APPENDIX I

NOATAK WETLAND AND HABITAT STUDY

Page

NOATAK, ALASKA, AIRPORT RELOCATION:
WETLAND AND HABITAT STUDY

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INTRODUCTION

The village of Noatak, Alaska, is located on the banks of the Noatak River, about 55 miles north of Kotzebue and 70 miles north of the Arctic Circle (Sec. 18, T025N, R019W, Kateel River Meridian). The village is located at the north and western edge of treeline in an area that represents a transition between boreal and tundra biomes. Average summer temperatures range from 40 to 60°F with the average winter temperature ranging from 15 to -21°F. Temperature extremes range from -59 to 75°F. Annual precipitation is 10–13 inches, including 48 inches of snowfall (ADCA 2005).

Noatak began as a hunting and fishing camp in the 19th century and developed into a permanent settlement due to the abundant subsistence resources in the area. A post office was established in 1940. A state-owned airport supports numerous commercial carriers that provide cargo and passenger service throughout the year. Currently, the village is not serviced by barges on the Noatak River (ADCA 2005). The establishment of the Cape Krusenstern National Monument and the Noatak National Preserve and Wildlife Preserve have increased air traffic through Noatak and made it a gateway to Park visitors.

The existing airport is currently threatened by bank erosion along west side of the Noatak River and will need to be relocated. Previous efforts to slow bank erosion using engineered structures have been unsuccessful. Relocation efforts will require the development of gravel resources in addition to the land required to accommodate the new airport facilities. An area southwest of the existing airport (study area) was identified by the Alaska Department of Transportation and Public Facilities (ADOT&PF) as potential locations for a new airport and materials site.

To support environmental permitting needs for airport relocation projects proposed by the ADOT&PF, an assessment was conducted of the wetlands and habitats within the study area boundaries. The wetlands study included classification and mapping of wetlands, vegetation, and wildlife habitats using aerial photointerpretation; a functional assessment of wetland types; and an evaluation of habitat values for selected wildlife species.

METHODS

VEGETATION AND WETLANDS

Wetland and vegetation types were classified and mapped in the study area using true-color aerial photography acquired by Aeromap, Inc., in October 2005, at a nominal scale of 1:2,400 (1 in = 700 ft). Wetland and vegetation community boundaries were delineated based on color signature, plant canopy, and surface relief, along with hydrological indicators such as drainage patterns and surface water connections. Mapping codes used for each wetland type followed *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Wetlands with similar functions were grouped into wetland types to simplify mapping display. Vegetation types were identified using Level IV classifications outlined in *The Alaska Vegetation Classification* (Viereck et al. 1992). Level IV classifications were grouped into Level III vegetation classes for mapping and discussion. Similarly, habitat types were assigned based on vegetation communities and physiographic landscape position (riverine, lowland, upland). Similar habitat types were grouped based on Level III vegetation classifications for mapping and reporting. No existing wetland maps from the National Wetlands Inventory (NWI) were available for the study area.

Maps were produced by digitizing polygons of each wetland, vegetation, or habitat type using *ArcMap GIS 9.1* software (ESRI, Redlands, CA). Maps were produced in the same spatial coordinate system as the aerial photography (Alaska State Plane, NAD83). Wetland types are presented in standard NWI map annotation; Alaska vegetation classes are presented according to Viereck et al. (1992). A tabular key to these annotations is provided with the map.

WETLAND FUNCTIONAL ASSESSMENT

The functional importance of wetlands in the study area was evaluated using criteria outlined in the *Literature Review and Evaluation Rationale* of the Wetland Evaluation Technique (Adamus et al. 1991). Because no field verification surveys were performed for this project, wetland functions were inferred from aerial photographic interpretation (open water connections, vegetation community types, landscape position), and our experience from surveys in similar areas of Alaska (Koyuk Airport, Rock Creek Mine, Glacier Creek Road).

The general procedure to evaluate wetland functions is based on the Hydrogeomorphic (HGM) Classification System (Brinson 1993). HGM models have not been developed for all of the wetlands found in study area, so this modified approach was used so that all wetlands would be evaluated using the same method. The relative importance of ten processes or attributes, encompassing hydrological, water quality, ecological, and social functions of wetlands in the project area were qualitatively ranked into categories of low, medium, and high importance. Many of these attributes are not exclusive to wetlands in the area.

Most wetland functional assessment rankings were based on landscape position, wetland size, relative abundance, and current knowledge of the study area. Additional information used in the evaluation included local topography, available information on animal use, and plant community structure. To simplify the number of wetland types evaluated, wetlands that were similar in function and vegetation structure were grouped into broader categories.

HYDROLOGY

Hydrology functions were determined from the topographic relation of the wetland surface to the local water table. For basins, the presence of an inlet or outlet (or both) was determined from aerial photography. Three specific processes were considered.

Ground water discharge—Movement (vertical or lateral) of water from the subsurface to the surface.

Ground water recharge—Downward movement of water from a wetland into the subsurface.

Erosion control and flow regulation— Various mechanisms that slow or impede the movement of water downslope and thus reduce its erosive force and moderate local stream flows.

WATER QUALITY

Water quality functions are wetland processes that can remove sediments, nutrients, and anthropogenic contaminants from the water while contributing important material to the invertebrate food web. Three general processes were considered.

Sediment/toxicant retention—A combination of physical and biological processes that result in the reduction of suspended sediment of water moving across or through a wetland.

Nutrient retention—Biological processes that result in the incorporation of dissolved nutrients (mainly N and P) into plant tissue and organic sediments. Also includes the process of denitrification in wetland soils.

Production export—The movement of relatively large amounts of organic material derived from primary production to adjacent areas. This process can include a wide range of secondary production exports such as insect emergence.

ECOLOGY

Ecological values are based on the relative ability of a wetland to support animal populations and provide local habitat diversity. Three general characteristics of a wetland were considered.

Aquatic habitat—The potential of a wetland to support a viable fish or invertebrate population.

Wildlife habitat—The potential of a wetland to support wetland-dependent birds; other locally abundant animals such as moose will be considered.

Regional ecological diversity—An index to how much a given wetland contributes to the overall landscape diversity of the watershed within which it is located. Wetland types that are regionally rare receive higher scores.

SOCIAL

Social values considered for this analysis include subsistence and recreational uses. These values include the importance of a wetland for hunting and gathering activities (e.g., fishing, waterfowl and mammal hunting, berry picking, firewood, and edible plant gathering), and transportation (boating or winter travel). Rankings for this value were made on the potential of a wetland to support subsistence activities.

No data, previous study, or ranking systems were available to evaluate the intangible social values of open space and aesthetics. While certain ranking systems for such values exist (for example, see U.S. Forest Service 2002), these systems are specific to the areas for which they were developed and may not be applicable to the current study area. In general, the study area and surrounding landscape are only lightly influenced by human use and appear continuous with the regional wilderness outside the immediate boundaries of the village. These subjective measures can not be evaluated without input from local residents and other interested parties; therefore, they were not considered in the context of wetland functional values.

HABITAT EVALUATION

Habitat types in the study area were derived by integrating information from NWI classifications (Cowardin et al. 1979), Alaska vegetation classifications (Viereck et al. 1992), and landscape characteristics considered important to wildlife, such as availability of food, security (or escape), and shelter. These factors may be directly related to the quantity and quality of vegetation, soils, hydrology, microtopography, and/or microclimate. In practice, multiple related NWI types and Alaska vegetation classes often comprise a single habitat type.

Typical wildlife use of habitats was determined from the wetland and vegetation classifications, the derived wildlife habitat classes, and a review of available literature on wildlife-habitat relationships in the region (ADNR 1989, Platte and Stehn 2002). Habitat value is a function of several factors including availability of cover, availability of food, availability of any special habitat needs, and the spatial and temporal arrangement of habitat (Adamus et al. 1991). Pertinent wildlife values include important foraging habitats, nesting or denning habitats, and habitats providing other important behavioral or life-history functions (e.g., escape cover from predators, seasonal food sources). Existing literature and data available from state and federal agencies in conjunction with vegetation classification of 2005 aerial photography were used in the determinations of wildlife habitat value for each habitat class.

RESULTS AND DISCUSSION

WETLANDS AND VEGETATION

The airport study area (2705.2 acres) was classified into 19 wetland NWI classes that covering a total of 2683.2 acres (Table 1; Figures 1–2); the remaining 21.9 acres were Uplands. The landscape is gently rolling tundra with open forest stands in protected area such as lee slopes and river and stream corridors. Lakes, bogs, and wet meadows occupy local depression basins. Many of these basins represent drained lakes in various stages of vegetational succession. Much of the vegetational diversity in the study area is the result of the interaction of both hydrological and successional processes that occur in these basin areas.

The 19 NWI types were grouped into 13 wetland types based on vegetational and hydrological similarities (Table 1). Upland areas were limited to fill and barren areas associated with the existing airport and the village of Noatak. The most common wetland types consist of shrub-sedge tundra (PSS1/EM1B, 776.3 acres) and moist graminoid-shrub tundra (PEM/SS1B, 737.7 acres). These wetland types occupy much of the lands between basins and tend to be dominated by sedge-willow and shrub-tussock tundra communities (Table 2, Figure 3).

Shrub tundra (PSS1/3B and PSS1B) is common in the study area (429.1 acres) with locally improved drainage and is indistinct from shrub-sedge tundra across the study area. The wetland type includes shrub-birch dominated closed and open low shrub (PSS1/3B) and willow dominated open and low shrub (PSS1B) communities. Boundaries between shrub-sedge tundra and shrub tundra should be considered approximate, as these types were difficult to distinguish due to the late date of the aerial photography.

Much of the basin areas supported graminoid-shrub bog communities (373.2 acres). These communities included wet graminoid meadow (PEM/SS1F), moist graminoid meadow (PEM1/SS3B), open low shrub/wet graminoid complex (PSS1/3B//PEM1F), and open low shrub (PSS3/EM1B) communities. All these communities develop on relatively thick peat deposits and represent a successional continuum from wet to moist soil conditions.

The remaining wetland types all represent 3.5% or less of the study area. No isolated wetland areas were noted within the study area. Uplands were limited to 21.9 acres of gravel fill and barren areas associated with the existing airstrip, roads and pads in the village of Noatak, and development associated with the village landfill (Figure 1). Based on our experience performing ecological land surveys in the Noatak National Preserve, upland areas may occur within the study area, but it is not possible to verify this without extensive field verification surveys. Possible upland areas include areas currently delineated as needleleaf forest (PFO4/SS1B), and some shrub tundra areas identified as woodland habitats (PSS1/3B). Some riverine scrub areas (PSS1C and PSS1/3C) may also include uplands.

WETLAND FUNCTIONAL ASSESSMENT

The functional values of wetlands in the study area are influenced by a short growing season, presence of continuous permafrost across the study area, wildlife use, remoteness from large population centers, and limited urban or industrial development. Because soils are underlain by permafrost, hydrological functions are somewhat limited. All other ecological, and water quality functions of wetlands in the study area are difficult to evaluate without ground survey data. However, wetlands in this area are contiguous with an extensive region that extends across a wide valley as part of a roughly ten mile wide corridor of wetlands that flanks the banks of the Noatak River. Social values of local wetlands were scored based on the results of interviews with Noatak residents (Mobley 2006).

Many of the wetland functions described here are not unique to this study area, but are common to terrain in this region. An exception to this is the wetland areas bordering the existing airstrip and village development. These areas likely perform important water-quality functions by intercepting sediments and toxicants originating from upland fill areas. These functions are not specific to a particular wetland type, but are a result of the wetlands proximity to existing development. Ecological values of wetlands in the study area are primarily determined by relative wildlife use. Many of the wetland and upland shrub communities in the study area probably provide valuable habitat for passerines and small mammals (shrews, voles, and other microtines). A complete summary of the rankings of the functional values for wetland types is presented (Table 3).

HABITAT EVALUATION

Eighteen wetland habitat types were identified in the study area (Figure 4, Table 4). Upland habitats were limited to human fill areas, and are not considered in this discussion. The dominant habitats were Lowland Moist Tundra (819.8 acres), Lowland Tussock Tundra (730.1 acres), Lowland Low Scrub (394.7 acres), and Lowland Low Scrub/Wet Tundra Complex (168.3 acres). The remaining habitat types covered 5% or less of the study area. A summary of the characteristics of the habitats found and their wildlife use is presented below.

WETLAND HABITATS

Lowland Aquatic Marsh/Pond Complex: This habitat types occurs in young drained basins and infilling ponds and includes areas of open water and aquatic vegetation. The marshes in this part of the state typically include sedges, such as water sedge (*Carex aquatilis*), Northwest Territory sedge (*Carex utriculata*), and cottongrass sedge (*Eriophorum angustifolium*). Wildlife values include foraging, nesting, and brooding areas for waterfowl and shorebirds, and staging areas for some migratory species of waterfowl, such as geese and swans (Lensink and Derksen 1990, Platte and Butler 1992, The Institute for Bird Populations 2003). Moose also use these habitats to forage on emergent vegetation.

Lakes: Lakes (and associated littoral zone) occurred in the western portion of the study area (94.5 acres) and occurred in large, isolated basins. Lakes provide the highest quality wildlife habitat in the study area. These lakes only receive input from precipitation and local runoff sources. These lakes are favored by waterbirds because they have 1) extensive shallow areas that can be used for foraging and provide open water areas in early spring; 2) well-developed littoral zones that support a variety of important submerged plant forage species; and 3) typically are bordered by wet graminoid meadows that provide nesting and foraging habitat. Waterfowl, particularly swans, geese, and ducks, would use the open water found on these lakes during migration and during the breeding season. Other waterbirds, including loons, gulls, grebes, and shorebirds also would use these habitats during the summer season. Noatak residents indicated that these lakes are occasionally used for subsistence hunting of waterfowl, but do not support populations of game fish.

Ponds: Ponds occur throughout the study area and cover a total of 19 acres. Small, shallow ponds adjacent to the airport probably have limited habitat value. Other ponds likely provide valuable waterfowl habitat. These ponds can provide resting/foraging habitat for migrating waterbirds, cover and forage for wood frogs (*Rana sylvatica*) and aquatic invertebrates, as well as forage for moose (*Alces alces*) and muskrats (*Ondatra zibethicus*).

Streams: The Kuchoruk Creek and its tributaries cross the center of the study area and cover a total of 18.4 acres. These streams may provide pathways for nutrient export from inland wetland areas (particularly tussock tundra areas) to the Noatak River. The streams may serve as migration corridors for small fish populations between inland lakes and the Noatak River. Noatak residents use the creek for access to berry picking area and to fish for whitefish, pike, trout, and arctic char (Mobley 2006). Residents also report hunting along the banks for ptarmigan, muskrat, and waterfowl.

Riverine Low Scrub and Riverine Tall Scrub: These habitats are seasonally flooded areas bordering Kuchoruk Creek and its tributaries and cover 26.1 acres in the study area. These habitats provide erosion control and some flow moderation during spring breakup. However, flooding may be infrequent due to the high and steep banks of Kuchoruk Creek (Mobley 2006)

Moose may prefer these areas as winter habitat due to presence of preferred forage (willows) and proximity to a travel corridor when the river freezes. Because of their location these areas may serve as escape cover for a variety of species during winter months when humans and wildlife may be using the frozen water to travel. Riverine Tall Scrub is highly productive breeding habitat for several passerine species including Northern Waterthrush (*Seiurus noveboracensis*), Orange-crowned Warbler (*Vermivora celata*), Wilson's Warbler (*Wilsonia pusilla*), Yellow Warbler, Blackpoll Warbler, and Fox Sparrow. Avian use of Riverine Low Scrub is typically low compared to Riverine Tall Scrub and is primarily limited to sparrows, such as the Savannah Sparrow (*Passerculus sandwichensis*). Arctic Warblers may also occur in this habitat.

Riverine Needleleaf Forest: Functions of this type are probably similar to those described for Lowland Needleleaf Forest habitats. These forests occur as very narrow bands of trees that establish on river levees. In the study area, this habitat occurs along Kuchoruk Creek and covers 22.2 acres. The relatively large stature of trees in riverine forest results in structural elements that are usually not found in forests elsewhere in the study area, attracting many forest-associated wildlife species that are near their northern distributional limit. Large snags often occur within mature white spruce stands that provide nest sites for cavity-nesting birds such as woodpeckers. Riverine stands also contain trees large enough to attract stick-nesting raptors, such as the Red-tailed Hawk (*Buteo jamaicensis*), Bald Eagle (*Haliaeetus lecuocephalus*) and the Great Horned Owl (*Bubo virginianus*), and corvids such as the Common Raven (*Corvus corax*). However, these species occur at relatively low densities in the study area. Mammals such as porcupine (*Erethizon dorsatum*), marten (*Martes americana*), and lynx often use riverine forests for browsing and hunting. Riverine Needleleaf Forest is also a preferred habitat for small mammals such as microtine rodents and the red squirrel (*Tamiasciurus hudsonicus*).

Lowland Aquatic Marsh: Marshes in the study area are semi-permanently flooded areas of emergent vegetation such as marsh horsetail (*Equisetum fluviatile*) or sedges (*Carex* spp.), and can occur in drained basin margins, pond margins, abandoned drainage channels, and in thermokarst areas. This habitat type covers 17.6 acres within the study area. Wildlife values for lowland sedge marshes include providing foraging and nesting areas for waterfowl and shorebirds, and staging areas for some migratory species of waterfowl, such as geese and swans (USFWS 2000). Moose forage on emergent vegetation in these habitats.

Lowland Wet Tundra: This habitat type frequently is associated with ponds and marshes, but also is interspersed between Lowland Open Scrub wetlands and in local depressions and areas of poor drainage due to the impoundment of surface water from gravel placement. This habitat type includes both Wet Sedge Tundra and Wet Sedge-Willow Tundra components and covers 131.5 acres. Wildlife use and habitat values for lowland wet meadows are similar to those for the lowland aquatic marsh, although the limited surface water may restrict use by some species that need open water for foraging, thus, overall habitat value is somewhat reduced for waterbirds. Sites close to lakes and ponds would make them attractive to dabbling ducks for feeding. Shorebirds such as Lesser Yellowlegs (*Tringa flavipes*) also are attracted to these areas. Microtines, such as voles and lemmings, will use drier areas in these habitats for nesting and foraging.

Lowland Moist Tundra: This type incorporates a number of related components (Table 3), but all are dominated by sedges with a varying amount of low shrub cover. This type was the most extensive in the study area and covered 819.8 acres. Most of this habitat type is characterized by patterned-ground development consisting of slightly raised polygon rims surrounding a wetter polygon center. Wildlife values are primarily in the provision of foraging habitats for a variety of mammals and as nesting habitat for some birds (primarily songbirds and a few shorebirds). Moose are likely to forage in this habitat, as browse is readily available. Overall wildlife value for this type is low-moderate, but may rank higher for some species.

Lowland Moist Meadow: This habitat is associated with pond margins in drained basins and in thermokarsting areas along in the vicinity of the airstrip and cover 28.1 acres of the study area. These meadows may have developed from Lowland Wet Meadows, but are probably dry during at least part of the growing season. Mammal use is probably restricted to foraging and other uses by microtines and voles. This habitat type is predominantly used by shorebirds and passerines for nesting and feeding.

Lowland Tussock Tundra: In the study area, this habitat is characterized by low shrubs such as bog blueberry (*Vaccinium uliginosum*) and *Eriophorum vaginatum* tussocks. This habitat type tends to occur in raised microsites and lacks obvious patterned-ground formations. Lowland Tussock Tundra is the second-most common habitat in the study area and covers 730.1 acres. Wildlife use is similar to that for Lowland Moist Meadows.

Lowland Tall Scrub: This habitat is dominated by tall willows (*Salix* spp) and shrub birch. In better-drained areas with favorable growth conditions, the shrub stands can have a closed canopy, but open canopy stands are more common. Tall shrub stands were uncommon in the study area and covered only 5.3 acres. This type mainly occurs in drained basin margins. Moose typically prefer this habitat, although the proximity and interspersion of the habitat relative to the village may precludes most use. Songbirds, such as warblers and sparrows, also use these habitats (Spindler and Kessel 1980, Sowl 2003).

Lowland Low Scrub: A diverse number of habitat components make up the Lowland Low Shrub type (Table 3), but all are composed shrub birch (*Betula gladulosa*) and low willow in varying proportions. The understory may contain significant cover of ericaceous shrubs, sedges, and mosses. In better-drained sites, the shrub canopy may be closed, but the open canopy community is more common. This habitat is the third-most common type and covers 394.7 acres in the study area. Lowland Low Scrub is of value to a few passerine species, primarily sparrows. Lowland Low Scrub could also be used by the Arctic Warbler (*Phylloscopus borealis*), which tends to select low scrub habitats; this species was listed as a Species of Conservation Concern by USFWS in 2002. Moose also will use these habitats, if dominated by willows (ADF&G 1986).

Lowland Low Scrub/Wet Tundra Complex: The largest area of this type occurs in the southern-central portion of the study area. This habitat is common in old colluvial basins and consists of raised peat “islands” that support dense shrub birch stands. These islands are separated by shallow ponds and wet sedge swales. This habitat type covers 132 acres. Wildlife use is similar to that for Lowland Low Scrub, but the addition of wetter tundra areas probably attracts more waterbirds, such as shorebirds, to these habitats.

Lowland Bog: Vegetation is dominated by sedges, forbs and various ericaceous low and dwarf shrubs. These areas are likely saturated at or near the surface from spring through mid-summer or beyond, and may have some standing water. This habitat is common throughout the study area and covers 132 acres. Wildlife use and habitat values are similar to those for the Fresh Sedge Marsh, although the lower coverage by shallow water may restrict use by some species that need open water for foraging and lowers the overall value of this habitat type.

Lowland Needleleaf Forest and Needleleaf Woodland: This habitat is characterized by a variable cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. Lowland Needleleaf forests tend to occur in isolated patches across the study area with a total cover of 51 acres. Lowland Needleleaf Woodlands are similar habitats, but with a greater cover of deciduous shrubs. Woodlands have a low (<25%) cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. Wildlife values are moderate-to-high primarily because of the mixture of both tree and shrub cover, which provides habitats for some species not found in habitats dominated only by shrubs. Bird densities in lowland needleleaf forests were intermediate between those of shrub and forested habitats in the Upper Tanana River Valley (Spindler and Kessel 1978, 1980). Although foraging moose do use this habitat, it does not provide the high-quality forage found in the lowland shrub and meadow habitats. Berries provide a seasonal food source for small mammals, birds, and bears in this habitat.

Lowland Needleleaf Woodland: Similar to Lowland Needleleaf forest, but with a greater cover of deciduous shrubs. This habitat is characterized by a thin (<25%) cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. This habitat has moderate-to-high values as wildlife habitat primarily because of the mixture of scattered trees and shrub cover, which provides habitats for some species not found in habitats dominated only by shrubs. Bird densities are less than in Lowland Needleleaf Forests and similar to more shrub-dominated habitats (Spindler and Kessel 1978, 1980). Although foraging moose do use this habitat, it does not provide the high-quality forage found in the lowland shrub and meadow habitats.

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Table 1. Wetland classes in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Wetland Class	NWI Code[a]	NWI Descriptor	Total Area (acres)
Lake	L1UBH	Lacustrine, limnetic, unconsolidated bottom, permanently flooded	94.5
Aquatic Herbaceous	L2ABH	Lacustrine, littoral, aquatic bed, permanently flooded	1.9
Perrenial Stream	R3UBH	Riverine, upper perrenial, unconsolidated bottom, permanently flooded	18.4
Pond	PUBH	Palustrine, unconsolidated bottom, permanently flooded	19.0
Aquatic Graminoid Marsh	PEM1H	Palustrine, emergent, persistent, permanently flooded	15.6
	PUB/EM1H	Palustrine, unconsolidated bottom/emergent persistent, permanently flooded	4.2
Wet Graminoid Meadow	PEM1F	Palustrine, emergent, persistent, semipermanently flooded	78.6
Graminoid-Shrub Bog	PEM/SS1F	Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, semipermanently flooded	10.6
	PEM1/SS3B	Palustrine, emergent persistent/scrub-shrub, broad-leaved evergreen, saturated	104.2
	PSS1/3B// PEM1F	Palustrine, broad-leaved deciduous/broad-leaved evergreen, saturated//Palustrine, emergent, persistent, semiperanently flooded	168.3
	PSS3/EM1B	Palustrine, scrub-shrub, broad-leaved evergreen/emergent, persistent, saturated	90.1
Moist Graminoid Meadow	PEM1B	Palustrine, emergent, persistent, saturated	30.9
Moist Shrub-Graminoid Tundra	PEM/SS1B	Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, saturated	737.7
Riverine Scrub	PSS1/3C	Palustrine, broad-leaved deciduous/broad-leaved evergreen, seasonally flooded	17.0
	PSS1C	Palustrine, broad-leaved deciduous, seasonally flooded	32.2
Shrub-Sedge Tundra	PSS/EM1B	Palustrine, broad-leaved deciduous/emergent persistent, saturated	776.3
Shrub Tundra	PSS1/3B	Palustrine, broad-leaved deciduous/broad-leaved evergreen, saturated	309.1
	PSS1B	Palustrine, broad-leaved deciduous, saturated	120.0
Needleleaf Forest	PFO4/SS1B	Palustrine, forested, needleleaf evergreen/broad-leaved deciduous, saturated	54.6
Total Wetlands			**2683.2**
Uplands	**Ur**	**Uplands**	**21.9**
Total Study Area			**2705.2**

[a] National Wetland Classification (Cowardin et al. 1979)

Table 2. Vegetation types (Level III and Level IV) in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Vegetation Type	Level IV Vegetation Classification[a]	Total Area (acres)
Water	Fresh Water	0.0
	Water	131.9
Water/Aquatic Marsh Complex	Water/Fresh Sedge Marsh Complex	4.2
Wet Graminoid Meadow	Fresh Sedge Marsh	17.6
	Subartic Lowland Sedge Bog Meadow	0.2
	Wet Sedge Meadow Tundra	78.6
	Wet Sedge-Willow Tundra	52.9
Barrens	Barren	2.2
	Barrens Urban	19.7
Closed Low Shrub	Closed Low Shrub Birch/Willow	10.3
	Closed Low Willow	2.8
Closed Tall Shrub	Closed Tall Willow	0.7
Moist Graminoid Meadow	Moist Sedge-Birch Tundra	121.1
	Moist Sedge-Grass Meadow Tundra	28.1
	Moist Sedge-Shrub Tundra	4.1
	Moist Sedge-Willow Tundra	663.7
	Subarctic Lowland Sedge Moist Meadow	2.8
Needleleaf Woodland	White Spruce Woodland	67.6
Open Low Shrub	Open Low Ericaceous Shrub Bog	90.1
	Open Low Mesic Shrub Birch-Ericaceous Shrub	255.9
	Open Low Shrub Birch-Ericaceous Shrub Bog	13.8
	Open Low Shrub Birch-Willow	73.5
	Open Low Willow	20.0
	Open Low Willow-Graminoid Shrub Bog	12.0
	Open Low Willow-Sedge Shrub Tundra	48.1
	Open Mixed Low Shrub-Sedge Tussock Bog Meadow	11.1
	Open Mixed Low Shrub-Sedge Tussock Tundra	730.1
Open Low Shrub/Wet Graminoid Meadow Complex	Open Low Mesic Shrub Birch-Ericaceous Shrub/Wet Sedge Meadow Tundra Complex	168.3
Open Needleleaf Forest	Open White Spruce	54.6
Open Tall Shrub	Open Tall Willow	19.4
Total Area		**2705.2**

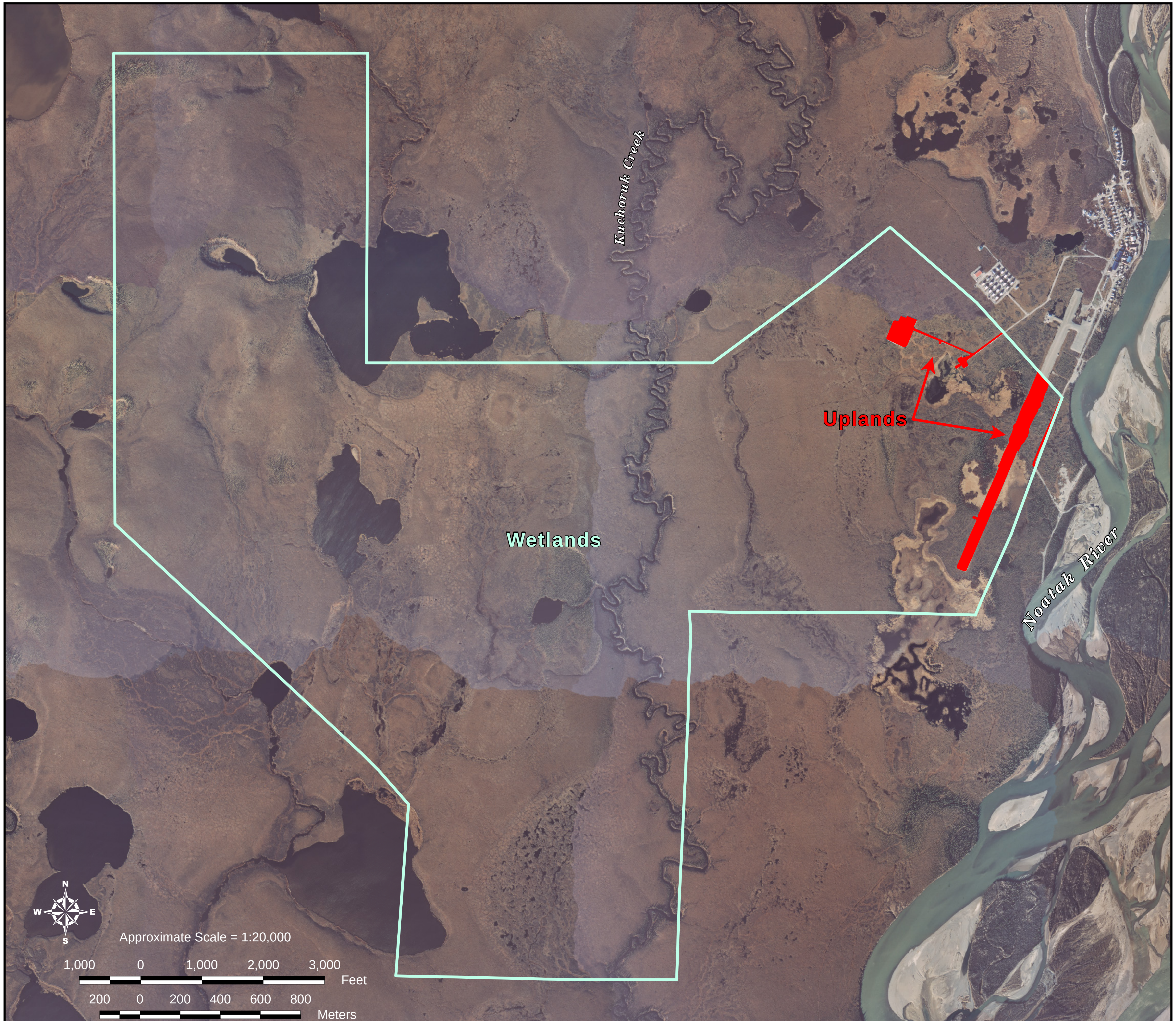
[a] The Alaska Vegetation Classification, Vierek et al. 1992.

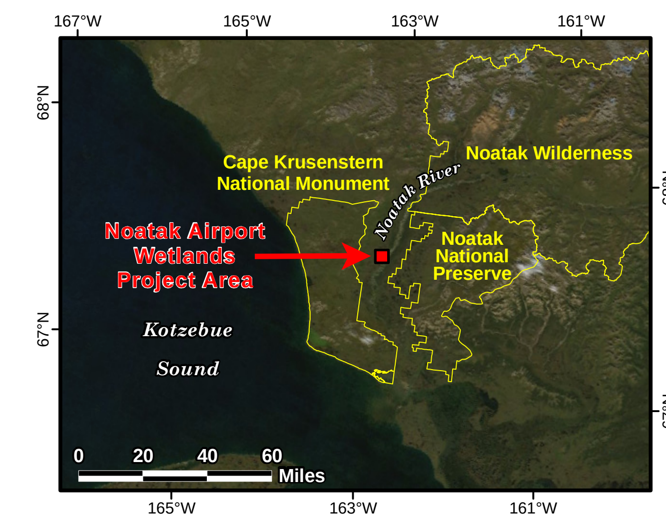
Table 3. Relative functions and values for wetland habitats identified in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Habitat \ Function & Value	Groundwater Discharge	Groundwater Recharge	Erosion Sensitivity	Sediment/ Toxicant Retention	Nutrient Retention	Production Export	Fish Habitat	Wildlife Habitat	Regional Ecological Diveristy	Subsistence/ Recreational Use
Lowland Aquatic Marsh/Pond	High	Low	Low	High	High	Med	Low	High	Med	Med
Lake	High	Low	Low	Low	Low	Low/ Med	Med/ High	High	Med	High
Pond	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Stream	Med	Low	Low	Low	Low	Med	Med	Med	Med	High
Riverine Low Scrub	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Riverine Tall Scrub	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Riverine Needleleaf Forest	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Lowland Wet Tundra	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Lowland Moist Tundra	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med
Lowland Moist Meadow	Low	Low	Low	Med	Low	Low	Low	Med	Med	Low
Lowland Tussock Tundra	Low	Low	Low	Low	Low	Med	Low	Med	Low	Med
Lowland Tall Scrub	Low	Low	Low	Low	Low	Low	Low	High	Med	Low
Lowland Low Scrub	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Lowland Low Scrub/Wet Tundra Complex	Low	Low	Low	Low	Low	Low	Low	High	Med	Med
Lowland Bog	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med
Lowland Needleleaf Forest	Low	Low	Low	Low	Low	Low	Low	High	Low	Med
Lowland Needleleaf Woodland	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med

Table 4. Wetland and upland habitat types in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Habitat Type	Habitat Components	Total Area (acres)
Wetland Habitats		
Lowland Aquatic Marsh/Pond Complex	Shallow Water/Lowland Aquatic Sedge Marsh	4.2
Lake	Water, Deep	94.5
Pond	Water, Shallow	19.0
Stream	Upper Perennial Stream	18.4
Riverine Low Scrub	Riverine Low Closed Birch-Willow Scrub	0.3
	Riverine Low Open Birch-Willow Scrub	1.7
	Riverine Low Open Willow Scrub	6.9
Riverine Tall Scrub	Riverine Tall Open Willow Scrub	17.2
Riverine Needleleaf Forest	Riverine White Spruce Forest	22.7
Lowland Aquatic Marsh	Aquatic Sedge Marsh, Shallow Water	17.6
Lowland Wet Tundra	Wet Sedge Tundra	78.6
	Wet Sedge-Willow Tundra	52.9
Lowland Moist Tundra	Moist Sedge Tundra	2.8
	Moist Sedge-Shrub Tundra	125.2
	Moist Sedge-Willow Tundra	663.7
Lowland Moist Meadow	Moist Sedge-Grass Meadow	28.1
Lowland Tussock Tundra	Lowland Shrub-Tussock Tundra	715.5
	Shrub-Tussock Tundra	14.6
Lowland Tall Scrub	Lowland Tall Closed Birch-Willow Scrub	2.2
	Lowland Tall Closed Willow Scrub	0.7
	Lowland Tall Open Willow Scrub	2.2
Lowland Low Scrub	Lowland Low Closed Birch-Willow Scrub	21.7
	Lowland Low Closed Willow	4.0
	Lowland Low Open Birch-Ericaceous Scrub	4.1
	Lowland Low Open Birch-Ericaceous Shrub	216.1
	Lowland Low Open Birch-Willow Tundra	83.7
	Lowland Low Open Willow	12.6
	Lowland Low Open Willow-Sedge Scrub	52.5
Lowland Low Scrub/Wet Tundra Complex	Lowland Low Open Birch-Ericaceous Shrub/Wet Sedge Tundra	168.3
Lowland Bog	Lowland Sedge-Shrub Bog	132.0
Lowland Needleleaf Forest	Lowland Open White Spruce Forest	51.0
Lowland Needleleaf Woodland	Lowland White Spruce Woodland	48.6
Total Wetland Habitat		**2683.6**
Upland Habitats		
Human Disturbed Barrens	Maintained Barrens	19.7
Human Gravel Fill	Gravel Fill	2.2
Total Upland Habitats		**21.9**
Total Area		**2705.0**





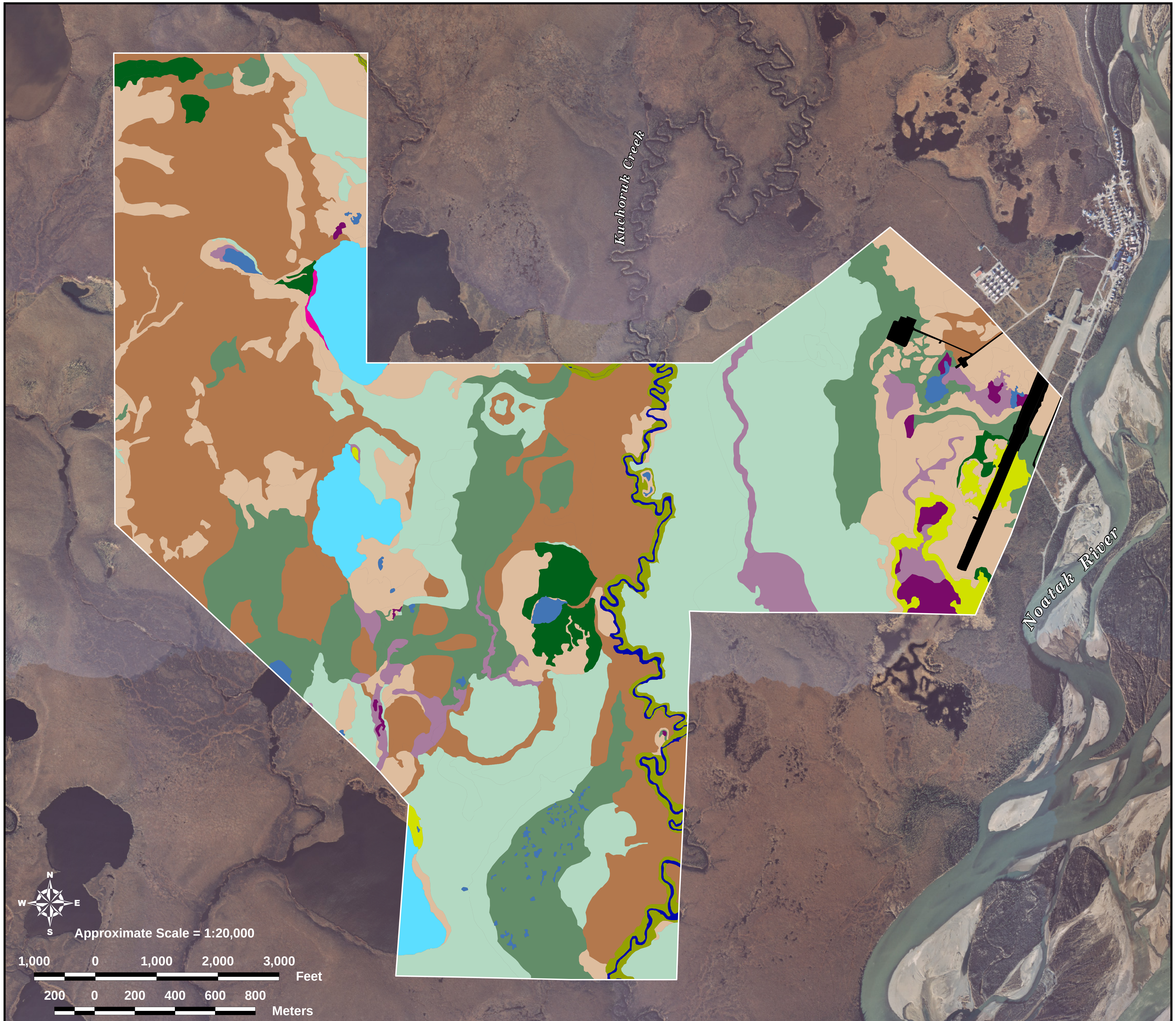
Notes:
Wetland map imagery is true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot
Inset map imagery: Blue Marble Next Generation, NASA

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 1. Wetland and Upland Boundaries

map prepared by:
ABR inc. environmental research & services

31 March 2006 | ABR File: Noatak_Airport_Wetlands_Photo_06-201-1.mxd



NWI[1] Code and Associated Wetland Class

Surface Waters of the U.S.:

L1UBH	Lake
L2ABH	Aquatic Herbaceous
R3UBH	Perrenial Stream
PUBH	Pond

Other Waters of the U.S.:

PEM1H, PUB/EM1H	Aquatic Graminoid Marsh
PEM1F	Wet Graminoid Meadow
PEM/SS1F, PEM1/SS3B, PSS1/3B//PEM1F, PSS3/EM1B	Graminoid-Shrub Bog
PEM1B	Moist Graminoid Meadow
PEM/SS1B	Moist Shrub-Graminoid Tundra
PSS1/3C, PSS1C	Riverine Scrub
PSS/EM1B	Shrub-Sedge Tundra
PSS1/3B, PSS1B	Shrub Tundra
PFO4/SS1B	Needleleaf Forest
Ur	Uplands

[1]Follows the National Wetlands Inventory (NWI) classification system of Cowardin et al. (1979). **Jurisdictional Wetland:** All wetlands in this study area have a downstream connection to navigable waters of the Noatak River and are considered jurisdictional.

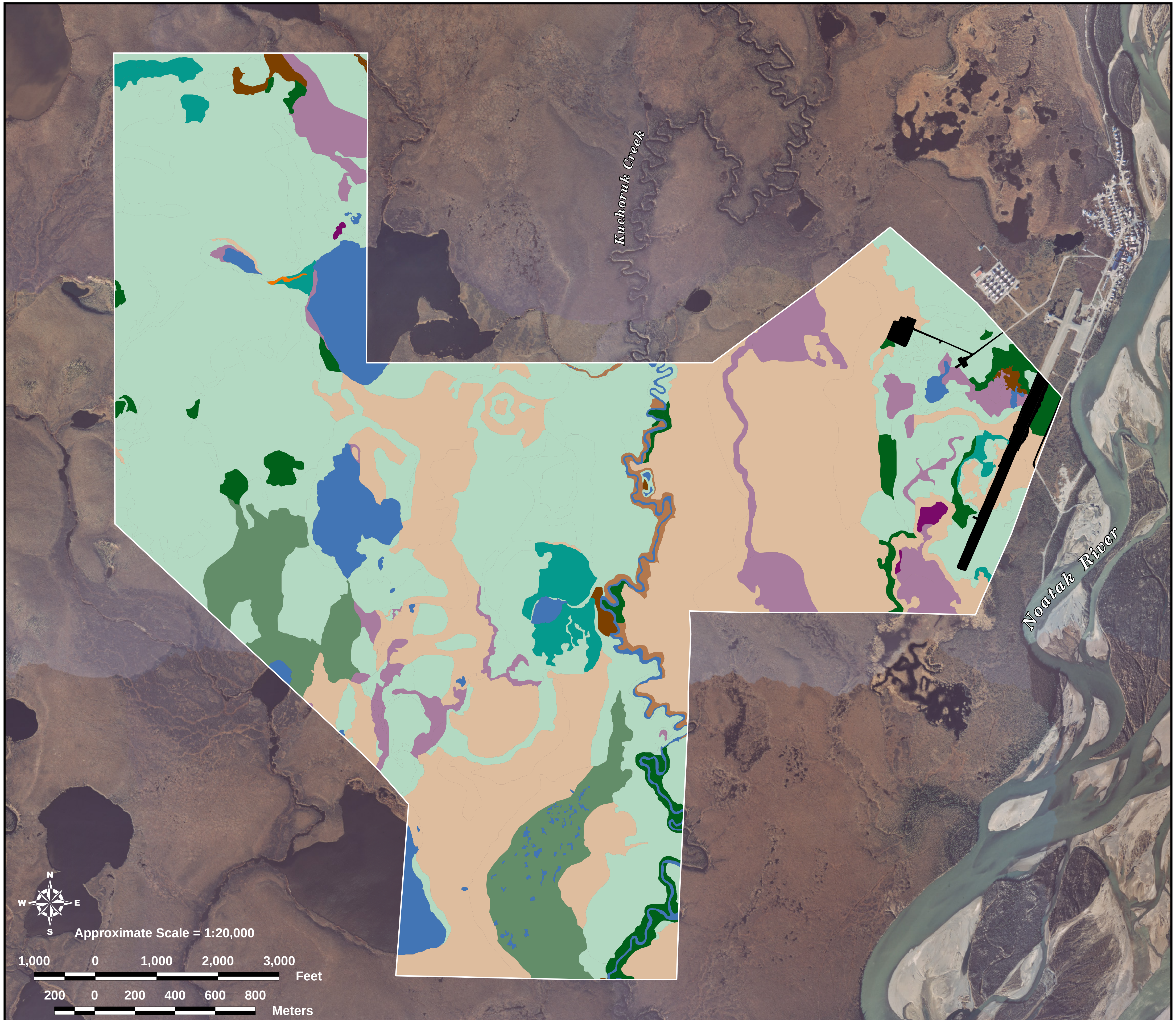
Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 2. Wetland Types

ABR inc. map prepared by: *environmental research & services*

4 April 2006 | ABR File: Noatak_Airport_Wetlands_06-201-1.mxd



Vegetation Type[1]

- Water
- Water/Aquatic Marsh Complex
- Wet Graminoid Meadow
- Moist Graminoid Meadow
- Open Low Shrub
- Open Low Shrub/Wet Graminoid Meadow Complex
- Closed Low Shrub
- Open Tall Shrub
- Closed Tall Shrub
- Open Needleleaf Forest
- Needleleaf Woodland
- Barrens

[1]Level III Vegetation Class of the Alaska Vegetation Classification (Viereck et. al. 1992).

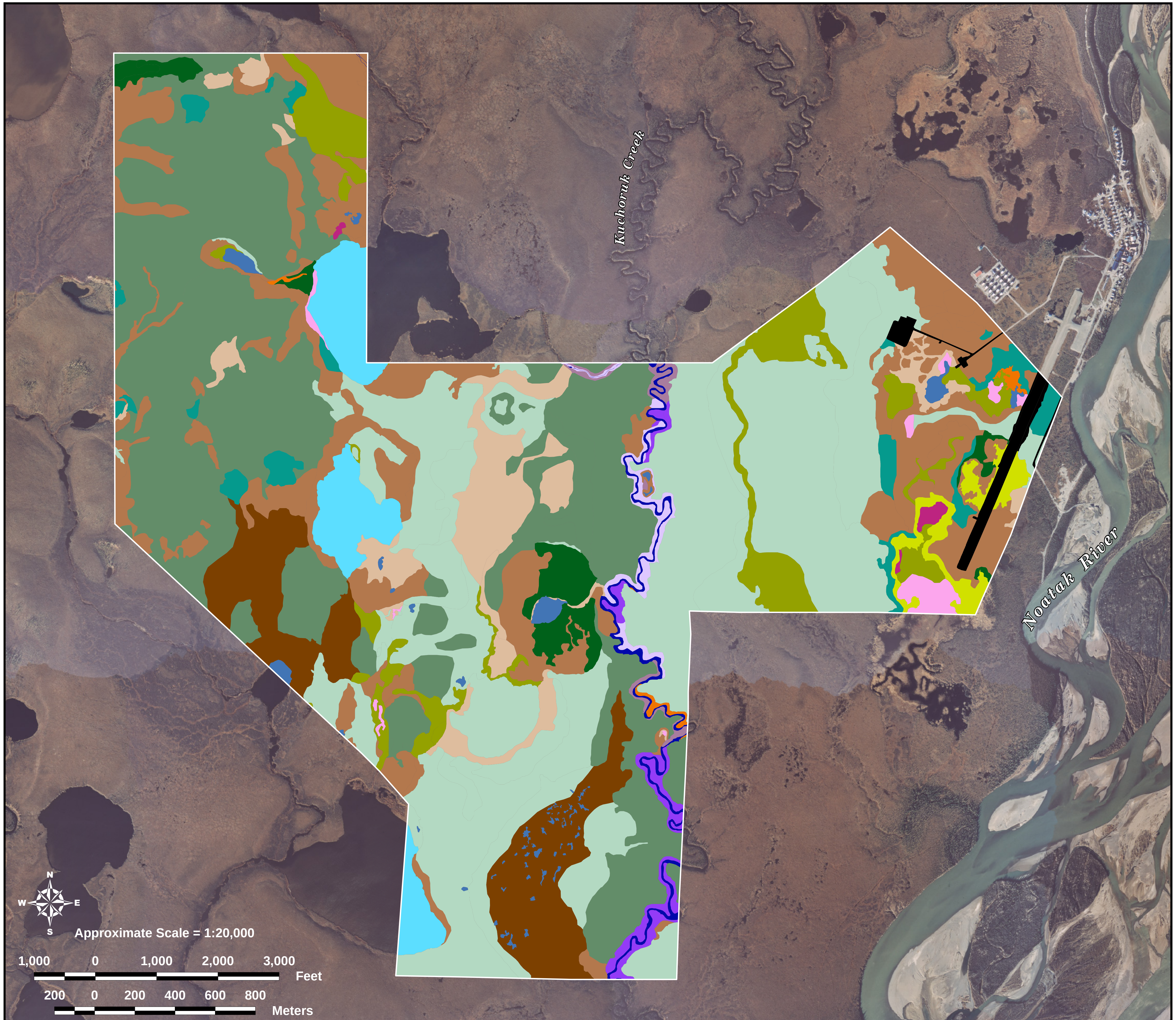
Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 3.
Vegetation Types

ABR inc. map prepared by: environmental research & services

4 April 2006	ABR File: Noatak_Airport_Vegetation_06-201-1.mxd



Habitat Type

- Lowland Aquatic Marsh/Pond Complex
- Lake
- Pond
- Stream
- Riverine Low Scrub
- Riverine Tall Scrub
- Riverine Needleleaf Forest
- Lowland Aquatic Marsh
- Lowland Wet Tundra
- Lowland Moist Tundra
- Lowland Moist Meadow
- Lowland Tussock Tundra
- Lowland Tall Scrub
- Lowland Low Scrub
- Lowland Low Scrub/Wet Tundra Complex
- Lowland Bog
- Lowland Needleleaf Forest
- Lowland Needleleaf Woodland
- Human Gravel Fill

Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 4. Habitat Types

ABR inc
map prepared by:
environmental research & services

4 April 2006 | ABR File: Noatak_Airport_Habitats_06-201-1.mxd

To:	Christopher Johnston, P.E.	From:	Ryan Cooper, PWS
	Northern Region DOT&PF		Stantec, Anchorage, Alaska
File:	Z614780000	Date:	October 5, 2017

Reference: Wetland Verification Memo: Noatak Airport Relocation Project

INTRODUCTION

PROJECT DESCRIPTION

The Alaska Department of Transportation and Public Facilities (DOT&PF), in cooperation with the Federal Aviation Administration (FAA), proposes to relocate the Noatak Airport to provide the Village of Noatak with a safe, reliable, and cost effective facility. This facility would provide the community with adequate access, support the community's long-term development goals, and conform to current FAA safety regulations.

The existing Noatak Airport and adjacent community are located on the west bank of the Noatak River, 55 miles northwest of Kotzebue (Appendix A: Figure 1). The proposed airport relocation would be located approximately 1.5 miles west of the existing airport. A new 2-mile long airport access road would be constructed from the Village of Noatak to the new airport location (Appendix A: Figures 2, 3).

PURPOSE

A proposed new airport for Noatak has been the subject of study for many years. A 2006 desktop wetland report (ABR 2006, Appendix B) was published using desktop delineation and functional assessment methods within a 2705.2-acre study area. The 2006 study classifies wetlands according to Cowardin and Viereck Habitat classifications using predominantly aerial photo signatures. No National Wetlands Inventory (NWI) or Natural Resources Conservation Service (NRCS) soils data was available for the study. Hydrology was evaluated using aerial signatures of seasonal flooding, drainage patterns, and similar signatures.

Since 2006, the alignment for the project has slightly changed and the study area has been expanded to 3102.01 acres to accommodate all proposed project features. The purpose of this report is to confirm, update, and expand the 2006 report effort by:

- Reviewing and comparing the change in the wetland indicator plant lists,
- Verifying 2006 wetland boundaries with 2016 aerial imagery,
    - Extending the delineation area where needed
- Verifying 2006 wetland classifications are still valid, and
- Verifying the 2006 wetland functions.

METHODS AND RESULTS

PLANT LIST

Since the 2006 study was completed, the 1996 USFWS Wetland Plant Indicator list (USFWS 1996) has been updated. The plant list differences applicable to the project vicinity (HUC 19050403) between 1996 and 2016 (Lichvar et al 2016) were reviewed and differences noted. We found that 131 plants were added to the list, and 14 were removed. Of the 31 remaining changes, 25% of the plants were given a wetter indicator status, and 75% of the plants were given a dryer indicator status. We reviewed each change and verified whether that change could possibly indicate a change to wetland type or wetland/upland status.

Table 1 and 2 summarize the results of this effort. There do not appear to be changes in the wetland plant list that would change a polygon's wetland status within the study area.

Table 1: Plant Classification Changes for Species Listed in the 2006 study

Scientific Name	Common Name	1996 Classification	2016 Classification	Change Between 1996-2016?
Carex aquatilis	Leafy Tussock Sedge	OBL	OBL	No
Carex utriculata	Northwest Territory Sedge	OBL	OBL	No
Betula glandulosa	Resin Birch	Not Listed	FAC	Yes
Equisetum fluviatile	Water Horsetail	OBL	OBL	No
Eriophorum angustifolium	Tall Cotton-Grass	Not Listed	OBL	Yes
Eriophorum vaginatum	Tussock Cotton-Grass	Not Listed	FACW	Yes
Picea glauca	White Spruce	FACU	FACU	No
Vaccinium uliginosum	Alpine Blueberry	FAC	FAC	No

Table 2: Plant List Changes for Willows Found in the Noatak Region

Scientific Name	Common Name	1996 Classification	2016 Classification	Change Between 1996-2016?
Salix alaxensis	Felt-Leaf Willow	FAC	FAC	No
Salix arbusculoides	Little-Tree Willow	FACW	FACW	No
Salix arctica	Arctic Willow	FAC	FACU	Yes
Salix arctophila	Northern Willow	OBL	OBL	No
Salix barclayi	Barclay's Willow	FAC	FAC	No
Salix barrattiana	Barratt's Willow	FACW	FACW	No

Scientific Name	Common Name	1996 Classification	2016 Classification	Change Between 1996-2016?
Salix bebbiana	Gray Willow	FAC	FAC	No
Salix boothii	Booth's Willow	Not Listed	OBL	Yes
Salix candida	Sage Willow	OBL	OBL	No
Salix chamissonis	Chamisso's Willow	FACW	FACW	No
Salix fuscescens	Alaska Bog Willow	FACW	FACW	No
Salix glauca	Gray-Leaf Willow	FAC	FAC	No
Salix hastata	Halberd Willow	FAC	FAC	No
Salix interior	Sandbar Willow	Not Listed	FACW	Yes
Salix myrtillifolia	Blueberry Willow	FACW	FACW	No
Salix ovalifolia	Arctic Seashore Willow	FAC	FAC	No
Salix phlebophylla	Skeleton-Leaf Willow	FACU	FACU	No
Salix planifolia	Tea-Leaf Willow	FACW	FACW	No
Salix polaris	Polar Willow	FACW	FACW	No
Salix pseudomonticola	False Mountain Willow	NI	FAC	Yes
Salix pulchra	Diamond-Leaf Willow	Not Listed	FACW	Yes
Salix reticulata	Net-Vein Willow	FAC	FAC	No
Salix richardsonii	Richardson's Willow	Not Listed	FACW	Yes
Salix rotundifolia	Round-Leaf Willow	FAC	FAC	No
Salix setchelliana	Setchell's Willow	FAC	FAC	No
Salix sphenophylla	Wedge-Leaf Willow	FAC	FAC	No

WETLAND BOUNDARIES

Wetland boundaries were reviewed against 2016 high resolution aerial photography to confirm if the polygons still accurately described the environment. We examined every polygon in the 2006 study and compared the 20 Cowardin and 31 Viereck classifications with more recent aerial photography (Digital Globe, 2016). We expanded the boundaries in the few locations where the current project extended beyond the 2006 study area boundary.

We found that the ecological boundaries have not changed, and the mapping is still accurate with current aerial photography. Uplands continue to be located on filled developed lands, with the rest of the landscape being wetlands and Waters of the United States. We extended the mapping from adjacent polygons to cover all proposed project features as needed (Figure 2).

Cowardin Classification

The Cowardin classifications (Table 3, Figure 2) confirm that the study area is mostly wetlands, with uplands being present on developed gravel pads. Most of the wetlands are Emergent or Scrub/Shrub saturated wetlands (PEM1B and PSS1B). Stunted black spruce are present in many polygons, but generally are not large enough to be considered trees.

Common classifications are PSS/EM1B and PEM/SS1B. These are very similar broad leaved deciduous shrub and emergent habitat mixes, with saturated growing conditions. Lakes, ponds, and riverine systems are also important components of the landscape (e.g. L1UBH, L2ABH, PUBH, R2UB, R3UBH).

Viereck Mapping

Viereck mapping (Table 4, Figure 3) confirms that the area is wetland tundra. The most common habitat is Open Low Shrub, a habitat which commonly supports dwarf birch (*Betula nana*), black spruce, (*Picea mariana*), and a variety of willow (*Salix sp.*). These also may host important berry producing shrubs, such as *Vaccinium sp*.

WETLAND FUNCTIONS

The 2006 study also included a desktop functional assessment, based on *Literature Review and Evaluation Rationale of the Wetland Evaluation Technique* (Adamus et al. 1991). The assessment focused on qualitatively ranking (i.e. low, medium, high) the following attributes:

- Hydrology
  - Ground water discharge
  - Ground water recharge
  - Erosion control and flow regulation
- Water Quality
  - Sediment/toxicant retention
  - Nutrient retention
  - Production export
- Ecology
  - Aquatic habitat
  - Wildlife habitat
  - Regional ecological diversity
  - Social

We reviewed the applicability of this method to be applied towards permitting a current project. Our review supports the methods and findings of the 2006 study; that wetlands are largely undisturbed, connected to similar continuous wetlands, and functioning naturally. Wetlands found in the project are not unique to the area.

The 2006 functional assessment is qualitative, and scored each polygon for individual functional attributes. The method does not produce a single quantitative score a habitat or polygon. Given this, in our experience, the wetlands would rank as a Category II or III and the Waters of the United States would rank as Category I.

Table 3: Summary of Cowardin Mapping

Cowardin	Acres
L1UBH	106.37
L2ABH	1.94
PEM/SS1B	795.58
PEM/SS1F	10.63
PEM1/SS3B	104.19
PEM1B	30.90
PEM1F	79.74
PEM1H	18.22
PFO4/SS1B	54.63
PSS/EM1B	804.85
PSS1/3B	355.82
PSS1/3B//PEM1F	168.27
PSS1/3C	16.97
PSS1B	150.44
PSS1C	35.42
PSS3/EM1B	90.08
PUB/EM1H	4.17
PUBH	22.47
R2UB	190.85
R3UBH	18.61
Ur	41.86
Total	**3,102.01**

Table 4: Summary of Viereck Mapping

Viereck	Acres
Barrens	41.86
Closed Low Shrub	13.06
Closed Tall Shrub	0.68
Moist Graminoid Meadow	839.16
Needleleaf Woodland	79.65
Open Low Shrub	1,349.69
Open Low Shrub/Wet Graminoid Meadow Complex	168.27
Open Needleleaf Forest	54.63
Open Tall Shrub	19.43
Stream	1.72
Water	338.29
Water/Aquatic Marsh Complex	4.17
Wet Graminoid Meadow	191.40
Total	**3,102.01**

CONCLUSION AND JURISDICTION

We have reviewed and verified the previous 2006 report and electronic mapping data for this project. The wetland classifications and boundaries appear to be accurate, and we have expanded them to include the current project. The new wetland indicator plant list does not appear to have changed enough to have an impact on any polygon classification (Tables 1 and 2).

Ryan Cooper, M.S.

Professional Wetland Scientist

Phone: (907) 343-5241

Ryan.cooper@stantec.com

Appendix: Appendix A:
- Figure 1: Vicinity Map
- Figure 2: Wetland Map
- Figure 3: Viereck Map

Appendix B: 2006 Wetland and Habitat Study

c. Missy Jensen, Environmental Impact Analyst, DOT&PF
Sara Lindberg, M.A., Environmental Department Manager, Stantec
John Limb, P.E., Senior Civil Engineer, Stantec

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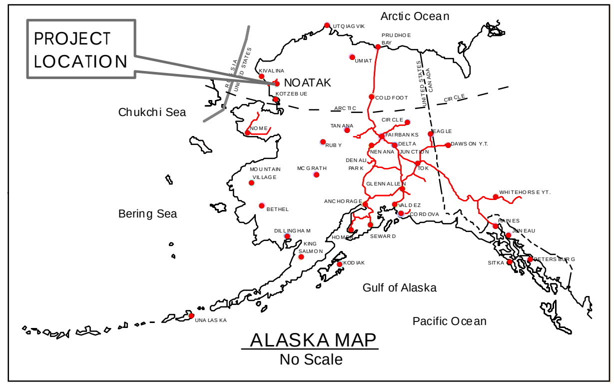
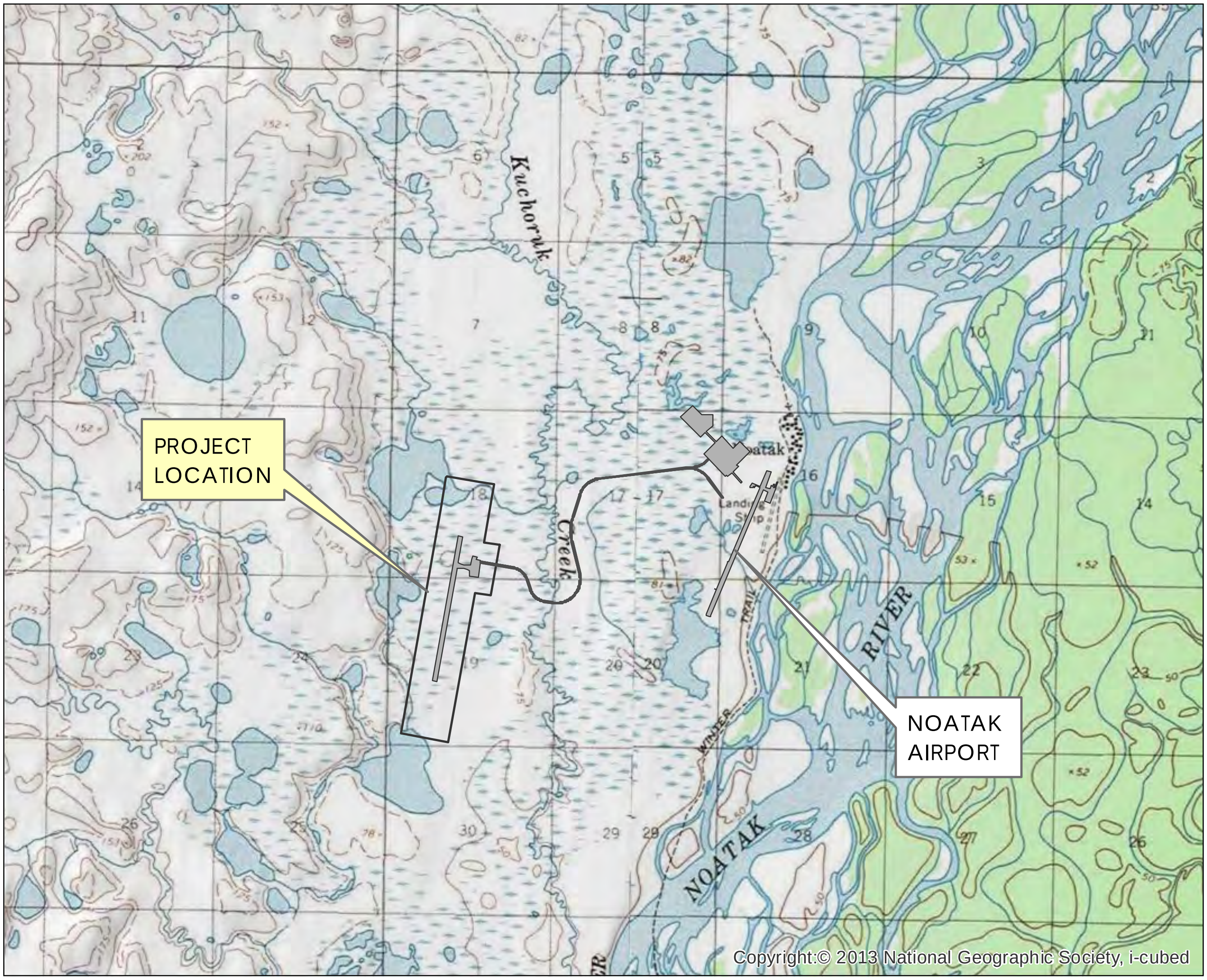
USFWS. 1996. National List of Vascular Plant Species that occur in Wetlands. Available at http://wetland-plants.usace.army.mil/nwpl_static/index.html.

Appendix A: Site Maps





Graphics developed by Stantec Consulting Services, Inc.

Project Origin: City of Noatak
Kotzebue Recording District,
Section 16-21, 28-32,
Township 25N, Range 19W
Kateel River Meridian
Noatak Airport
USGS: NOATAK (C-2) ALASKA
673357 N 1625840 W

0 0.5 1 2 Miles
1:63,360 (at original document size of 8.5x11)

STATE OF ALASKA
Department of Transportation and Public Facilities
2301 Peger Road Fairbanks, AK 99709

NOATAK AIRPORT RELOCATION
NOATAK, ALASKA

Location & Vicinity Map

DATE: October, 2017

FIGURE **1**

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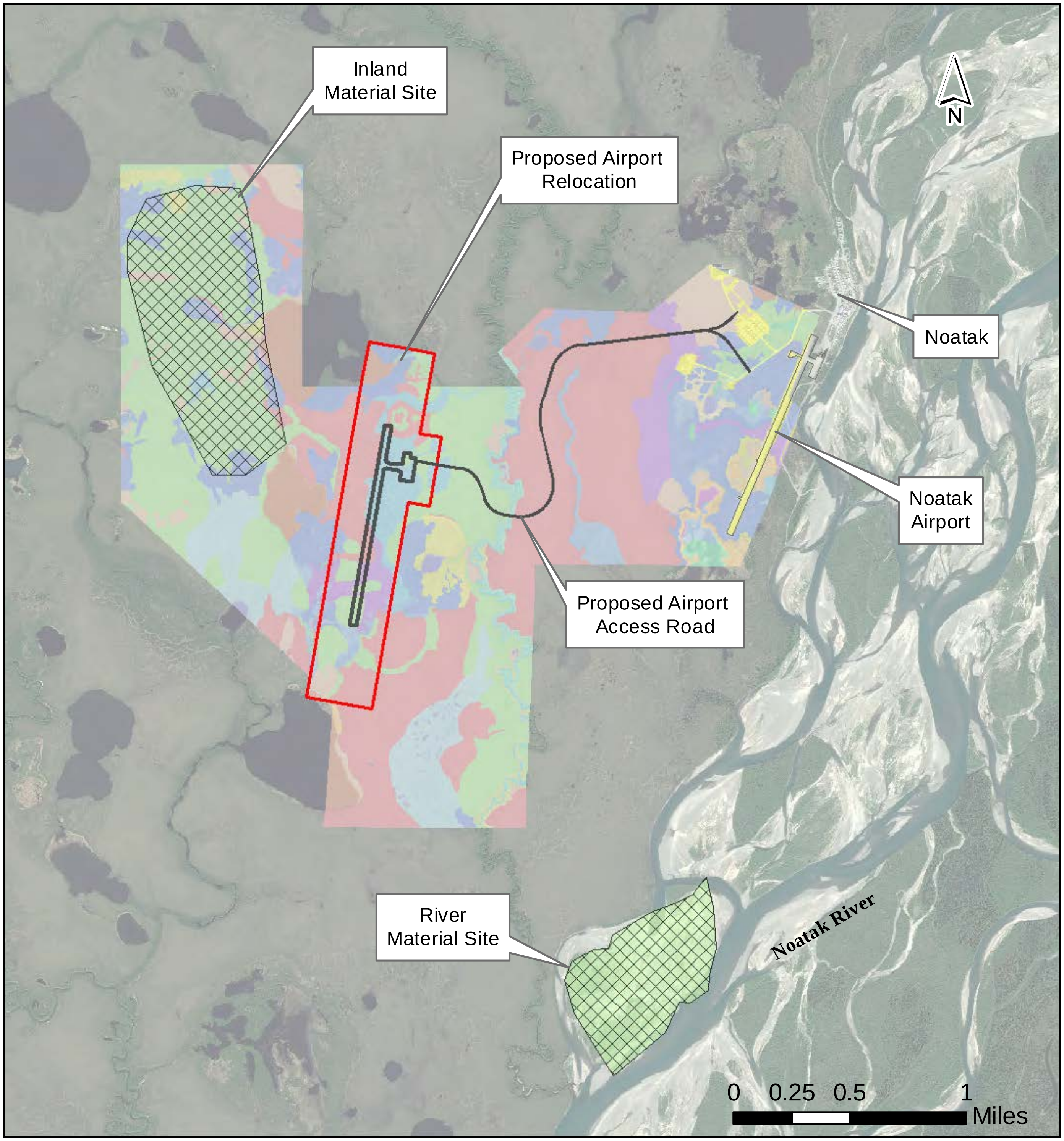

LEGEND

Project Area
Proposed Runway & Apron
Potential Material Site

Wetlands

- L1UBH
- L2ABH
- PEM/SS1B
- PEM/SS1F
- PEM1/SS3B
- PEM1B
- PEM1F
- PEM1H
- PFO4/SS1B
- PSS/EM1B
- PSS1/3B
- PSS1/3B//PEM1F
- PSS1/3C
- PSS1B
- PSS1C
- PSS3/EM1B
- PUB/EM1H
- PUBH
- R2UB
- R3UBH
- Ur

STATE OF ALASKA
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2301 Peger Road Fairbanks, AK 99709

NOATAK AIRPORT RELOCATION
NOATAK, ALASKA
Wetlands

DATE: October, 2017

FIGURE **2**

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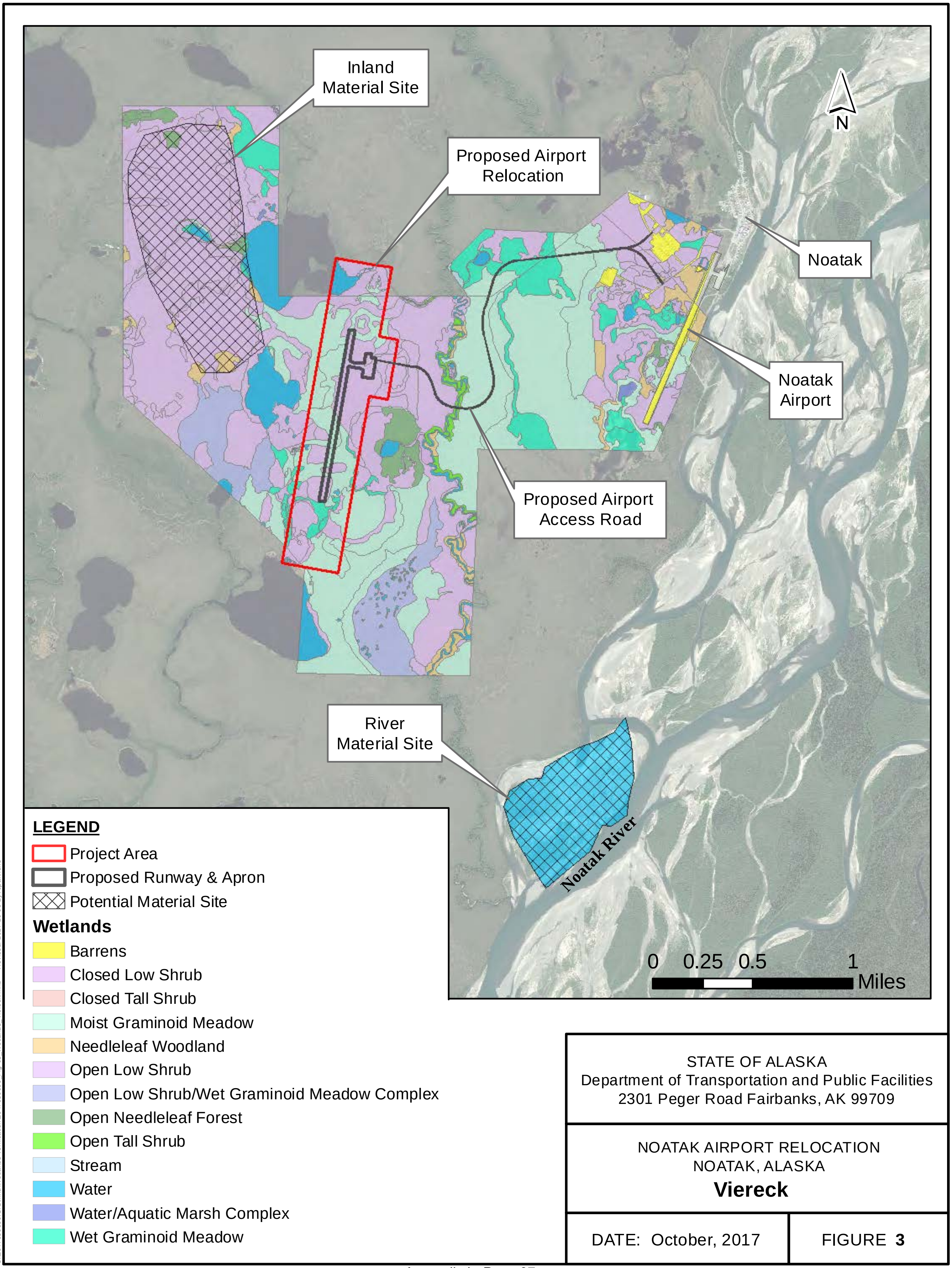
Inland Material Site
Proposed Airport Relocation
Noatak
Noatak Airport
Proposed Airport Access Road
River Material Site
Noatak River
N
0 0.25 0.5 1 Miles
LEGEND
Project Area
Proposed Runway & Apron
Potential Material Site
Wetlands
Barrens
Closed Low Shrub
Closed Tall Shrub
Moist Graminoid Meadow
Needleleaf Woodland
Open Low Shrub
Open Low Shrub/Wet Graminoid Meadow Complex
Open Needleleaf Forest
Open Tall Shrub
Stream
Water
Water/Aquatic Marsh Complex
Wet Graminoid Meadow
STATE OF ALASKA
Department of Transportation and Public Facilities
2301 Peger Road Fairbanks, AK 99709
NOATAK AIRPORT RELOCATION
NOATAK, ALASKA
Viereck
DATE: October, 2017
FIGURE 3

Appendix B: 2006 Wetland Report

NOATAK, ALASKA, AIRPORT RELOCATION:
WETLAND AND HABITAT STUDY

Prepared for

Julianne M. Hanson, P.E., Associate
Environmental Project Manager
USKH, Inc.
2515 A Street
Anchorage, AK 99503

Prepared by

Erik Pullman
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INTRODUCTION

The village of Noatak, Alaska, is located on the banks of the Noatak River, about 55 miles north of Kotzebue and 70 miles north of the Arctic Circle (Sec. 18, T025N, R019W, Kateel River Meridian). The village is located at the north and western edge of treeline in an area that represents a transition between boreal and tundra biomes. Average summer temperatures range from 40 to 60°F with the average winter temperature ranging from 15 to -21°F. Temperature extremes range from -59 to 75°F. Annual precipitation is 10–13 inches, including 48 inches of snowfall (ADCA 2005).

Noatak began as a hunting and fishing camp in the 19th century and developed into a permanent settlement due to the abundant subsistence resources in the area. A post office was established in 1940. A state-owned airport supports numerous commercial carriers that provide cargo and passenger service throughout the year. Currently, the village is not serviced by barges on the Noatak River (ADCA 2005). The establishment of the Cape Krusenstern National Monument and the Noatak National Preserve and Wildlife Preserve have increased air traffic through Noatak and made it a gateway to Park visitors.

The existing airport is currently threatened by bank erosion along west side of the Noatak River and will need to be relocated. Previous efforts to slow bank erosion using engineered structures have been unsuccessful. Relocation efforts will require the development of gravel resources in addition to the land required to accommodate the new airport facilities. An area southwest of the existing airport (study area) was identified by the Alaska Department of Transportation and Public Facilities (ADOT&PF) as potential locations for a new airport and materials site.

To support environmental permitting needs for airport relocation projects proposed by the ADOT&PF, an assessment was conducted of the wetlands and habitats within the study area boundaries. The wetlands study included classification and mapping of wetlands, vegetation, and wildlife habitats using aerial photointerpretation; a functional assessment of wetland types; and an evaluation of habitat values for selected wildlife species.

METHODS

VEGETATION AND WETLANDS

Wetland and vegetation types were classified and mapped in the study area using true-color aerial photography acquired by Aeromap, Inc., in October 2005, at a nominal scale of 1:2,400 (1 in = 700 ft). Wetland and vegetation community boundaries were delineated based on color signature, plant canopy, and surface relief, along with hydrological indicators such as drainage patterns and surface water connections. Mapping codes used for each wetland type followed *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Wetlands with similar functions were grouped into wetland types to simplify mapping display. Vegetation types were identified using Level IV classifications outlined in *The Alaska Vegetation Classification* (Viereck et al. 1992). Level IV classifications were grouped into Level III vegetation classes for mapping and discussion. Similarly, habitat types were assigned based on vegetation communities and physiographic landscape position (riverine, lowland, upland). Similar habitat types were grouped based on Level III vegetation classifications for mapping and reporting. No existing wetland maps from the National Wetlands Inventory (NWI) were available for the study area.

Maps were produced by digitizing polygons of each wetland, vegetation, or habitat type using *ArcMap GIS 9.1* software (ESRI, Redlands, CA). Maps were produced in the same spatial coordinate system as the aerial photography (Alaska State Plane, NAD83). Wetland types are presented in standard NWI map annotation; Alaska vegetation classes are presented according to Viereck et al. (1992). A tabular key to these annotations is provided with the map.

WETLAND FUNCTIONAL ASSESSMENT

The functional importance of wetlands in the study area was evaluated using criteria outlined in the *Literature Review and Evaluation Rationale* of the Wetland Evaluation Technique (Adamus et al. 1991). Because no field verification surveys were performed for this project, wetland functions were inferred from aerial photographic interpretation (open water connections, vegetation community types, landscape position), and our experience from surveys in similar areas of Alaska (Koyuk Airport, Rock Creek Mine, Glacier Creek Road).

The general procedure to evaluate wetland functions is based on the Hydrogeomorphic (HGM) Classification System (Brinson 1993). HGM models have not been developed for all of the wetlands found in study area, so this modified approach was used so that all wetlands would be evaluated using the same method. The relative importance of ten processes or attributes, encompassing hydrological, water quality, ecological, and social functions of wetlands in the project area were qualitatively ranked into categories of low, medium, and high importance. Many of these attributes are not exclusive to wetlands in the area.

Most wetland functional assessment rankings were based on landscape position, wetland size, relative abundance, and current knowledge of the study area. Additional information used in the evaluation included local topography, available information on animal use, and plant community structure. To simplify the number of wetland types evaluated, wetlands that were similar in function and vegetation structure were grouped into broader categories.

HYDROLOGY

Hydrology functions were determined from the topographic relation of the wetland surface to the local water table. For basins, the presence of an inlet or outlet (or both) was determined from aerial photography. Three specific processes were considered.

Ground water discharge—Movement (vertical or lateral) of water from the subsurface to the surface.

Ground water recharge—Downward movement of water from a wetland into the subsurface.

Erosion control and flow regulation— Various mechanisms that slow or impede the movement of water downslope and thus reduce its erosive force and moderate local stream flows.

WATER QUALITY

Water quality functions are wetland processes that can remove sediments, nutrients, and anthropogenic contaminants from the water while contributing important material to the invertebrate food web. Three general processes were considered.

Sediment/toxicant retention—A combination of physical and biological processes that result in the reduction of suspended sediment of water moving across or through a wetland.

Nutrient retention—Biological processes that result in the incorporation of dissolved nutrients (mainly N and P) into plant tissue and organic sediments. Also includes the process of denitrification in wetland soils.

Production export—The movement of relatively large amounts of organic material derived from primary production to adjacent areas. This process can include a wide range of secondary production exports such as insect emergence.

ECOLOGY

Ecological values are based on the relative ability of a wetland to support animal populations and provide local habitat diversity. Three general characteristics of a wetland were considered.

Aquatic habitat—The potential of a wetland to support a viable fish or invertebrate population.

Wildlife habitat—The potential of a wetland to support wetland-dependent birds; other locally abundant animals such as moose will be considered.

Regional ecological diversity—An index to how much a given wetland contributes to the overall landscape diversity of the watershed within which it is located. Wetland types that are regionally rare receive higher scores.

SOCIAL

Social values considered for this analysis include subsistence and recreational uses. These values include the importance of a wetland for hunting and gathering activities (e.g., fishing, waterfowl and mammal hunting, berry picking, firewood, and edible plant gathering), and transportation (boating or winter travel). Rankings for this value were made on the potential of a wetland to support subsistence activities.

No data, previous study, or ranking systems were available to evaluate the intangible social values of open space and aesthetics. While certain ranking systems for such values exist (for example, see U.S. Forest Service 2002), these systems are specific to the areas for which they were developed and may not be applicable to the current study area. In general, the study area and surrounding landscape are only lightly influenced by human use and appear continuous with the regional wilderness outside the immediate boundaries of the village. These subjective measures can not be evaluated without input from local residents and other interested parties; therefore, they were not considered in the context of wetland functional values.

HABITAT EVALUATION

Habitat types in the study area were derived by integrating information from NWI classifications (Cowardin et al. 1979), Alaska vegetation classifications (Viereck et al. 1992), and landscape characteristics considered important to wildlife, such as availability of food, security (or escape), and shelter. These factors may be directly related to the quantity and quality of vegetation, soils, hydrology, microtopography, and/or microclimate. In practice, multiple related NWI types and Alaska vegetation classes often comprise a single habitat type.

Typical wildlife use of habitats was determined from the wetland and vegetation classifications, the derived wildlife habitat classes, and a review of available literature on wildlife-habitat relationships in the region (ADNR 1989, Platte and Stehn 2002). Habitat value is a function of several factors including availability of cover, availability of food, availability of any special habitat needs, and the spatial and temporal arrangement of habitat (Adamus et al. 1991). Pertinent wildlife values include important foraging habitats, nesting or denning habitats, and habitats providing other important behavioral or life-history functions (e.g., escape cover from predators, seasonal food sources). Existing literature and data available from state and federal agencies in conjunction with vegetation classification of 2005 aerial photography were used in the determinations of wildlife habitat value for each habitat class.

RESULTS AND DISCUSSION

WETLANDS AND VEGETATION

The airport study area (2705.2 acres) was classified into 19 wetland NWI classes that covering a total of 2683.2 acres (Table 1; Figures 1–2); the remaining 21.9 acres were Uplands. The landscape is gently rolling tundra with open forest stands in protected area such as lee slopes and river and stream corridors. Lakes, bogs, and wet meadows occupy local depression basins. Many of these basins represent drained lakes in various stages of vegetational succession. Much of the vegetational diversity in the study area is the result of the interaction of both hydrological and successional processes that occur in these basin areas.

The 19 NWI types were grouped into 13 wetland types based on vegetational and hydrological similarities (Table 1). Upland areas were limited to fill and barren areas associated with the existing airport and the village of Noatak. The most common wetland types consist of shrub-sedge tundra (PSS1/EM1B, 776.3 acres) and moist graminoid-shrub tundra (PEM/SS1B, 737.7 acres). These wetland types occupy much of the lands between basins and tend to be dominated by sedge-willow and shrub-tussock tundra communities (Table 2, Figure 3).

Shrub tundra (PSS1/3B and PSS1B) is common in the study area (429.1 acres) with locally improved drainage and is indistinct from shrub-sedge tundra across the study area. The wetland type includes shrub-birch dominated closed and open low shrub (PSS1/3B) and willow dominated open and low shrub (PSS1B) communities. Boundaries between shrub-sedge tundra and shrub tundra should be considered approximate, as these types were difficult to distinguish due to the late date of the aerial photography.

Much of the basin areas supported graminoid-shrub bog communities (373.2 acres). These communities included wet graminoid meadow (PEM/SS1F), moist graminoid meadow (PEM1/SS3B), open low shrub/wet graminoid complex (PSS1/3B//PEM1F), and open low shrub (PSS3/EM1B) communities. All these communities develop on relatively thick peat deposits and represent a successional continuum from wet to moist soil conditions.

The remaining wetland types all represent 3.5% or less of the study area. No isolated wetland areas were noted within the study area. Uplands were limited to 21.9 acres of gravel fill and barren areas associated with the existing airstrip, roads and pads in the village of Noatak, and development associated with the village landfill (Figure 1). Based on our experience performing ecological land surveys in the Noatak National Preserve, upland areas may occur within the study area, but it is not possible to verify this without extensive field verification surveys. Possible upland areas include areas currently delineated as needleleaf forest (PFO4/SS1B), and some shrub tundra areas identified as woodland habitats (PSS1/3B). Some riverine scrub areas (PSS1C and PSS1/3C) may also include uplands.

WETLAND FUNCTIONAL ASSESSMENT

The functional values of wetlands in the study area are influenced by a short growing season, presence of continuous permafrost across the study area, wildlife use, remoteness from large population centers, and limited urban or industrial development. Because soils are underlain by permafrost, hydrological functions are somewhat limited. All other ecological, and water quality functions of wetlands in the study area are difficult to evaluate without ground survey data. However, wetlands in this area are contiguous with an extensive region that extends across a wide valley as part of a roughly ten mile wide corridor of wetlands that flanks the banks of the Noatak River. Social values of local wetlands were scored based on the results of interviews with Noatak residents (Mobley 2006).

Many of the wetland functions described here are not unique to this study area, but are common to terrain in this region. An exception to this is the wetland areas bordering the existing airstrip and village development. These areas likely perform important water-quality functions by intercepting sediments and toxicants originating from upland fill areas. These functions are not specific to a particular wetland type, but are a result of the wetlands proximity to existing development. Ecological values of wetlands in the study area are primarily determined by relative wildlife use. Many of the wetland and upland shrub communities in the study area probably provide valuable habitat for passerines and small mammals (shrews, voles, and other microtines). A complete summary of the rankings of the functional values for wetland types is presented (Table 3).

HABITAT EVALUATION

Eighteen wetland habitat types were identified in the study area (Figure 4, Table 4). Upland habitats were limited to human fill areas, and are not considered in this discussion. The dominant habitats were Lowland Moist Tundra (819.8 acres), Lowland Tussock Tundra (730.1 acres), Lowland Low Scrub (394.7 acres), and Lowland Low Scrub/Wet Tundra Complex (168.3 acres). The remaining habitat types covered 5% or less of the study area. A summary of the characteristics of the habitats found and their wildlife use is presented below.

WETLAND HABITATS

Lowland Aquatic Marsh/Pond Complex: This habitat types occurs in young drained basins and infilling ponds and includes areas of open water and aquatic vegetation. The marshes in this part of the state typically include sedges, such as water sedge (*Carex aquatilis*), Northwest Territory sedge (*Carex utriculata*), and cottongrass sedge (*Eriophorum angustifolium*). Wildlife values include foraging, nesting, and brooding areas for waterfowl and shorebirds, and staging areas for some migratory species of waterfowl, such as geese and swans (Lensink and Derksen 1990, Platte and Butler 1992, The Institute for Bird Populations 2003). Moose also use these habitats to forage on emergent vegetation.

Lakes: Lakes (and associated littoral zone) occurred in the western portion of the study area (94.5 acres) and occurred in large, isolated basins. Lakes provide the highest quality wildlife habitat in the study area. These lakes only receive input from precipitation and local runoff sources. These lakes are favored by waterbirds because they have 1) extensive shallow areas that can be used for foraging and provide open water areas in early spring; 2) well-developed littoral zones that support a variety of important submerged plant forage species; and 3) typically are bordered by wet graminoid meadows that provide nesting and foraging habitat. Waterfowl, particularly swans, geese, and ducks, would use the open water found on these lakes during migration and during the breeding season. Other waterbirds, including loons, gulls, grebes, and shorebirds also would use these habitats during the summer season. Noatak residents indicated that these lakes are occasionally used for subsistence hunting of waterfowl, but do not support populations of game fish.

Ponds: Ponds occur throughout the study area and cover a total of 19 acres. Small, shallow ponds adjacent to the airport probably have limited habitat value. Other ponds likely provide valuable waterfowl habitat. These ponds can provide resting/foraging habitat for migrating waterbirds, cover and forage for wood frogs (*Rana sylvatica*) and aquatic invertebrates, as well as forage for moose (*Alces alces*) and muskrats (*Ondatra zibethicus*).

Streams: The Kuchoruk Creek and its tributaries cross the center of the study area and cover a total of 18.4 acres. These streams may provide pathways for nutrient export from inland wetland areas (particularly tussock tundra areas) to the Noatak River. The streams may serve as migration corridors for small fish populations between inland lakes and the Noatak River. Noatak residents use the creek for access to berry picking area and to fish for whitefish, pike, trout, and arctic char (Mobley 2006). Residents also report hunting along the banks for ptarmigan, muskrat, and waterfowl.

Riverine Low Scrub and Riverine Tall Scrub: These habitats are seasonally flooded areas bordering Kuchoruk Creek and its tributaries and cover 26.1 acres in the study area. These habitats provide erosion control and some flow moderation during spring breakup. However, flooding may be infrequent due to the high and steep banks of Kuchoruk Creek (Mobley 2006)

Moose may prefer these areas as winter habitat due to presence of preferred forage (willows) and proximity to a travel corridor when the river freezes. Because of their location these areas may serve as escape cover for a variety of species during winter months when humans and wildlife may be using the frozen water to travel. Riverine Tall Scrub is highly productive breeding habitat for several passerine species including Northern Waterthrush (*Seiurus noveboracensis*), Orange-crowned Warbler (*Vermivora celata*), Wilson's Warbler (*Wilsonia pusilla*), Yellow Warbler, Blackpoll Warbler, and Fox Sparrow. Avian use of Riverine Low Scrub is typically low compared to Riverine Tall Scrub and is primarily limited to sparrows, such as the Savannah Sparrow (*Passerculus sandwichensis*). Arctic Warblers may also occur in this habitat.

Riverine Needleleaf Forest: Functions of this type are probably similar to those described for Lowland Needleleaf Forest habitats. These forests occur as very narrow bands of trees that establish on river levees. In the study area, this habitat occurs along Kuchoruk Creek and covers 22.2 acres. The relatively large stature of trees in riverine forest results in structural elements that are usually not found in forests elsewhere in the study area, attracting many forest-associated wildlife species that are near their northern distributional limit. Large snags often occur within mature white spruce stands that provide nest sites for cavity-nesting birds such as woodpeckers. Riverine stands also contain trees large enough to attract stick-nesting raptors, such as the Red-tailed Hawk (*Buteo jamaicensis*), Bald Eagle (*Haliaeetus lecuocephalus*) and the Great Horned Owl (*Bubo virginianus*), and corvids such as the Common Raven (*Corvus corax*). However, these species occur at relatively low densities in the study area. Mammals such as porcupine (*Erethizon dorsatum*), marten (*Martes americana*), and lynx often use riverine forests for browsing and hunting. Riverine Needleleaf Forest is also a preferred habitat for small mammals such as microtine rodents and the red squirrel (*Tamiasciurus hudsonicus*).

Lowland Aquatic Marsh: Marshes in the study area are semi-permanently flooded areas of emergent vegetation such as marsh horsetail (*Equisetum fluviatile*) or sedges (*Carex* spp.), and can occur in drained basin margins, pond margins, abandoned drainage channels, and in thermokarst areas. This habitat type covers 17.6 acres within the study area. Wildlife values for lowland sedge marshes include providing foraging and nesting areas for waterfowl and shorebirds, and staging areas for some migratory species of waterfowl, such as geese and swans (USFWS 2000). Moose forage on emergent vegetation in these habitats.

Lowland Wet Tundra: This habitat type frequently is associated with ponds and marshes, but also is interspersed between Lowland Open Scrub wetlands and in local depressions and areas of poor drainage due to the impoundment of surface water from gravel placement. This habitat type includes both Wet Sedge Tundra and Wet Sedge-Willow Tundra components and covers 131.5 acres. Wildlife use and habitat values for lowland wet meadows are similar to those for the lowland aquatic marsh, although the limited surface water may restrict use by some species that need open water for foraging, thus, overall habitat value is somewhat reduced for waterbirds. Sites close to lakes and ponds would make them attractive to dabbling ducks for feeding. Shorebirds such as Lesser Yellowlegs (*Tringa flavipes*) also are attracted to these areas. Microtines, such as voles and lemmings, will use drier areas in these habitats for nesting and foraging.

Lowland Moist Tundra: This type incorporates a number of related components (Table 3), but all are dominated by sedges with a varying amount of low shrub cover. This type was the most extensive in the study area and covered 819.8 acres. Most of this habitat type is characterized by patterned-ground development consisting of slightly raised polygon rims surrounding a wetter polygon center. Wildlife values are primarily in the provision of foraging habitats for a variety of mammals and as nesting habitat for some birds (primarily songbirds and a few shorebirds). Moose are likely to forage in this habitat, as browse is readily available. Overall wildlife value for this type is low-moderate, but may rank higher for some species.

Lowland Moist Meadow: This habitat is associated with pond margins in drained basins and in thermokarsting areas along in the vicinity of the airstrip and cover 28.1 acres of the study area. These meadows may have developed from Lowland Wet Meadows, but are probably dry during at least part of the growing season. Mammal use is probably restricted to foraging and other uses by microtines and voles. This habitat type is predominantly used by shorebirds and passerines for nesting and feeding.

Lowland Tussock Tundra: In the study area, this habitat is characterized by low shrubs such as bog blueberry (*Vaccinium uliginosum*) and *Eriophorum vaginatum* tussocks. This habitat type tends to occur in raised microsites and lacks obvious patterned-ground formations. Lowland Tussock Tundra is the second-most common habitat in the study area and covers 730.1 acres. Wildlife use is similar to that for Lowland Moist Meadows.

Lowland Tall Scrub: This habitat is dominated by tall willows (*Salix* spp) and shrub birch. In better-drained areas with favorable growth conditions, the shrub stands can have a closed canopy, but open canopy stands are more common. Tall shrub stands were uncommon in the study area and covered only 5.3 acres. This type mainly occurs in drained basin margins. Moose typically prefer this habitat, although the proximity and interspersion of the habitat relative to the village may precludes most use. Songbirds, such as warblers and sparrows, also use these habitats (Spindler and Kessel 1980, Sowl 2003).

Lowland Low Scrub: A diverse number of habitat components make up the Lowland Low Shrub type (Table 3), but all are composed shrub birch (*Betula gladulosa*) and low willow in varying proportions. The understory may contain significant cover of ericaceous shrubs, sedges, and mosses. In better-drained sites, the shrub canopy may be closed, but the open canopy community is more common. This habitat is the third-most common type and covers 394.7 acres in the study area. Lowland Low Scrub is of value to a few passerine species, primarily sparrows. Lowland Low Scrub could also be used by the Arctic Warbler (*Phylloscopus borealis*), which tends to select low scrub habitats; this species was listed as a Species of Conservation Concern by USFWS in 2002. Moose also will use these habitats, if dominated by willows (ADF&G 1986).

Lowland Low Scrub/Wet Tundra Complex: The largest area of this type occurs in the southern-central portion of the study area. This habitat is common in old colluvial basins and consists of raised peat “islands” that support dense shrub birch stands. These islands are separated by shallow ponds and wet sedge swales. This habitat type covers 132 acres. Wildlife use is similar to that for Lowland Low Scrub, but the addition of wetter tundra areas probably attracts more waterbirds, such as shorebirds, to these habitats.

Lowland Bog: Vegetation is dominated by sedges, forbs and various ericaceous low and dwarf shrubs. These areas are likely saturated at or near the surface from spring through mid-summer or beyond, and may have some standing water. This habitat is common throughout the study area and covers 132 acres. Wildlife use and habitat values are similar to those for the Fresh Sedge Marsh, although the lower coverage by shallow water may restrict use by some species that need open water for foraging and lowers the overall value of this habitat type.

Lowland Needleleaf Forest and Needleleaf Woodland: This habitat is characterized by a variable cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. Lowland Needleleaf forests tend to occur in isolated patches across the study area with a total cover of 51 acres. Lowland Needleleaf Woodlands are similar habitats, but with a greater cover of deciduous shrubs. Woodlands have a low (<25%) cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. Wildlife values are moderate-to-high primarily because of the mixture of both tree and shrub cover, which provides habitats for some species not found in habitats dominated only by shrubs. Bird densities in lowland needleleaf forests were intermediate between those of shrub and forested habitats in the Upper Tanana River Valley (Spindler and Kessel 1978, 1980). Although foraging moose do use this habitat, it does not provide the high-quality forage found in the lowland shrub and meadow habitats. Berries provide a seasonal food source for small mammals, birds, and bears in this habitat.

Lowland Needleleaf Woodland: Similar to Lowland Needleleaf forest, but with a greater cover of deciduous shrubs. This habitat is characterized by a thin (<25%) cover of white spruce (*Picea glauca*) with an understory of willow and ericaceous shrubs. This habitat has moderate-to-high values as wildlife habitat primarily because of the mixture of scattered trees and shrub cover, which provides habitats for some species not found in habitats dominated only by shrubs. Bird densities are less than in Lowland Needleleaf Forests and similar to more shrub-dominated habitats (Spindler and Kessel 1978, 1980). Although foraging moose do use this habitat, it does not provide the high-quality forage found in the lowland shrub and meadow habitats.

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Table 1. Wetland classes in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Wetland Class	NWI Code[a]	NWI Descriptor	Total Area (acres)
Lake	L1UBH	Lacustrine, limnetic, unconsolidated bottom, permanently flooded	94.5
Aquatic Herbaceous	L2ABH	Lacustrine, littoral, aquatic bed, permanently flooded	1.9
Perrenial Stream	R3UBH	Riverine, upper perrenial, unconsolidated bottom, permanently flooded	18.4
Pond	PUBH	Palustrine, unconsolidated bottom, permanently flooded	19.0
Aquatic Graminoid Marsh	PEM1H	Palustrine, emergent, persistent, permanently flooded	15.6
	PUB/EM1H	Palustrine, unconsolidated bottom/emergent persistent, permanently flooded	4.2
Wet Graminoid Meadow	PEM1F	Palustrine, emergent, persistent, semipermanently flooded	78.6
Graminoid-Shrub Bog	PEM/SS1F	Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, semipermanently flooded	10.6
	PEM1/SS3B	Palustrine, emergent persistent/scrub-shrub, broad-leaved evergreen, saturated	104.2
	PSS1/3B// PEM1F	Palustrine, broad-leaved deciduous/broad-leaved evergreen, saturated//Palustrine, emergent, persistent, semiperanently flooded	168.3
	PSS3/EM1B	Palustrine, scrub-shrub, broad-leaved evergreen/emergent, persistent, saturated	90.1
Moist Graminoid Meadow	PEM1B	Palustrine, emergent, persistent, saturated	30.9
Moist Shrub-Graminoid Tundra	PEM/SS1B	Palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, saturated	737.7
Riverine Scrub	PSS1/3C	Palustrine, broad-leaved deciduous/broad-leaved evergreen, seasonally flooded	17.0
	PSS1C	Palustrine, broad-leaved deciduous, seasonally flooded	32.2
Shrub-Sedge Tundra	PSS/EM1B	Palustrine, broad-leaved deciduous/emergent persistent, saturated	776.3
Shrub Tundra	PSS1/3B	Palustrine, broad-leaved deciduous/broad-leaved evergreen, saturated	309.1
	PSS1B	Palustrine, broad-leaved deciduous, saturated	120.0
Needleleaf Forest	PFO4/SS1B	Palustrine, forested, needleleaf evergreen/broad-leaved deciduous, saturated	54.6
Total Wetlands			**2683.2**
Uplands	**Ur**	**Uplands**	**21.9**
Total Study Area			**2705.2**

[a] National Wetland Classification (Cowardin et al. 1979)

Table 2. Vegetation types (Level III and Level IV) in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Vegetation Type	Level IV Vegetation Classification[a]	Total Area (acres)
Water	Fresh Water	0.0
	Water	131.9
Water/Aquatic Marsh Complex	Water/Fresh Sedge Marsh Complex	4.2
Wet Graminoid Meadow	Fresh Sedge Marsh	17.6
	Subartic Lowland Sedge Bog Meadow	0.2
	Wet Sedge Meadow Tundra	78.6
	Wet Sedge-Willow Tundra	52.9
Barrens	Barren	2.2
	Barrens Urban	19.7
Closed Low Shrub	Closed Low Shrub Birch/Willow	10.3
	Closed Low Willow	2.8
Closed Tall Shrub	Closed Tall Willow	0.7
Moist Graminoid Meadow	Moist Sedge-Birch Tundra	121.1
	Moist Sedge-Grass Meadow Tundra	28.1
	Moist Sedge-Shrub Tundra	4.1
	Moist Sedge-Willow Tundra	663.7
	Subarctic Lowland Sedge Moist Meadow	2.8
Needleleaf Woodland	White Spruce Woodland	67.6
Open Low Shrub	Open Low Ericaceous Shrub Bog	90.1
	Open Low Mesic Shrub Birch-Ericaceous Shrub	255.9
	Open Low Shrub Birch-Ericaceous Shrub Bog	13.8
	Open Low Shrub Birch-Willow	73.5
	Open Low Willow	20.0
	Open Low Willow-Graminoid Shrub Bog	12.0
	Open Low Willow-Sedge Shrub Tundra	48.1
	Open Mixed Low Shrub-Sedge Tussock Bog Meadow	11.1
	Open Mixed Low Shrub-Sedge Tussock Tundra	730.1
Open Low Shrub/Wet Graminoid Meadow Complex	Open Low Mesic Shrub Birch-Ericaceous Shrub/Wet Sedge Meadow Tundra Complex	168.3
Open Needleleaf Forest	Open White Spruce	54.6
Open Tall Shrub	Open Tall Willow	19.4
Total Area		**2705.2**

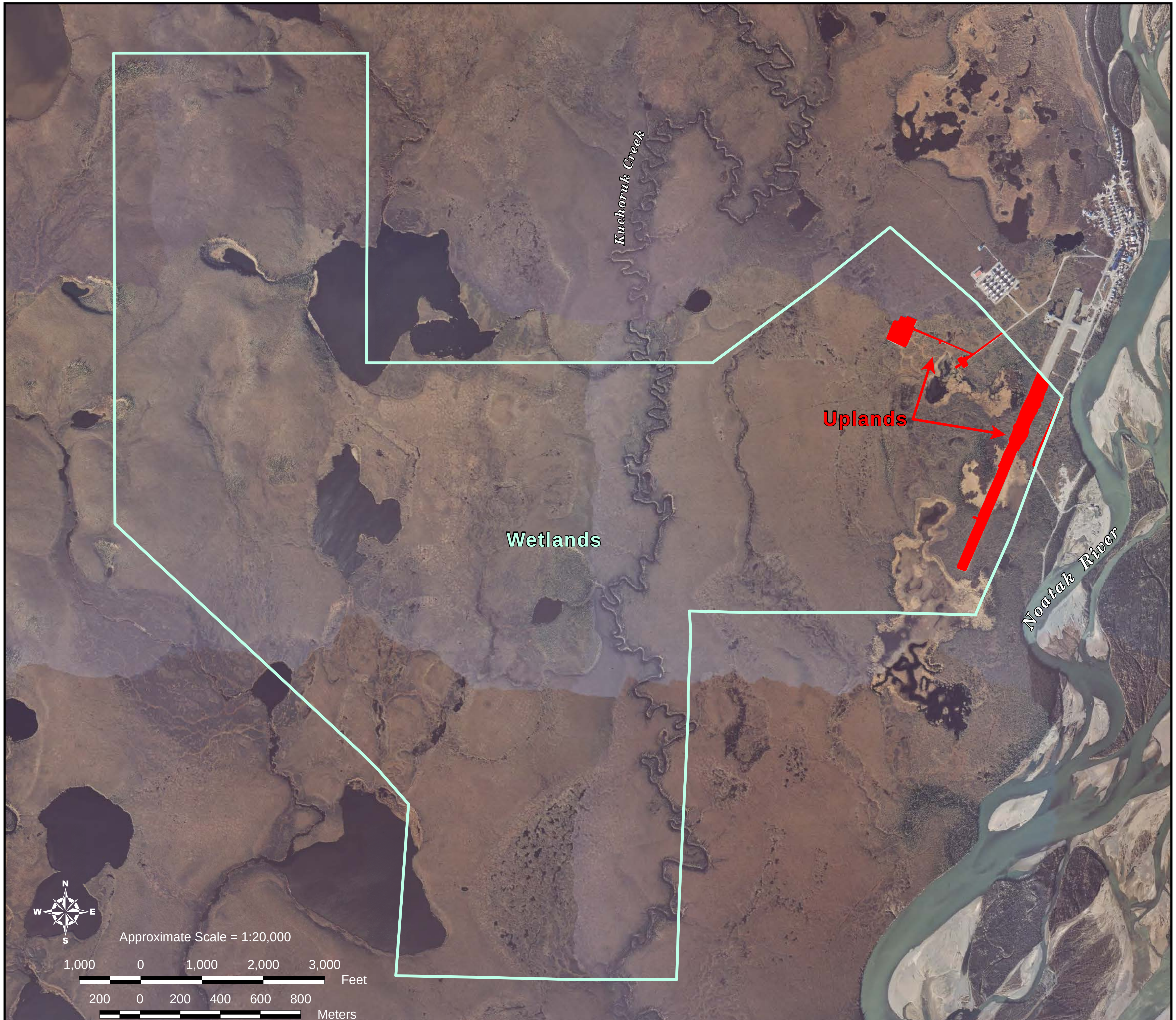
[a] The Alaska Vegetation Classification, Vierek et al. 1992.

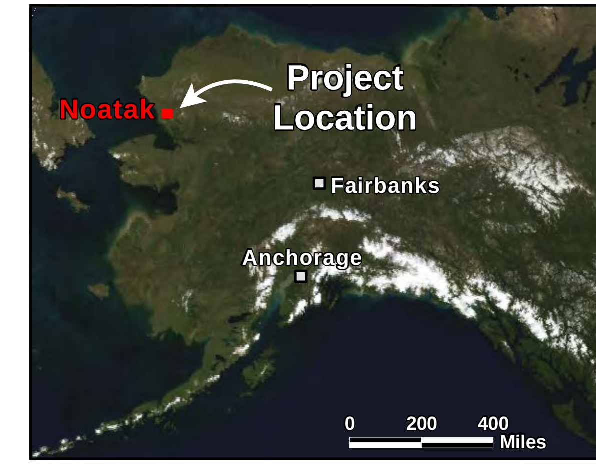
Table 3. Relative functions and values for wetland habitats identified in the Noatak airport relocation study area, Noatak, Alaska, 2005.

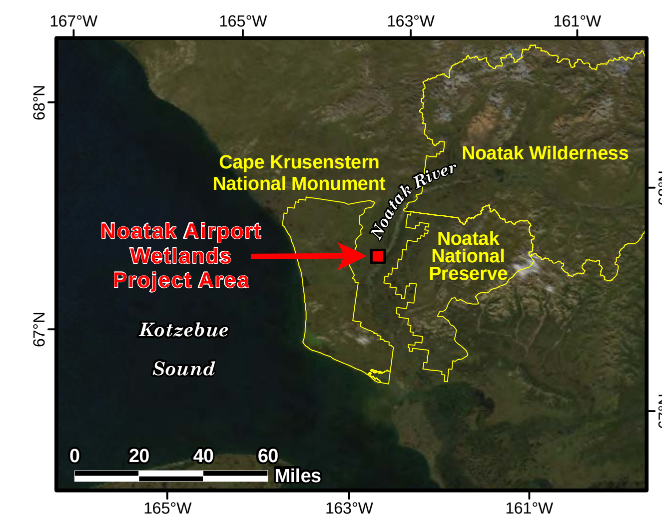
Function & Value / Habitat	Groundwater Discharge	Groundwater Recharge	Erosion Sensitivity	Sediment/ Toxicant Retention	Nutrient Retention	Production Export	Fish Habitat	Wildlife Habitat	Regional Ecological Diveristy	Subsistence/ Recreational Use
Lowland Aquatic Marsh/Pond	High	Low	Low	High	High	Med	Low	High	Med	Med
Lake	High	Low	Low	Low	Low	Low/ Med	Med/ High	High	Med	High
Pond	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Stream	Med	Low	Low	Low	Low	Med	Med	Med	Med	High
Riverine Low Scrub	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Riverine Tall Scrub	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Riverine Needleleaf Forest	Low	Low	High	Med	Low	Low	Low	Med/ High	Med	Low
Lowland Wet Tundra	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Lowland Moist Tundra	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med
Lowland Moist Meadow	Low	Low	Low	Med	Low	Low	Low	Med	Med	Low
Lowland Tussock Tundra	Low	Low	Low	Low	Low	Med	Low	Med	Low	Med
Lowland Tall Scrub	Low	Low	Low	Low	Low	Low	Low	High	Med	Low
Lowland Low Scrub	Low	Low	Low	Low	Low	Low	Low	Med	Low	Low
Lowland Low Scrub/Wet Tundra Complex	Low	Low	Low	Low	Low	Low	Low	High	Med	Med
Lowland Bog	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med
Lowland Needleleaf Forest	Low	Low	Low	Low	Low	Low	Low	High	Low	Med
Lowland Needleleaf Woodland	Low	Low	Low	Low	Low	Low	Low	Med	Low	Med

Table 4. Wetland and upland habitat types in the Noatak airport relocation study area, Noatak, Alaska, 2005.

Habitat Type	Habitat Components	Total Area (acres)
Wetland Habitats		
Lowland Aquatic Marsh/Pond Complex	Shallow Water/Lowland Aquatic Sedge Marsh	4.2
Lake	Water, Deep	94.5
Pond	Water, Shallow	19.0
Stream	Upper Perennial Stream	18.4
Riverine Low Scrub	Riverine Low Closed Birch-Willow Scrub	0.3
	Riverine Low Open Birch-Willow Scrub	1.7
	Riverine Low Open Willow Scrub	6.9
Riverine Tall Scrub	Riverine Tall Open Willow Scrub	17.2
Riverine Needleleaf Forest	Riverine White Spruce Forest	22.7
Lowland Aquatic Marsh	Aquatic Sedge Marsh, Shallow Water	17.6
Lowland Wet Tundra	Wet Sedge Tundra	78.6
	Wet Sedge-Willow Tundra	52.9
Lowland Moist Tundra	Moist Sedge Tundra	2.8
	Moist Sedge-Shrub Tundra	125.2
	Moist Sedge-Willow Tundra	663.7
Lowland Moist Meadow	Moist Sedge-Grass Meadow	28.1
Lowland Tussock Tundra	Lowland Shrub-Tussock Tundra	715.5
	Shrub-Tussock Tundra	14.6
Lowland Tall Scrub	Lowland Tall Closed Birch-Willow Scrub	2.2
	Lowland Tall Closed Willow Scrub	0.7
	Lowland Tall Open Willow Scrub	2.2
Lowland Low Scrub	Lowland Low Closed Birch-Willow Scrub	21.7
	Lowland Low Closed Willow	4.0
	Lowland Low Open Birch-Ericaceous Scrub	4.1
	Lowland Low Open Birch-Ericaceous Shrub	216.1
	Lowland Low Open Birch-Willow Tundra	83.7
	Lowland Low Open Willow	12.6
	Lowland Low Open Willow-Sedge Scrub	52.5
Lowland Low Scrub/Wet Tundra Complex	Lowland Low Open Birch-Ericaceous Shrub/Wet Sedge Tundra	168.3
Lowland Bog	Lowland Sedge-Shrub Bog	132.0
Lowland Needleleaf Forest	Lowland Open White Spruce Forest	51.0
Lowland Needleleaf Woodland	Lowland White Spruce Woodland	48.6
Total Wetland Habitat		**2683.6**
Upland Habitats		
Human Disturbed Barrens	Maintained Barrens	19.7
Human Gravel Fill	Gravel Fill	2.2
Total Upland Habitats		**21.9**
Total Area		**2705.0**







Notes:
Wetland map imagery is true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot
Inset map imagery: Blue Marble Next Generation, NASA

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 1. Wetland and Upland Boundaries

ABR inc
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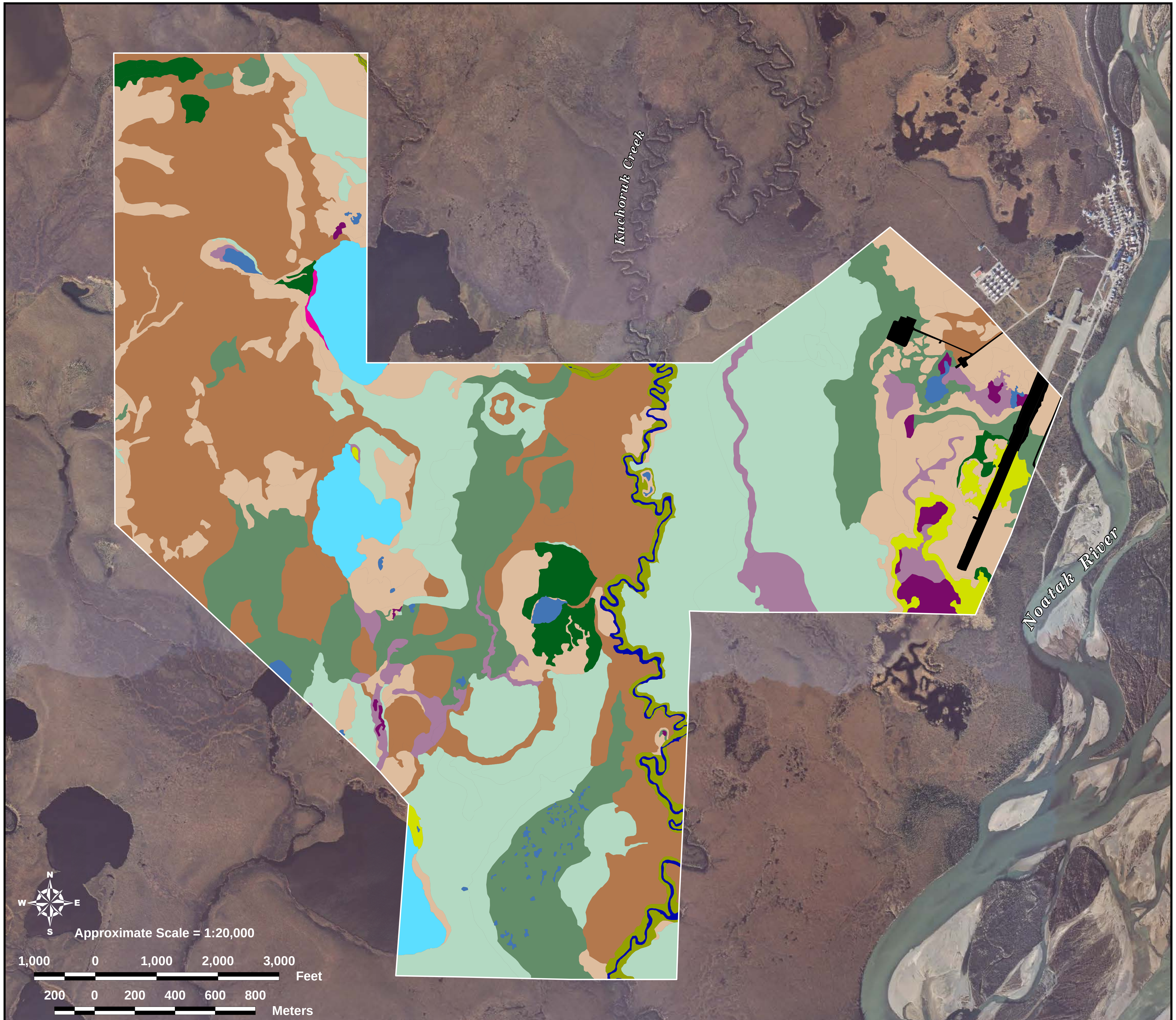
31 March 2006 | ABR File: Noatak_Airport_Wetlands_Photo_06-201-1.mxd



NWI[1] Code and Associated Wetland Class

Surface Waters of the U.S.:

L1UBH	Lake
L2ABH	Aquatic Herbaceous
R3UBH	Perrenial Stream
PUBH	Pond

Other Waters of the U.S.:

PEM1H, PUB/EM1H	Aquatic Graminoid Marsh
PEM1F	Wet Graminoid Meadow
PEM/SS1F, PEM1/SS3B, PSS1/3B//PEM1F, PSS3/EM1B	Graminoid-Shrub Bog
PEM1B	Moist Graminoid Meadow
PEM/SS1B	Moist Shrub-Graminoid Tundra
PSS1/3C, PSS1C	Riverine Scrub
PSS/EM1B	Shrub-Sedge Tundra
PSS1/3B, PSS1B	Shrub Tundra
PFO4/SS1B	Needleleaf Forest
Ur	Uplands

[1]Follows the National Wetlands Inventory (NWI) classification system of Cowardin et al. (1979). **Jurisdictional Wetland:** All wetlands in this study area have a downstream connection to navigable waters of the Noatak River and are considered jurisdictional.

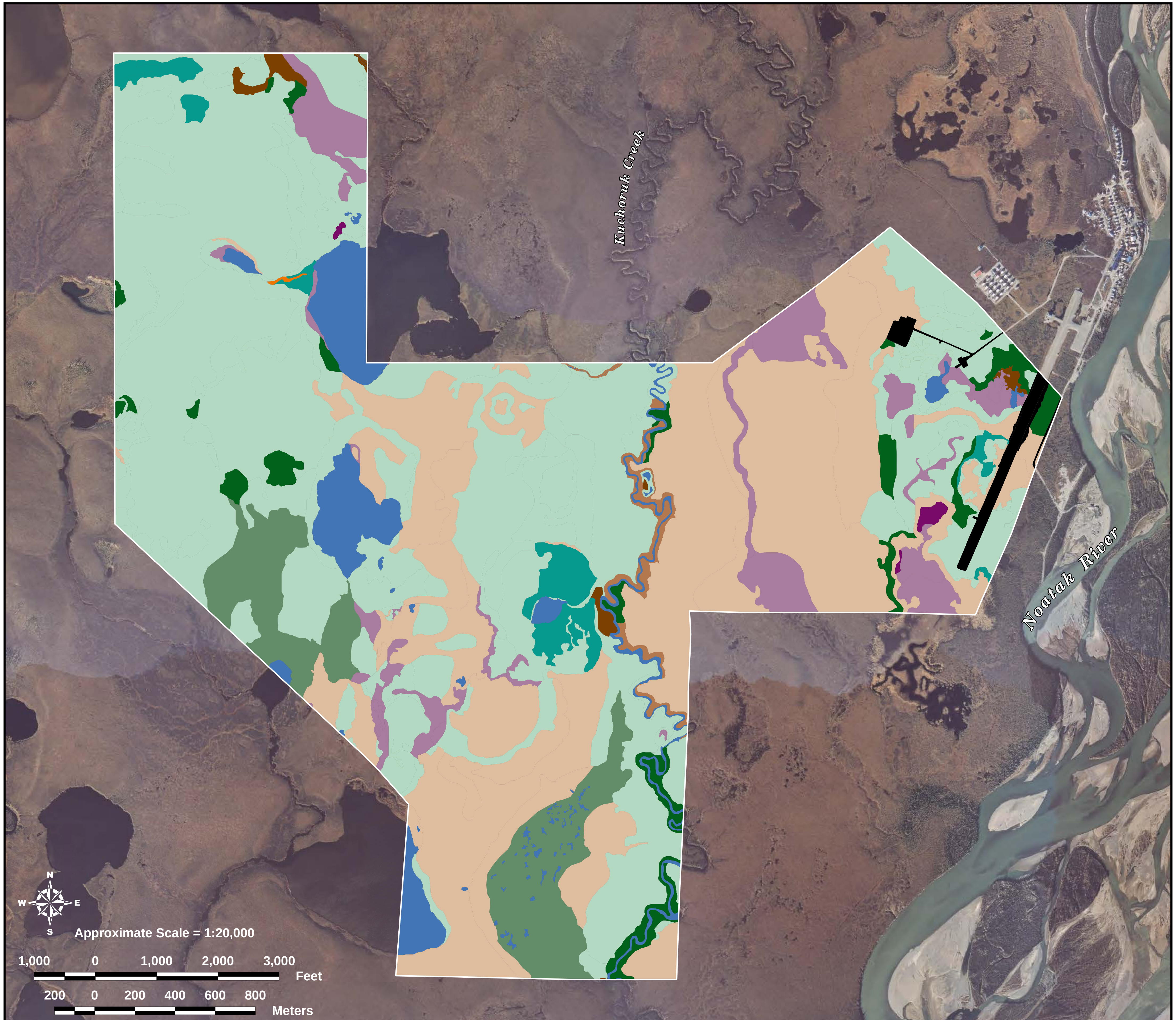
Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 2. Wetland Types

ABR inc. map prepared by: environmental research & services

4 April 2006 | ABR File: Noatak_Airport_Wetlands_06-201-1.mxd



Vegetation Type[1]

- Water
- Water/Aquatic Marsh Complex
- Wet Graminoid Meadow
- Moist Graminoid Meadow
- Open Low Shrub
- Open Low Shrub/Wet Graminoid Meadow Complex
- Closed Low Shrub
- Open Tall Shrub
- Closed Tall Shrub
- Open Needleleaf Forest
- Needleleaf Woodland
- Barrens

[1]Level III Vegetation Class of the Alaska Vegetation Classification (Viereck et. al. 1992).

Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 3. Vegetation Types

ABR inc. map prepared by: environmental research & services

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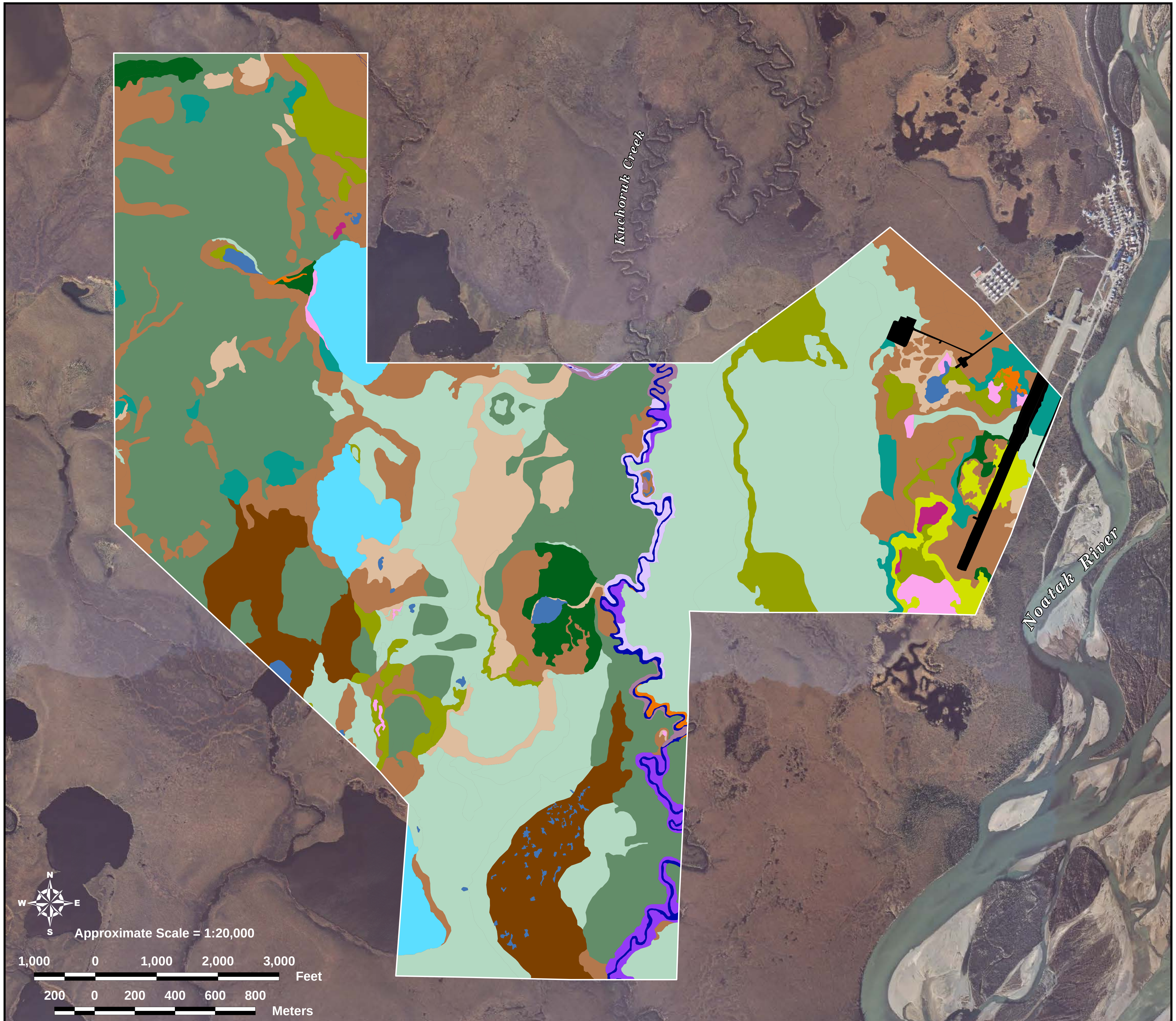

Habitat Type

- Lowland Aquatic Marsh/Pond Complex
- Lake
- Pond
- Stream
- Riverine Low Scrub
- Riverine Tall Scrub
- Riverine Needleleaf Forest
- Lowland Aquatic Marsh
- Lowland Wet Tundra
- Lowland Moist Tundra
- Lowland Moist Meadow
- Lowland Tussock Tundra
- Lowland Tall Scrub
- Lowland Low Scrub
- Lowland Low Scrub/Wet Tundra Complex
- Lowland Bog
- Lowland Needleleaf Forest
- Lowland Needleleaf Woodland
- Human Gravel Fill

Notes:
Background imagery: true-color photography acquired October 2005 by AeroMap U.S.
Map projection: ASP Zone 7, NAD83, US foot

Wetlands Determination and Habitat Assessment of Noatak Airport, Alaska

Figure 4. Habitat Types

map prepared by:
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