northeast side of large lake at base of K-hill west. Drainage apparent along paths between willows. This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

#### VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESCENDING ORDER

<table>
<thead>
<tr>
<th>3/3 Abbrev.</th>
<th>Tree Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Salix, Unidentified</td>
<td>80</td>
<td>YES</td>
<td>FAC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Vaccinium uliginosum</td>
<td>10</td>
<td>NO</td>
<td>FAC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hydrophytic Vegetation Present?** Yes [X] No  
**Hydric Soil Present?** Yes [X] No  
**Wetland Hydrology Present?** Yes [X] No  
**Dominance Test worksheet:**

<table>
<thead>
<tr>
<th>Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)</th>
</tr>
</thead>
</table>

**Prevalence Index worksheet:**

<table>
<thead>
<tr>
<th>Total % Cover of:</th>
<th>Multiply by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBL species</td>
<td>0 x 1 = 0</td>
</tr>
<tr>
<td>FACW species</td>
<td>0 x 2 = 0</td>
</tr>
<tr>
<td>FAC species</td>
<td>190 x 3 = 570</td>
</tr>
<tr>
<td>FACU species</td>
<td>0 x 4 = 0</td>
</tr>
<tr>
<td>UPL species</td>
<td>0 x 5 = 0</td>
</tr>
<tr>
<td>Column Totals:</td>
<td>190 (A) 570 (B)</td>
</tr>
</tbody>
</table>

**Prevalence Index = B/A = 3**

**Hydrophytic Vegetation Indicators:**

- Yes Dominance Test is >50%
- Yes Prevalence Index is ≤3.0

**Morphological Adaptations** (Provide supporting data in Remarks or on a separate Problematic Hydrophytic Vegetation (Explain))

1 Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

#### Appendix H Page 120
<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
<th>Texture</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6</td>
<td>Sod</td>
<td></td>
<td>DME-16-008</td>
<td></td>
</tr>
<tr>
<td>6-26</td>
<td>Brown silty clay loam</td>
<td></td>
<td>No roots; DME-16-008</td>
<td></td>
</tr>
</tbody>
</table>

Hydric Soil Indicators:

<table>
<thead>
<tr>
<th>Type</th>
<th>Texture</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel</td>
<td>DME-16-008</td>
<td>Stantec Cultural Point Oct 2016</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>DME-16-008</td>
<td>Stantec Cultural Point Oct 2016</td>
</tr>
<tr>
<td>Thick Dark Surface</td>
<td>DME-16-008</td>
<td>Stantec Cultural Point Oct 2016</td>
</tr>
<tr>
<td>Alaska Gleyed</td>
<td>DME-16-008</td>
<td>Stantec Cultural Point Oct 2016</td>
</tr>
<tr>
<td>Alaska Redox</td>
<td>DME-16-008</td>
<td>Stantec Cultural Point Oct 2016</td>
</tr>
</tbody>
</table>

Restrictive Layer (if present):

<table>
<thead>
<tr>
<th>Type</th>
<th>Depth (inches)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permafrost</td>
<td>72</td>
<td>Oct 2016 Stantec Cultural Point DME-16-008 was used for soils. While Munsell colors were not identified, we interpreted 0-6 inches as being organics, 6-26 inches as being a layer of organic/mineral soil mix meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less, 'dense...roots' as organics). Saturation was noted at below 5 inches. As the site was sampled in October, we expect the organics to be saturated during June - August.</td>
</tr>
</tbody>
</table>

HYDROLOGY

Wetland Hydrology Indicators:

<table>
<thead>
<tr>
<th>Field Observations</th>
<th>Wetland Hydrology Present?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water</td>
<td>Yes x No</td>
</tr>
<tr>
<td>High Water Table</td>
<td>x</td>
</tr>
<tr>
<td>Sediment Deposits</td>
<td>x</td>
</tr>
<tr>
<td>Drift Deposits</td>
<td>x</td>
</tr>
<tr>
<td>Surface Soil Cracks</td>
<td>x</td>
</tr>
</tbody>
</table>

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The Oct 2016 Stantec Cultural Point DME-16-008 found 50-75% water saturation at 6 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.
Larger willows along northeast side of large lake at base of K-hill west
### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

- **Hydrophytic Vegetation Present?** Yes ☑ No ❌
- **Hydric Soil Present?** Yes ☑ No ❌
- **Wetland Hydrology Present?** Yes ☑ No ❌

**Remarks:**
Old channel and gravel bars with standing water adjacent to south. This point combines the soil information from an Oct 2016 cultural investigation with the site photos of vegetation during a Sept 2016 site visit, both conducted by Stantec. While wetlands data was not taken specifically, at this location we have determined that there was enough information from these investigations to inform the status of the site.

### VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECRENDING ORDER

#### Dominance Test worksheet:
- Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
- Total Number of Dominant Species Across All Strata: 2 (B)
- Percent of Dominant Species That Are OBL, FACW, or FAC: 1 (A/B)

#### Prevalence Index worksheet:
- Total % Cover of OBL species: 50 x 1 = 50
- Total % Cover of FACW species: 60 x 2 = 120
- Total % Cover of FAC species: 10 x 3 = 30
- Total % Cover of UPL species: 10 x 5 = 50
- Column Totals: 200 (A) 280 (B)
- Prevalence Index = B/A = 2.5455

#### Morphological Adaptations:
- Hydrophytic Vegetation Indicators:
  - Yes Dominance Test is >50%
  - Yes Prevalence Index is ≤3.0
  - Morphological Adaptations² (Provide supporting data in Remarks or on a separate sheet)
  - Problematic Hydrophytic Vegetation² (Explain)

#### Hydrophytic Vegetation Present?** Yes ☑ No ❌

**Remarks:**
Shrubs were present on the microtopographic 'highs'. Also unidentified grasses and sedges are present. VacVit and RhoTom were identified in cultural investigation notes. BetNan appears present in the background of the closeup photo.
SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-2</td>
<td>Moss</td>
<td>JAJ-16-048</td>
</tr>
<tr>
<td>2-4</td>
<td>Brown silty clay loam</td>
<td>JAJ-16-048</td>
</tr>
<tr>
<td>4-10</td>
<td>Gray clay no gravels</td>
<td>JAJ-16-048</td>
</tr>
</tbody>
</table>

1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. 2Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: Indicators for Problematic Hydric Soils:

-Histosol or Histel (A1)
-Histic Epipedon (A2)
-Hydrogen Sulfide (A4)
-Thick Dark Surface (A12)
-Alaska Gleyed (A13)
-Alaska Redox (A14)
-Alaska Gleyed Pores (A15)

-Indicates a layer with a distinctive color change (e.g., brown, gray, etc.).

Restrictive Layer (if present):

Type: Depth (inches): Remarks

Hydric Soil Present? Yes x No

Remarks: Soils information is taken from a Oct 2016 cultural resources investigation. 25-50% saturation was noted at 5-11". While Munsell colors were not identified, we interpreted a 2" layer of moss, at 2-4" a layer of saturated organics (primarily due to the 'dense roots') meeting the definition of a Histic Epipedon, and at 4-10" a layer of mineral soil meeting the definition of a Histic Epipedon ('grey' being chroma 2 or less). This interpretation has been boosted by the site photographs and our regional experience.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient):

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)

Secondary Indicators (2 or more required):

- Water-stained Leaves (B9)
- Drainage Patterns (B10)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Salt Deposits (C5)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No Depth (inches):
Water Table Present? Yes x No Depth (inches): ~5
Saturation Present? Yes x No Depth (inches): 5
(includes capillary fringe)

Wetland Hydrology Present? Yes x No

Remarks: The Oct 2016 cultural investigation notes 25-50% water saturation at 5-11 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 5 inch mark.

Appendix H Page 124
| Notes: | Old channel and gravel bars with standing water adjacent to south. P7 site vegetation (Low bush cranberry, Labrador tea) |

<table>
<thead>
<tr>
<th>South</th>
<th>North</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>Plant Closeup</td>
</tr>
</tbody>
</table>

| Hovering Over P7 (in field notes as HP14) |
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina
Borough/City: NW Arctic
Sampling Date: Sept/Oct 2016
Applicant/Owner: DOT&PF
Investigator(s): Stantec
Landform (hiltside, terrace, hummocks, etc): Flat transition of habitat
Local relief (concave, convex, none): Flat
Subregion: Western Brooks Range Mts Foothills
Lat: 67.76341
Long: -164.473383
Datum: NAD83
Soil Map Unit Name: Not Available
NWI classification: PSS1/EM1B
Vegetation, Soil, or Hydrology... (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes x No
Hydric Soil Present? Yes x No
Wetland Hydrology Present? Yes x No

Remarks: Edge of geomorphic change. Up raised on south side to less vegetated plateau, shrubs diminishing to the south grading to tussock/grassy. Point combines soil information from an Oct 2016 cultural investigation (point JAJ-16-009) with site photos of vegetation during a Sept 2016 site visit (P12), both conducted by Stantec. While wetlands data was not taken specifically, at this location we have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECRDING ORDER

<table>
<thead>
<tr>
<th>Tree Stratum</th>
<th>Number of Dominant Species</th>
<th>That Are OBL, FACW, or FAC: 1 (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cover:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50% of total cover:</td>
<td>0</td>
<td>20% of total cover: 0</td>
</tr>
<tr>
<td>Sapling/Shrub Stratum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Salix sp (unknown)</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>Betula nana</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Vaccinium uliginosum</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Rhododendron tomentosum</td>
<td>25</td>
</tr>
<tr>
<td>Total Cover:</td>
<td>155</td>
<td>77.5</td>
</tr>
<tr>
<td>50% of total cover:</td>
<td>0</td>
<td>20% of total cover: 0</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50% of total cover:</td>
<td>0</td>
<td>20% of total cover: 0</td>
</tr>
</tbody>
</table>

Hydrophytic Vegetation Indicators:
Yes Dominance Test is >50%
Yes Prevalence Index is ≤3.0
Morphological Adaptations (Provide supporting data in Remarks or on a separate page)
Problematic Hydrophytic Vegetation (Explain)
1 Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Domination Test worksheet:
Number of Dominant Species
That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species
That Are OBL, FACW, or FAC: 1 (A/B)

Prevalence Index worksheet:
Total % Cover of: Multiply by:
OBL species 0 x 1 = 0
FACW species 25 x 2 = 50
FAC species 130 x 3 = 390
FACU species 0 x 4 = 0
UPL species 0 x 5 = 0
Column Totals: 155 (A) 440 (B)
Prevalence Index = B/A = 2.8387

Hydrophytic Vegetation Present? Yes x No

Remarks: High shrubs are assumed to be willow species. Detailed photo examination also show BetNan, VacUli, and Labrador Tea. Herbs are present, but are too distant to identify, and do not appear to be FACU or UPL species.
SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-2</td>
<td>Sod</td>
<td></td>
</tr>
<tr>
<td>2-16</td>
<td>JAJ-16-009</td>
<td></td>
</tr>
</tbody>
</table>

Hydric Soil Indicators:

<table>
<thead>
<tr>
<th>Primary Indicators (any one indicator is sufficient)</th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>x Histic Epipedon (A2)</td>
<td>x Drainage Patterns (B10)</td>
</tr>
<tr>
<td>Hydrogen Sulfide (A4)</td>
<td>x Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Thick Dark Surface (A12)</td>
<td>x Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Alaska Gleyed (A13)</td>
<td>x Salt Deposits (C5)</td>
</tr>
<tr>
<td>Alaska Redox (A14)</td>
<td>x Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Alaska Gleyed Pores (A15)</td>
<td>x FAC-Neutral Test (D5)</td>
</tr>
</tbody>
</table>

Restrictive Layer (if present):

<table>
<thead>
<tr>
<th>Type:</th>
<th>Permafrost</th>
<th>Depth (Inches):</th>
<th>Hydric Soil Present?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks: Soils information is taken from a Oct 2016 cultural resources investigation. 50-75% saturation was noted at 2 to 16 inches in Oct. While Munsell colors were not identified, we interpreted there to be a 2 inch layer of organics, which is probably saturated during the growing season. At 5-40 inches a mixture of organics (due to the 'dense roots') and mineral loam. We assume this meets the definition of a Histic Epipedon, ('brown' being chroma 2 or less). This interpretation has been boosted by the site photographs.

HYDROLOGY

Wetland Hydrology Indicators:

<table>
<thead>
<tr>
<th>Field Observations:</th>
<th>Wetland Hydrology Present?</th>
<th>Yes</th>
<th>x</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water Present?</td>
<td>Yes</td>
<td>No</td>
<td>x</td>
<td>Depth (inches):</td>
</tr>
<tr>
<td>Water Table Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
<td>Depth (inches):</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
<td>Depth (inches):</td>
</tr>
</tbody>
</table>

Remarks: The Oct 2016 cultural investigation notes 50-75% water saturation at 2-16 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 5 inch mark. We also note microtopo relief and drainage patterns in the "South" site photos.
<table>
<thead>
<tr>
<th>Notes:</th>
<th>Edge of geomorphic change. Up raised on south side to less vegetated plateau, shrubs diminishing to the south grading to tussock/grassy.</th>
</tr>
</thead>
</table>

![Looking North](image1)

![Looking East](image2)

![Looking South](image3)

![Looking West](image4)
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina  
Borough/City: NW Arctic  
Sampling Date: Sept/Oct 2016

Applicant/Owner: DOT&PF  
Investigator(s): Stantec  
Local relief (concave, convex, none): Convex  
Subregion: Western Brooks Range Mts Foothills

Landform (hillside, terrace, hummocks, etc): Terrace above wetter area  
Slope (%): 0  
Latitude: 67.755301  
Longitude: -164.477827  
Datum: NAD83  
Soil Map Unit Name: Not Available  
NWI classification: PSS1/EM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No  
If no, explain in Remarks.

Are Vegetation, Soil, or Hydrology significantly disturbed? Are “Normal Circumstances” present? Yes x No  
If needed, explain any answers in Remarks.

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes x No  
Wetland Hydrology Present? Yes x No  
Remarks: Edge of second side channel to east. Standing ponds chain. Flat elevated tundra between two side channels. Point combines soil information (from an Oct 2016 cultural investigation and a March/April 2015 Golder geotechnical investigation) with site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. While wetlands data was not taken specifically, at this location we have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECENDING ORDER

<table>
<thead>
<tr>
<th>Tree Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>3</td>
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<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sapling/Shrub Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 rhodolom</td>
<td>Rhododendron tomentosum</td>
<td>75</td>
<td>YES FACW</td>
<td></td>
</tr>
<tr>
<td>2 vacvit</td>
<td>Vaccinium vitis-idaea</td>
<td>75</td>
<td>YES FAC</td>
<td></td>
</tr>
<tr>
<td>3 salsp</td>
<td>Salix sp (unknown species)</td>
<td>50</td>
<td>YES FAC</td>
<td></td>
</tr>
<tr>
<td>4 betnan</td>
<td>Betula nana</td>
<td>10</td>
<td>NO FAC</td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Herb Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ervivag</td>
<td>Eriophorum vaginatum</td>
<td>2</td>
<td>YES FACW</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
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<td></td>
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<td>4</td>
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<td>7</td>
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<td>9</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% of total cover:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plot size (radius, or length x width)  
% Bare Ground  
% Cover of Wetland Bryophytes  
Total Cover of Bryophytes

Hydrophytic Vegetation Present? Yes x No  
Remarks: Shrub species are present throughout the site photos. Small numbers of EnVag seed heads are visible. There is apparent dense shrub cover, which appears to be RhoTom/VacVit or similar.

Appendix H Page 129
**SOIL**

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-25</td>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frozen, brown</td>
<td></td>
</tr>
</tbody>
</table>

1 Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. 2 Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel (A1)</td>
<td>Alaska Color Change (TA4)</td>
<td>Alaska Gleyed Without Hue 5Y or Redder</td>
</tr>
<tr>
<td>x Histic Epipedon (A2)</td>
<td>Alaska Alpine Swales (TA5)</td>
<td>Underlying Layer</td>
</tr>
<tr>
<td>Hydrogen Sulfide (A4)</td>
<td>Alaska Redox With 2.5Y Hue</td>
<td>Other (Explain in Remarks)</td>
</tr>
<tr>
<td>Thick Dark Surface (A12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska Gleyed (A13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska Redox (A14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska Gleyed Pores (A15)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed.

**Restrictive Layer (if present):**

<table>
<thead>
<tr>
<th>Type</th>
<th>Permafrost</th>
<th>Hydric Soil Present?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth (inches):</td>
<td>25</td>
<td>Yes [X] No</td>
</tr>
</tbody>
</table>

**Remarks:** Oct 2016 Stantec Cultural Point DME-16-023 and a March/April 2015 Golder geotechnical investigation was used for soils (point K15-13). While Munsell colors were not identified, we interpreted 0-4 inches as being organics, 4-25 inches as being a layer of mineral soil meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less). Saturation was noted at 4 inches and below. As the site was sampled in October, we expect the organics to be saturated during June - August.

**HYDROLOGY**

**Wetland Hydrology Indicators:**

<table>
<thead>
<tr>
<th></th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>x High Water Table (A2)</td>
<td>Sparsely Vegetated Concave Surface (B8)</td>
</tr>
<tr>
<td>x Saturation (A3)</td>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Hydrogen Sulfide Odor (C1)</td>
<td>Salt Deposits (C5)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
<td>Dry-Season Water Table (C2)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
<td>Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
<td>Geomorphic Position (D2)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
<td>Shallow Aquitard (D3)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
<td>x Microtopographic Relief (D4)</td>
</tr>
</tbody>
</table>

**Field Observations:**

| Surface Water Present? | Yes [X] No |
| Water Table Present? | Yes [X] No |
| Saturation Present? | Yes [X] No |
| (includes capillary fringe) |

**Wetland Hydrology Present?**

|  | Yes | No |

**Remarks:** The Oct 2016 Stantec Cultural Point DME-16-023 found 75-100% water saturation at 4 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 4 inch mark during June - August.

Appendix H Page 130
<table>
<thead>
<tr>
<th>Notes:</th>
<th>Edge of second side channel to east. Standing ponds chain. Flat elevated tundra between two side channels perpendicular to curved lake forming North end.</th>
</tr>
</thead>
</table>

Looking North

Looking East

Looking South

Looking West
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina  
Borough/City: NW Arctic  
Sampling Date: Sept/Oct 2016

Applicant/Owner: DOT&PF  
Investigator(s): Stantec  
Local relief (concave, convex, none): Concave  
Subregion: Western Brooks Range Mt Foothills

Landform (hillside, terrace, hummocks, etc): Flat  
Slope (%): 0  
Lat: 67.774894  
Long: -164.422309  
Datum: NAD83

Soil Map Unit Name: Not Available  
NWI classification: PSS1J

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? Are 'Normal Circumstances' present? Yes x No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes x No

Hydric Soil Present? Yes x No

Wetland Hydrology Present? Yes x No

Remarks: This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site. Our hypothesis is that these riverine wetlands experience regular flooding during spring highwater. This would provide the wetland hydrology, and the scouring force to prevent a dense herb layer.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESEASONING ORDER

<table>
<thead>
<tr>
<th>Tree Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>75</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td></td>
<td>Total Cover:</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50% of total cover:</td>
<td>0</td>
<td>20% of total cover:</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sapling/Shrub Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 salsp Salix sp (unknown species)</td>
<td>75</td>
<td>YES</td>
<td>FAC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>3</td>
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<td>4</td>
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<tr>
<td>6</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cover:</td>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50% of total cover:</td>
<td>37.5</td>
<td>20% of total cover:</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Herb Stratum</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td>9</td>
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</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cover: 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50% of total cover:</td>
<td>0</td>
<td>20% of total cover:</td>
</tr>
</tbody>
</table>

Plot size (radius, or length x width) % Bare Ground % Cover of Wetland Bryophytes Total Cover of Bryophytes

Remarks: The vegetation consists of tall unidentified willow species. Some unidentified grasses are present in the herb layer. Our hypothesis is that these riverine wetlands experience regular flooding during spring highwater. This would provide the wetland hydrology, and the scouring force to prevent a dense herb layer.
### SOIL

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hydric Soil Indicators:**

- Histosol or Histel (A1)
- Histic Epipedon (A2)
- Hydrogen Sulfide (A4)
- Thick Dark Surface (A12)
- Alaska Gleyed (A13)
- Alaska Redox (A14)
- Alaska Gleyed Pores (A15)

**Restrictive Layer (if present):**

<table>
<thead>
<tr>
<th>Type:</th>
<th>Depth (Inches):</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hydric Soil Present?**

- **Yes**
- **No**

**Remarks:** Oct 2016 Stantec Cultural Point JAJ-16-013 was used for soils. While Munsell colors were not identified, we interpreted 0-2 inches as being organics, 2-16 inches as being a layer of organic/mineral soil mix meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less). We interpreted ‘dense...roots’ as being evidence of organics. Saturation was noted at below 2 inches. As the site was sampled in October, we expect the organics to be saturated during June - August.

### HYDROLOGY

**Watertable Hydrology Indicators:**

<table>
<thead>
<tr>
<th>Primary Indicators (any one indicator is sufficient)</th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>x High Water Table (A2)</td>
<td>x Drainage Patterns (B10)</td>
</tr>
<tr>
<td>x Saturation (A3)</td>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
<td>Salt Deposits (C5)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
<td>Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
<td>Geomorphic Position (D2)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
<td>Shallow Aquitard (D3)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
<td>Microtopographic Relief (D4)</td>
</tr>
<tr>
<td></td>
<td>FAC-Neutral Test (D5)</td>
</tr>
</tbody>
</table>

**Field Observations:**

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes</th>
<th>No</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
</tr>
</tbody>
</table>

**Field Observations (includes capillary fringe):**

- **Depth (inches):**
  - 2
  - 8

**Wetland Hydrology Present?**

- **Yes**
- **x**
- **No**

**Remarks:** Oct 2016 Stantec Cultural Point DME-16-013 found 25-50% water saturation at 2". No note of a water table, this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8" mark during June-Aug. It is also important to review the secondary characteristics of this site. We find that this site likely experiences seasonal flooding during spring highwater (note lack of dense herb layer, indicating scouring).
<table>
<thead>
<tr>
<th>Notes</th>
<th>Ground vegetation at P16 (sedge and moss). Water slough from Wulik River. Tapers off 500 ft. to east</th>
</tr>
</thead>
</table>

Looking North

Looking East

Looking South

Looking West
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina  
Borough/City: NW Arctic  
Sampling Date: Sept/Oct 2016

Applicant/Owner: DOT&PF  
Investigator(s): Stantec  
Local relief (concave, convex, none): Concave  
Subregion: Western Brooks Range Mts Foothills

Sampling Point: P20  
Landform (hillside, terrace, hummocks, etc): Tundra  
Slope (%): 0  
NWI classification: PSS1/EM1B

Soil Map Unit Name: Not Available  
Datum: NAD83  
Lat: 67.762042  
Long: -164.422233

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology naturally problematic? Are “Normal Circumstances” present? Yes No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes No  
Hydric Soil Present? Yes No  
Wetland Hydrology Present? Yes No  
Is the Sampled Area within a Wetland? Yes x No

Remarks: Largest gravel material site along Wulik River. Little bit higher ground - no standing water. Soil probe sample saturated. Low areas saturated at surface, sedges, moss covered surface, 20% grass, 30% moss. This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESCENDING ORDER

<table>
<thead>
<tr>
<th>3/3 Abbrev.</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tree stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover: 0</td>
<td>50% of total cover: 0</td>
<td>20% of total cover: 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 sapling/shrub stratum</td>
<td>Salix, Unidentified</td>
<td>50</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td>Vaccinium vitis-idaea</td>
<td>5</td>
<td>NO</td>
<td>FAC</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td>5</td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>55</td>
<td>50% of total cover: 27.5</td>
<td>20% of total cover: 11</td>
<td></td>
</tr>
<tr>
<td>1 herb stratum</td>
<td>Grass, Unidentified</td>
<td>20</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td>Sedge, Unidentified</td>
<td>20</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
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<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>40</td>
<td>50% of total cover: 20</td>
<td>20% of total cover: 8</td>
<td></td>
</tr>
</tbody>
</table>

Hydrophytic Vegetation Present? Yes x No

Remarks:

Appendix H Page 135
SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hydric Soil Indicators:

Indicators for Problematic Hydric Soils:
- Histosol or Histel (A1)
- Alaska Color Change (TA4)\(^1\)
- Alaska Gleyed Without Hue 5Y or Redder
- Underlying Layer
- Alaska Redox With 2.5Y Hue
- Other (Explain in Remarks)

Restrictive Layer (if present):

Type: Permafrost
Depth (inches): 10

Remarks: Oct 2016 Stantec Cultural Point JAJ-16-46. While Munsell colors were not identified, we interpreted 0-2" as moss/organics, 2-3" as organic/mineral soil mix meeting the definition of a Histic Epipedon ('brown' being interpreted as chroma 2 or less). We interpreted 'dense...roots' as being evidence of organics. 3-10" as clay without organics. 50-75% saturation was noted at 2". As the site was sampled in Oct. we expect saturated organics during June-Aug.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient):
- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)

Secondary Indicators (2 or more required):
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Other (Explain in Remarks)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- Microtopographic Relief (D4)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes x No
Water Table Present? Yes x No
Saturation Present? Yes x No

Wetland Hydrology Present? Yes x No

Field Observations:

Surface Water Present? Yes x No
Water Table Present? Yes x No
Saturation Present? Yes x No

Remarks: The Oct 2016 Stantec Cultural Point JAJ-16-46 found 50-75% water saturation at 2 inches. The Stantec 9/15/17 field visit notes saturation at the surface. In our experience in the region, saturation of this degree probably means the water table is above or near the 8 inch mark. Micro relief is evident, and we believe the permafrost is present above 24" during the growing season, and able to perch water to within 12 inches.
Largest gravel material site along Wulik River. Little bit higher ground - no standing water. Soil probe sample saturated. Low areas saturated at surface, sedges, moss covered surface, 20% grass, 30% moss
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina  
Borough/City: NW Arctic  
Sampling Date: Sept/Oct 2016

Applicant/Owner: DOT&PF  
Investigator(s): Stantec  
Local relief (concave, convex, none): Convex  
Landform (hillside, terrace, hummocks, etc): Terrace  
Subregion: Western Brooks Range Mts Foothills  
Long: -164.406934  
Datum: NAD83

Soil Map Unit Name: Not Available  
NWI classification: PSS1/EM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  
If no, explain in Remarks.

Are Vegetation, Soil, or Hydrology significantly disturbed? Yes  No  
Are “Normal Circumstances” present? Yes  No  
Are Vegetation, Soil, or Hydrology naturally problematic? Yes  No  
(If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes  No  
Hydric Soil Present? Yes  No  
Wetland Hydrology Present? Yes  No  

Remarks: Just south of cluster of 3 ponds. Elevated to north of ponds, on edge of elevated ridge that wraps to the east of the ponds. This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECDING ORDER

<table>
<thead>
<tr>
<th>3/3 Abbrev.</th>
<th>Species Name</th>
<th>Absolute</th>
<th>Dominant</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% Cover</td>
<td>Species</td>
<td>Status</td>
</tr>
<tr>
<td>Tree Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td></td>
<td></td>
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<td>3</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>0</td>
<td>0</td>
<td>20% of total cover: 0</td>
<td></td>
</tr>
<tr>
<td>Herb Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>4</td>
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<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>70</td>
<td>35</td>
<td>20% of total cover: 14</td>
<td></td>
</tr>
<tr>
<td>Sapling/Shrub Stratum</td>
<td>Rhododendron tomentosum</td>
<td>50</td>
<td>YES</td>
<td>FACW</td>
</tr>
<tr>
<td>1</td>
<td>Vacuillum uliginosum</td>
<td>10</td>
<td>NO</td>
<td>FAC</td>
</tr>
<tr>
<td>3</td>
<td>Salix Unidentified</td>
<td>5</td>
<td>NO</td>
<td>FAC</td>
</tr>
<tr>
<td>4</td>
<td>Arctous ruber</td>
<td>5</td>
<td>NO</td>
<td>FAC</td>
</tr>
</tbody>
</table>
| Prevalence Index worksheet:  
Total % Cover of:  
 Multiply by:  
OBL species 0  x 1 = 0  
FACW species 50  x 2 = 100  
FAC species 20  x 3 = 60  
FACU species 0  x 4 = 0  
UPL species 0  x 5 = 0  
Column Totals: 70  (A) 160  (B)  
Prevalence Index = B/A = 2.2857

Hydrophytic Vegetation Indicators:  
Yes Dominance Test is >50%  
Yes Prevalence Index is ≤3.0  
Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate separate  
Problematic Hydrophytic Vegetation¹ (Explain)

¹ Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes  No  

Remarks: The point is taken on a slight convex rise. It primarily consists of grass/sedge (unid) and low shrubs, with a few scattered moderate height willow. Grass tussocks are evident in regular patterns.
### Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-2</td>
<td>Sod</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12</td>
<td>Org</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains.  
<sup>2</sup>Location: PL=Pore Lining, M=Matrix.

### Hydric Soil Indicators:

<table>
<thead>
<tr>
<th>Hydric Soil Indicators:</th>
<th>Indicators for Problematic Hydric Soils&lt;sup&gt;3&lt;/sup&gt;:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel (A1)</td>
<td>Alaska Color Change (TA4)&lt;sup&gt;4&lt;/sup&gt; Alaska Gleyed Without Hue 5Y or Redder</td>
</tr>
<tr>
<td>x Histic Epipedon (A2)</td>
<td>Alaska Alpine Swales (TA5) Underlying Layer</td>
</tr>
<tr>
<td>Hydrogen Sulfide (A4)</td>
<td>Alaska Redox With 2.5Y Hue Other (Explain in Remarks)</td>
</tr>
<tr>
<td>Thick Dark Surface (A12)</td>
<td></td>
</tr>
<tr>
<td>Alaska Gleyed (A13)</td>
<td></td>
</tr>
<tr>
<td>Alaska Redox (A14)</td>
<td></td>
</tr>
<tr>
<td>Alaska Gleyed Pores (A15)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>3</sup>One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed 
<sup>4</sup>Give details of color change in Remarks.

### Restrictive Layer (if present):

<table>
<thead>
<tr>
<th>Type:</th>
<th>Depth (Inches):</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

### Remarks:

Oct 2016 Stantec Cultural Point JAJ-16-020 25-50% water saturation at 2 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.

### Hydrology

#### Wetland Hydrology Indicators:

<table>
<thead>
<tr>
<th>Primary Indicators (any one indicator is sufficient)</th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>High Water Table (A2)</td>
<td>Drainage Patterns (B10)</td>
</tr>
<tr>
<td>x Saturation (A3)</td>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
<td>Salt Deposits (C5)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
<td>Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
<td>Geomorphic Position (D2)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
<td>Shallow Aquitard (D3)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
<td>x Microtopographic Relief (D4)</td>
</tr>
<tr>
<td></td>
<td>FAC-Neutral Test (D5)</td>
</tr>
</tbody>
</table>

#### Field Observations:

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes</th>
<th>No</th>
<th>x</th>
<th>Depth (inches):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
<td>Depth (inches):</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
<td>Depth (inches):</td>
</tr>
</tbody>
</table>

(includes capillary fringe)

#### Wetland Hydrology Present? | Yes | x | No |

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: The Oct 2016 Stantec Cultural Point JAJ-16-020 25-50% water saturation at 2 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.
Just south of cluster of 3 ponds. Elevated to north of ponds, on edge of elevated ridge that wraps to the east of the ponds.
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina
Borough/City: NW Arctic
Sampling Date: Sept/Oct 2016
Applicant/Owner: DOT&PF
Investigator(s): Stantec
Local relief (concave, convex, none): Flat
Subregion: Western Brooks Range Mts Foothills
Soil Map Unit Name: Not Available
NWI classification: PEM1/SS1C
Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No
(If no, explain in Remarks.)
Are Vegetation _, Soil _, or Hydrology significantly disturbed? _ Are ‘Normal Circumstances’ present? Yes x No
(If needed, explain any answers in Remarks.)
SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes x No
Hydric Soil Present? Yes x No
Wetland Hydrology Present? Yes x No

Remarks: Standing water at surface in current location. Sporadic shrubs, seeding grasses/sedges. This point combines the soil information (from an Oct 2016 cultural investigation and a March/April 2015 Golder geotechnical investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESEASONING ORDER

<table>
<thead>
<tr>
<th>Tree Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cover: 0</td>
<td>50% of total cover: 0</td>
<td>20% of total cover: 0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sapling/Shrub Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Salix Unidentified</td>
<td>50</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td>Eriophorum vaginatum</td>
<td>5</td>
<td>NO</td>
<td>FACW</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>FACU</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>Total Cover: 50</td>
<td>50% of total cover: 25</td>
<td>20% of total cover: 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Herb Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carex sp (unidentified)</td>
<td>100</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td>Eriophorum vaginatum</td>
<td>5</td>
<td>NO</td>
<td>FACW</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>FACU</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>FAC</td>
</tr>
<tr>
<td>Total Cover: 105</td>
<td>50% of total cover: 52.5</td>
<td>20% of total cover: 21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plot size (radius, or length x width) | % Bare Ground | % Cover of Wetland Bryophytes | Total Cover of Bryophytes |
-------------------------------------|---------------|-----------------------------|--------------------------|

Remarks: The vegetation consists primarily of sedges and grasses, with some interspersed willows. Cottongrass is evident, and standing water was reported. While identifying specific species is difficult, indicators are likely to be FAC or wetter.
## SOIL

### Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hydric Soil Indicators:**

- **Histosol or Histel (A1)**: Alaska Color Change (TA4)<sup>4</sup>
- **Hydrogen Sulfide (A4)**: Alaska Redox With 2.5Y Hue
- **Thick Dark Surface (A12)**
- **Alaska Gleyed (A13)**
- **Alaska Redox (A14)**
- **Alaska Gleyed Pores (A15)**

<sup>4</sup>Give details of color change in Remarks.

**Restrictive Layer (if present):**

- **Type:** None
- **Depth (Inches):** None

**Remarks:** Oct 2016 Stantec Cultural Point JAJ-16-30 and March/April 2015 Golder geotechnical investigation was used for soils (point K15-21). While Munsell colors were not identified, we interpreted 0-2” as organics, 2-12” as a layer of organic/mineral soil mix meeting the definition of a Histic Epipedon (‘brown’ being chroma 2 or less, ‘dense...roots’ as being organics). Saturation was noted at below 2 inches. As the site was sampled in October, we expect the organics to be saturated during June – August.

### HYDROLOGY

#### Wetland Hydrology Indicators:

- **Surface Water Present?** Yes x No
- **Water Table Present?** Yes x No
- **Saturation Present?** Yes x No

**Remarks:** The Sept site visit notes standing water. The Oct 2016 Stantec Cultural Point JAJ-16-30 found 75-100% water saturation at 2 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.
| Notes: | Dry surface conditions from upper edge of last feature to current location. Short pond ~500 ft to south. Standing water at surface in current location. Sporadic shrubs, seeding grasses/sedges. |

**Looking North**

**Looking East**

**Looking South**

**Looking West**
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina  Borough/City: NW Arctic  Sampling Date: Sept/Oct 2016
Applicant/Owner: Stantec  DOT&PF  Investigator(s): Stantec
Local relief (concave, convex, none): Flat  Landform (hillside, terrace, hummocks, etc): Meadow
Soil Map Unit Name: Not Available  NIW classification: PSS1/EM1E

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology significantly disturbed? Are ‘Normal Circumstances’ present? Yes x No (If needed, explain any answers in Remarks.)
Are Vegetation ____ , Soil ____ , or Hydrology ____ naturally problematic?  (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes x No  Is the Sampled Area within a Wetland? Yes x No
Hydric Soil Present? Yes x No  Wetland Hydrology Present? Yes x No

Remarks: Standing water with small open water areas. Base of medium sized elongated rise. Hydrologically connected to pond, near by sedges and taller grasses. This point combines the soil information (from an Oct 2016 cultural investigation and a March/April 2015 Golder geotechnical investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECENDING ORDER

<table>
<thead>
<tr>
<th>3/3 Abbrev.</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td></td>
<td></td>
<td></td>
<td>50% of total cover: 0 20% of total cover: 0</td>
</tr>
</tbody>
</table>

| Sapling/Shrub Stratum |              |                 |                   |                 |
| 1           |              |                 |                   |                 |
| 2           |              |                 |                   |                 |
| 3           |              |                 |                   |                 |
| 4           |              |                 |                   |                 |
| 5           |              |                 |                   |                 |
| 6           |              |                 |                   |                 |
| Total Cover: |              |                 |                   | 50% of total cover: 0 20% of total cover: 0 |

| Herb Stratum |              |                 |                   |                 |
| 1           | Carex sp (unidentified) | 100 | YES | FACW |
| 2           |              |                 |                   |                 |
| 3           |              |                 |                   |                 |
| 4           |              |                 |                   |                 |
| 5           |              |                 |                   |                 |
| 6           |              |                 |                   |                 |
| 7           |              |                 |                   |                 |
| 8           |              |                 |                   |                 |
| 9           |              |                 |                   |                 |
| 10          |              |                 |                   |                 |
| Total Cover: |              |                 |                   | 100 50% of total cover: 50 20% of total cover: 20 |

Plot size (radius, or length x width) % Bare Ground % Cover of Wetland Bryophytes Total Cover of Bryophytes

Remarks: The site has standing water and sedge monoculture. While the specific species is not evident, it is likely to be FACW or OBL.

Appendix H Page 144
## Soil Profile Description

(Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
<th>Texture</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Sod</td>
<td>JAJ-16-006</td>
<td>Silty clay loam</td>
<td>Fine to small roots JAJ-16-006 is the Stantec Cultural Point</td>
</tr>
<tr>
<td>2-21</td>
<td>Brown, no gravels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-18</td>
<td>Frozen, dark grayish brown</td>
<td>Organic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-84</td>
<td>Frozen peat</td>
<td>ORGANIC SILT 40-50% Ice; Golder K15-15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. Location: PL=Pore Lining, M=Matrix.

## Hydric Soil Indicators

<table>
<thead>
<tr>
<th>Indicators for Problematic Hydric Soils:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel (A1)</td>
</tr>
<tr>
<td>x Histic Epipedon (A2)</td>
</tr>
<tr>
<td>Hydrogen Sulfide (A4)</td>
</tr>
<tr>
<td>Thick Dark Surface (A12)</td>
</tr>
<tr>
<td>Alaska Gleyed (A13)</td>
</tr>
<tr>
<td>Alaska Redox (A14)</td>
</tr>
<tr>
<td>Alaska Gleyed Pores (A15)</td>
</tr>
</tbody>
</table>

1One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed

## Restrictive Layer (if present):

<table>
<thead>
<tr>
<th>Type</th>
<th>Depth (Inches):</th>
<th>Remarks</th>
</tr>
</thead>
</table>

Golder found peat/organics from 0-18", Oct 2016 Stantec Cultural Point JAJ-16-006 and March/April 2015 Golder geotechnical investigation was used for soils (point K-15-15). While Munsell colors were not identified, we interpreted 0-2" as organics, 2-21" as organics (roots) and a layer of mineral soil meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less). Saturation was noted at below 2".

## Hydric Soil Present?

Yes x No

## HYDROLOGY

### Wetland Hydrology Indicators:

<table>
<thead>
<tr>
<th>Primary Indicators (any one indicator is sufficient)</th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>x Surface Water (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>x High Water Table (A2)</td>
<td>Drainage Patterns (B10)</td>
</tr>
<tr>
<td>x Saturation (A3)</td>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
<td>Salt Deposits (C5)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
<td>Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
<td>Geomorphic Position (D2)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
<td>Shallow Aquitard (D3)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
<td>Microtopographic Relief (D4)</td>
</tr>
<tr>
<td></td>
<td>FAC-Neutral Test (D5)</td>
</tr>
</tbody>
</table>

## Field Observations:

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes x No</th>
<th>Depth (inches): 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes x No</td>
<td>Depth (inches): 0</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes x No</td>
<td>Depth (inches): 0</td>
</tr>
</tbody>
</table>

(includes capillary fringe)

## Wetland Hydrology Present?

Yes x No

## Remarks:

The Oct 2016 Stantec Cultural Point JAJ-16-006 found 25-50% saturation at 2 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. The Sept site visit found standing water.
Standing water with small open water areas. Base of medium sized elongated rise. Hydrologically connected to pond, near by sedges and taller grasses.
### WETLAND DETERMINATION DATA FORM - Alaska Region

<table>
<thead>
<tr>
<th>Project/Site:</th>
<th>Kivalina</th>
<th>Borough/City:</th>
<th>NW Arctic</th>
<th>Sampling Date:</th>
<th>Sept/Oct 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicant/Owner:</td>
<td>DOT&amp;PF</td>
<td>Investigator(s):</td>
<td>Stantec</td>
<td>Local relief (concave, convex, none):</td>
<td>Slope</td>
</tr>
<tr>
<td>Landform (hillside, terrace, hummocks, etc)</td>
<td>Hillside</td>
<td>Subregion:</td>
<td>Western Brooks Range Mts Foothills</td>
<td>Latitude:</td>
<td>67.77329</td>
</tr>
<tr>
<td>Longitude:</td>
<td>164.47876</td>
<td>Datum:</td>
<td>NAD83</td>
<td>Soil Map Unit Name:</td>
<td>Not Available</td>
</tr>
<tr>
<td>NWI classification:</td>
<td>PSS1/EM1C</td>
<td>Are climatic / hydrologic conditions on the site typical for this time of year?</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Are Vegetation, Soil, or Hydrology significantly disturbed?</td>
<td>Are ‘Normal Circumstances’ present?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are Vegetation, Soil, or Hydrology naturally problematic?</td>
<td>Remarks</td>
<td>Drainage feature towards lake. This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

<table>
<thead>
<tr>
<th>Hydrophytic Vegetation Present?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland Hydrology Present?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESCENDING ORDER

<table>
<thead>
<tr>
<th>3/3 Abbrev.</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>0</td>
<td>50% of total cover:</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sapling/Shrub Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Vaccinium uliginosum</td>
<td>75</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td>Salix sp (unidentified)</td>
<td>50</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>3</td>
<td>Vaccinium vitis-idaea</td>
<td>40</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>4</td>
<td>Rhododendron tomentosum</td>
<td>10</td>
<td>NO</td>
<td>FACW</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>175</td>
<td>50% of total cover:</td>
<td>87.5</td>
<td></td>
</tr>
<tr>
<td>Herb Stratum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Unidentified Grass</td>
<td>5</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td>5</td>
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<td>6</td>
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<td>8</td>
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<tr>
<td>9</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cover:</td>
<td>5</td>
<td>50% of total cover:</td>
<td>2.5</td>
<td></td>
</tr>
</tbody>
</table>

### Dominance Test worksheet:

- Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A) |
- Total Number of Dominant Species Across All Strata: 4 (B) |
- Percent of Dominant Species That Are OBL, FACW, or FAC: 1 (A/B) |

### Prevalence Index worksheet:

- Total % Cover of OBL species x 1 = 0 |
- Total % Cover of FACW species x 2 = 20 |
- Total % Cover of FAC species x 3 = 510 |
- Total % Cover of UPL species x 5 = 0 |
- Column Totals: 180 (A) = 530 (B) |
- Prevalence Index = B/A = 2.9444 |

### Hydrophytic Vegetation Indicators:

- Yes Dominance Test is >50% |
- Yes Prevalence Index is ≤3.0 |
- Morphological Adaptations | Provide supporting data in Remarks or on a separate paper |
- Problematic Hydrophytic Vegetation | (Explain) |

### Remarks:

- A shrub sloping hillside, with dense layers of VacVit and VacUli, and a covering chest high layer of willows.
SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>Sod</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-16</td>
<td></td>
<td>Brown/grey clay silty</td>
<td></td>
</tr>
</tbody>
</table>

Hydric Soil Indicators:

- Histosol or Histel (A1)
- Alaska Color Change (TA4)
- Alaska Gleyed Without Hue 5Y or Redder
- Histic Epipedon (A2)
- Alaska Alpine Swales (TAS)
- Underlying Layer
- Hydrogen Sulfide (A4)
- Alaska Redox With 2.5Y Hue
- Other (Explain in Remarks)
- Thick Dark Surface (A12)
- Alaska Gleyed (A13)
- Alaska Redox (A14)
- Alaska Gleyed Pores (A15)

Restrictive Layer (if present):

Type: None
Depth (inches):

Remarks: Oct 2016 Stantec Cultural Point JAJ-16-016 was used for soils. While Munsell colors were not identified, we interpreted 0-2" as organics, 2-16" as a layer of organic/mineral soil mix meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less, 'few...roots' as organics). Saturation was noted at below 2". As the site was sampled in October, we expect the organics to be saturated during June – August. Shallow organic layers for histic epipedons are common in Arctic Regions.

Hydrology

Wetland Hydrology Indicators:

- Surface Water (A1)
- Inundation Visible on Aerial Imagery (B7)
- High Water Table (A2)
- Sparsely Vegetated Concave Surface (B8)
- Saturation (A3)
- Marl Deposits (B15)
- Water Marks (B1)
- Hydrogen Sulfide Odor (C1)
- Sediment Deposits (B2)
- Dry-Season Water Table (C2)
- Drift Deposits (B3)
- Other (Explain in Remarks)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)

Field Observations:

- Surface Water Present? Yes x No
- Water Table Present? Yes x No
- Saturation Present? Yes x No

Remarks: The Oct 2016 Stantec Cultural Point JAJ-16-016 found 25-50% water saturation at 2 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.
Drainage feature towards lake. Mid chest high shrub, with a mixture of low shrub and emergent vegetation. Slight microtopographic relief evident.
WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Kivalina
Borough/City: NW Arctic
Sampling Date: Sept/Oct 2016
Applicant/Owner: DOT&PF
Sampling Point: P56
Investigator(s): Stantec
Local relief (concave, convex, none): Concave
Subregion: Upper Kobuk, Koyukuk Hills and Val
Lat: 67.754557 Long: -164.562484 Datum: NAD83
Soil Map Unit Name: Not Available
NW Arctic
Are climatic / hydrologic conditions on the site typical for this time of year? Yes No
Are Vegetation, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No
Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes No
Hydric Soil Present? Yes No
Wetland Hydrology Present? Yes No

Remarks: Slight rise near shoreline. Location where north/central proposed route would cross lagoon. Small section is slightly drier than surrounding, but is still a wetland. This point combines the soil information (from an Oct 2016 cultural investigation) with the site photos of vegetation during a Sept 2016 site visit, conducted by Stantec. We have determined that there was enough information from these investigations to inform the status of the site.

VEGETATION – Use scientific names of plants. List all species in the plot. MUST LIST COVER IN DESECDENDING ORDER

<table>
<thead>
<tr>
<th>Tree Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 vaculi</td>
<td>Vaccinium uliginosum</td>
<td>80</td>
<td>YES</td>
<td>FAC</td>
</tr>
<tr>
<td>2 rhotom</td>
<td>Rhododendron tomentosum</td>
<td>75</td>
<td>YES</td>
<td>FACW</td>
</tr>
<tr>
<td>3 Salix sp (Unidentified)</td>
<td>10</td>
<td>NO</td>
<td>FAC</td>
<td></td>
</tr>
<tr>
<td>Total Cover: 0</td>
<td>50% of total cover: 0</td>
<td>20% of total cover: 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sapling/Shrub Stratum</th>
<th>Species Name</th>
<th>Absolute % Cover</th>
<th>Dominant Species?</th>
<th>Indicator Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Grass, Unidentified</td>
<td>5</td>
<td>YES</td>
<td>FAC</td>
<td></td>
</tr>
<tr>
<td>Total Cover: 5</td>
<td>50% of total cover: 2.5</td>
<td>20% of total cover: 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hydrophytic Vegetation Indicators:
Yes Dominance Test is >50%
Yes Prevalence Index is ≤3.0
Morphological Adaptations
Supporting data in Remarks or on a separate
Problematic Hydrophytic Vegetation

Hydrophytic Vegetation Present? Yes No

Appendix H Page 150
SOIL Sampling Point: P56

**Profile Description:** (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

<table>
<thead>
<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Redox Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Color (moist)</td>
<td>%</td>
</tr>
<tr>
<td>0-4</td>
<td>Peat Moss</td>
<td>DEM-16-17</td>
</tr>
<tr>
<td>4-20</td>
<td>Brown/gray clay silty</td>
<td>Some roots; DEM-16-17 DEM-16-17 is the Stantec Cultural Point</td>
</tr>
</tbody>
</table>

1 Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains.
2 Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

<table>
<thead>
<tr>
<th>Indicators for Problematic Hydric Soils:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histosol or Histel (A1)</td>
</tr>
<tr>
<td>Histic Epipedon (A2)</td>
</tr>
<tr>
<td>Hydrogen Sulfide (A4)</td>
</tr>
<tr>
<td>Thick Dark Surface (A12)</td>
</tr>
<tr>
<td>Alaska Gleyed (A13)</td>
</tr>
<tr>
<td>Alaska Redox (A14)</td>
</tr>
<tr>
<td>Alaska Gleyed Pores (A15)</td>
</tr>
<tr>
<td>Other (Explain in Remarks)</td>
</tr>
</tbody>
</table>

3One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed by human activity or natural disturbance.
4Give details of color change in Remarks.

**Restrictive Layer (if present):**

<table>
<thead>
<tr>
<th>Type: Permafrost</th>
<th>Hydric Soil Present?</th>
<th>Yes</th>
<th>x</th>
<th>No</th>
</tr>
</thead>
</table>

**Remarks:**

Oct 2016 Stantec Cultural Point DME-16-017 was used for soils. While Munsell colors were not identified, we interpreted 0-4" as organics, 4-20" as a layer of organic/mineral soil mix meeting the definition of a Histic Epipedon ('brown' being chroma 2 or less, 'few...roots' as being evidence of organics). Saturation was noted at below 4". As the site was sampled in October, we expect the organics to be saturated during June – August. Shallow organic for epipedon are common in the Arctic.

**HYDROLOGY**

**Wetland Hydrology Indicators:**

<table>
<thead>
<tr>
<th>Primary Indicators (any one indicator is sufficient)</th>
<th>Secondary Indicators (2 or more required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Water (A1)</td>
<td>Water-stained Leaves (B9)</td>
</tr>
<tr>
<td>High Water Table (A2)</td>
<td>Drainage Patterns (B10)</td>
</tr>
<tr>
<td>Saturation (A3)</td>
<td>Oxidized Rhizospheres along Living Roots (C3)</td>
</tr>
<tr>
<td>Water Marks (B1)</td>
<td>Presence of Reduced Iron (C4)</td>
</tr>
<tr>
<td>Sediment Deposits (B2)</td>
<td>Salt Deposits (C5)</td>
</tr>
<tr>
<td>Drift Deposits (B3)</td>
<td>Stunted or Stressed Plants (D1)</td>
</tr>
<tr>
<td>Algal Mat or Crust (B4)</td>
<td>Geomorphic Position (D2)</td>
</tr>
<tr>
<td>Iron Deposits (B5)</td>
<td>Shallow Aquitard (D3)</td>
</tr>
<tr>
<td>Surface Soil Cracks (B6)</td>
<td>Microtopographic Relief (D4)</td>
</tr>
<tr>
<td></td>
<td>FAC-Neutral Test (D5)</td>
</tr>
</tbody>
</table>

**Field Observations:**

<table>
<thead>
<tr>
<th>Surface Water Present?</th>
<th>Yes</th>
<th>No</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Table Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
</tr>
<tr>
<td>Saturation Present?</td>
<td>Yes</td>
<td>x</td>
<td>No</td>
</tr>
</tbody>
</table>

Depth (inches):

- Surface Water: 8
- Water Table: 8
- Saturation: 4

(includes capillary fringe)

**Wetland Hydrology Present?**

Yes | x | No

**Remarks:**

The Oct 2016 Stantec Cultural Point DME-16-017 found 25-50% water saturation at 4 inches. There is no note of a water table, as this information is not typically recorded in a cultural investigation. In our experience in the region, saturation of this degree probably means the water table is near the 8 inch mark during June - August. It is also important to review the secondary characteristics of this site.

Appendix H Page 151
Notes: Location where north/central proposed route would cross lagoon. Slight terrace evident along shoreline, with flatter wetlands evident in the distance.
| Notes: | Aerial photo during Stantec visit (HP1). K-Hill and study area looking north. Small riverine system is evident in the mid-ground, with shrub dominated wetlands in the foreground. |

---

**Project/Site:** Kivalina  
**Site No.:** HP1  
**Applicant/Owner:** DOT&PF  
**Investigator(s):** Stantec  
**Date:** 9/14/2017  
**Cowardin:** R2US
| Notes: | Ice wedge polygon features. Saturated and seasonally flooded wetland are evident. |
Wulik River braids. Shrub habitat is evident, along with emergent wetlands in the distance. The shrubs around the river braids appear to be seasonally flooded, as evident from the gravel deposits.
<p>| Notes: | Helicopter overview looking west. Shrub habitat is evident near the shoreline, along with emergent wetland habitat and ponds in the distance. |</p>
<table>
<thead>
<tr>
<th>Project/Site:</th>
<th>Kivalina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site No.:</td>
<td>HP19</td>
</tr>
<tr>
<td>Applicant/Owner:</td>
<td>DOT&amp;PF</td>
</tr>
<tr>
<td>Investigator(s):</td>
<td>Stantec</td>
</tr>
<tr>
<td>Date:</td>
<td>9/16/2017</td>
</tr>
<tr>
<td>Notes:</td>
<td>View of sloping wetlands back up to K-Hill.</td>
</tr>
</tbody>
</table>

![Image of sloping wetlands back up to K-Hill.](image-url)
<p>| Notes: | Photo taken during Stantec Site visit. Shoreline of ocean. Demonstrates a small terrace above the shoreline, with a flat wetland to the background. |</p>
<table>
<thead>
<tr>
<th>Notes:</th>
<th>Helicopter overview of potential gravel source near lagoon. Primarily emergent wetland, with a few small shrubs present. Ponds are evident, as is the ocean in the background.</th>
</tr>
</thead>
</table>
Kivalina and south entrance to Kivalina Lagoon/mouth of Wulik River. Pictures give a good understanding of the meandering riverine system and wetland complexes reaching to the ocean. Lakes and ponds are evident in the distance. Along the river banks one can note high shrubs, which may provide important bird habitat.
<table>
<thead>
<tr>
<th>Project/Site:</th>
<th>Kivalina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site No.:</td>
<td>HP36</td>
</tr>
<tr>
<td>Applicant/Owner:</td>
<td>DOT&amp;PF</td>
</tr>
<tr>
<td>Investigator(s):</td>
<td>Stantec</td>
</tr>
<tr>
<td>Date:</td>
<td>9/15/2017</td>
</tr>
<tr>
<td>Cowardin:</td>
<td>PEM1/SS1C</td>
</tr>
</tbody>
</table>

**Notes:** Photo taken during Stantec Site visit (HP36). Flat wetland, primarily emergent vegetation with some shrubs present. At least seasonal flooding is evident from vegetation patterns. Lakes and ponds in the background.
<table>
<thead>
<tr>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo taken during Stantec Site visit (HP37). Scrub Shrub wetland evident, with evidence of prime bird habitat. Lakes and ponds are present in the distance.</td>
</tr>
<tr>
<td>Project/Site:</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Site No.:</td>
</tr>
<tr>
<td>Applicant/Owner:</td>
</tr>
<tr>
<td>Investigator(s):</td>
</tr>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Cowardin:</td>
</tr>
</tbody>
</table>

**Notes:**

Aerial Photo taken during Stantec Site Visit (HP38). Flat emergent wetland evident, with some shrubs present.
Aerial photos of K-Hill taken by Stantec (HP39). Upland
| Notes: | Topography change next to lake - start of higher/drier plateau, blueberries, low shrubs, small hummocks, no standing water. P1 site vegetation, Polar grass, blueberry, Labrador tea |

| North | East |

| East |  |
Boundary between vegetation and geomorphic change. North - higher/drier, hummocky, some taller grasses. South - flatter, smaller hummocks. Boundary curves around to the east and then south.
<table>
<thead>
<tr>
<th>Notes:</th>
<th>Vegetation and landscape change, standing water between tussocks on south/flatter side. P3 site vegetation (sedges, cottongrass, Labrador tea)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>North</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="North" /></td>
<td><img src="Image" alt="East" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>South</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="South" /></td>
<td><img src="Image" alt="West" /></td>
</tr>
</tbody>
</table>
Lower lying finger of grassy/less shrub vegetation extending up the hill. Slight geomorphic change from areas to west and east.
Notes:

Photo taken during Stantec Site visit. Wulik River gravel bar
| Notes: | Slope break from sloping area at base of K-Hill to more flat ground extending westward. Transition to more grass/sedge. Smaller tussocks. Walking west, standing water occurs between tussocks. Undulating between low and elevated spots with more shrub or elevated - 0.5 - 1 ft. Undulating bands run North-South for the most part. Not particular drainage paths distinctly. Frozen/frost conditions. |

| North | East |
| South | West |
| Notes: | Standing water, frozen ground, example of wet ground boundary. Cottongrass present in this area |

<table>
<thead>
<tr>
<th>North</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="North" /></td>
<td><img src="image2" alt="East" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>South</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="South" /></td>
<td><img src="image4" alt="West" /></td>
</tr>
</tbody>
</table>
Increasing dryness, increasing shrubs - 20 - 30% cover. Grasses and moss ground cover, increasing elevation to west slightly.
| Notes: | Moving west along potential southern route- wetland with surface water, increasing elevation to west. P33 represents edge of standing surface water |

<table>
<thead>
<tr>
<th>North</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>West</td>
</tr>
<tr>
<td>Notes:</td>
<td>Wetland channel feature between pond and longer slough lake. Standing water at surface. No shrubs. Cottongrass present</td>
</tr>
<tr>
<td>Notes:</td>
<td>Photo taken during Stantec Site visit. Pockets of standing water wetlands throughout this area. Standing water in current location.</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>North</td>
<td><img src="image1" alt="North Image" /></td>
</tr>
<tr>
<td>East</td>
<td><img src="image2" alt="East Image" /></td>
</tr>
<tr>
<td>South</td>
<td><img src="image3" alt="South Image" /></td>
</tr>
<tr>
<td>West</td>
<td><img src="image4" alt="West Image" /></td>
</tr>
</tbody>
</table>
Notes: Standing water wetland complex, lateral N-S ridges between
Wetland complex, saturated at surface but not standing water at this exact location.
Notes: Feature on northern proposed route, north of two lakes. Down sloping to west. Small shrubs present (similar to Photo Points P3 and P4), intermixed with grass vegetation and tussocks.
Looking North

Looking East

Looking South

Looking West

Photo taken during Stantec Site visit. Potential drainage feature, standing water. Hummocks widespread, with low emergent and shrub vegetation.
| Notes: | Saturated area just north of small pond, standing water, grasses/sedges only. |

**Looking North**

**Looking East**

**Looking South**

**Looking West**
Notes: Drainage/wetland feature sloping to lake, sedges, standing water.
Small drainage feature. Grass only in this strip as compared to areas around containing more shrubs. Standing water at surface.
Notes: Slope break just off the tip of lake toward river/gravel bar. Moss, lichen, sparse grass and shrubs.
<table>
<thead>
<tr>
<th>Notes:</th>
<th>Wetland. There was a visible vegetative shift from wetlands to uplands (see enclosure 1 figure 1 of 10), and the upland soil consisted of shallow (6 inch) organic layer with gravel and cobbles layer below. -164.386537, 67.808152 (WGS 1984)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project/Site:</td>
<td>Kivalina</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>Applicant/Owner:</td>
<td>DOT&amp;PF</td>
</tr>
<tr>
<td>Date:</td>
<td>8/15/2017</td>
</tr>
<tr>
<td>Notes:</td>
<td>Upland. -164.387573, 67.808517 (WGS 1984)</td>
</tr>
<tr>
<td>Project/Site:</td>
<td>Kivalina</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Site No.:</td>
<td>USACE 3</td>
</tr>
<tr>
<td>Applicant/Owner:</td>
<td>DOT&amp;PF</td>
</tr>
<tr>
<td>Investigator(s):</td>
<td>Jeremy Grauf</td>
</tr>
<tr>
<td>Date:</td>
<td>8/15/2017</td>
</tr>
<tr>
<td>Cowardin:</td>
<td>Upland</td>
</tr>
<tr>
<td>Notes:</td>
<td>Upland. -164.385235, 67.809277 (WGS 1984)</td>
</tr>
<tr>
<td>Notes:</td>
<td>K-Hill Slope. 0-2cm: Brown silt, 30-50% gravels with small to large sub-rounded to angular pebbles, roots throughout; 2-10cm: brown silt clay loam, &gt;75% gravels with small to very large pebbles and small cobbles, some roots; 10 cmbs terminated due to impassable gravels. 67.809801, -164.386027</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Project/Site: Kivalina  Site No.: JAJ-17-009
Applicant/Owner: DOT&PF  Investigator(s): Stantec, Justin Junge
Date: 8/16/2017  Cowardin: Upland
| Notes: | 0-18cm: Root mat, vegetation layer, brown silty loam, no gravels, rootlets to small roots throughout, loose compaction; 18-38cm grey compacted silt, no gravels, +75% water saturation at 20 cm; 39 cmbs terminated. Permafrost at 40 cmbs. 67.805115, -164.375925 |

---

**Project/Site:** Kivalina  
**Site No.:** JRH-17-012  
**Applicant/Owner:** DOT&PF  
**Date:** 8/16/2017  
**Investigator(s):** Stantec, John Hemmeter  
**Cowardin:** Wetland
Notes: WCP1 = Wetland Control Point 1. 0-20cm: Saturated active organic mat & organic-rich silt (A/B soil horizons); 20-35cm: Saturated gray silt. Terminated shovel probe at 35 cmbs; soil probe showed no change in sediments before encountering rock at 60 cmbs. 67.810444, -164.409389