MUSTANG DEVELOPMENT PROJECT

WETLAND FUNCTIONAL ASSESSMENT AND CATEGORIZATION REPORT

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Prepared for:

Brooks Range Petroleum Corporation

510 L St., Suite 601
Anchorage, AK 99501

Prepared by:

oasis ENVIRONMENTAL

An ERM Company
825 W. 8th Ave.
Anchorage, AK 99501

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ACRONYMS AND ABBREVIATIONS

ACP .... Arctic Coastal Plain
ACS .... Alaska Clean Seas
ADFG........................... Alaska Department of Fish and Game
ADNR........................... Alaska Department of Natural Resources
BRPC........................... Brooks Range Petroleum Company
Corps Manual............... 1987 Corps of Engineers Wetland Delineation Manual
CFR .... Code of Federal Regulations
CWA .... Clean Water Act
DS................................ drill site
EIS .... Environmental Impact Statement
EPA.............................. United States Environmental Protection Agency
GIS............................... Geographic Information System
HDR .... HDR, Inc.
JD .... Jurisdictional Determination
KRU .... Kuparuk River Unit
MDP............................. Mustang Development Project
NRCS........................... National Resources Conservation Service
NWI.............................. National Wetlands Inventory
NSB .... North Slope Borough
OASIS.......................... OASIS Environmental, Inc., an ERM company
PJD .... Preliminary Jurisdictional Determination
PTP.............................. Point Thompson Project
Regional Supplement... Alaska Regional Supplement to the 1987 Corps Manual
SMU............................. Southern Miluveach Unit
T&E.............................. Threatened and Endangered Species
USACE......................... United States Army Corps of Engineers
USFWS........................ United States Fish and Wildlife Service
USGS........................... United States Geologic Survey

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1. INTRODUCTION

Brooks Range Petroleum Corporation (BRPC) is proposing to develop the Mustang Field, an oil and gas reservoir located in the Southern Miluveach Unit (SMU and adjacent to the western unit boundary of the Kuparuk River Unit [KRU] (Figure 1). The proposed Mustang Development Project (MDP) will include a processing center to produce sales quality oil for transport to the Alpine common carrier pipeline system, located south of the proposed project. All aspects of the proposed MDP, including infrastructure, roads, pads, and the gravel mine, could impact wetlands through the placement of gravel fill (see the *Mustang Development Project Request for Approved Jurisdictional Determination Report* [OASIS 2012b] for a description of all project components project location map).

This report presents the process of categorizing wetlands within the MDP into United States Army Corps of Engineers (USACE) functional classification categories, per the USACE Alaska District Regulatory Guidance Letter RGL-09-01, (USACE 2009). The classification process described in this report involves two primary steps:

1. Wetland functional assessment: each wetland within the project area is evaluated for its ability to perform one or more pre-defined functions, related to water quality, water quantity and habitat.
2. Wetland categorization: to determine the appropriate level of mitigation required for the project, wetlands are evaluated and assigned to one of the more traditional USACE categories (per USACE 2009), intended to describe the ecological service provided by wetlands to the overall landscape or ecosystem. The categorization system used by USACE contains four categories, I-IV, with category I being the highest functioning wetlands and category IV being degraded and low functioning wetlands (USACE 2009).

Accordingly, the methods and results sections of this report are each separated into a “Functional Assessment” section and a “Categorization” section. The wetland categorization described in this report will be used to determine the level of compensatory mitigation (e.g. debts and credits) required for permitting of the MDP, as described in the compensatory mitigation statement included in the Mustang Development Project Section 404 application package (OASIS 2012c).

This functional assessment and categorization report is associated with the following reports being completed by OASIS in support of permitting efforts for the MDP:

- The Mustang Development Project Request for Approved Jurisdictional Determination (OASIS 2012b) summarizes the 2011 wetland delineation and mapping, and vegetation classification efforts, using field and desktop (Geographic Information Systems [GIS]) methods, as well as the anticipated jurisdictional status of assessment area wetlands. Delineation, classification and mapping data from that report was used as input for the functional assessment model described in this report.

- MDP's compensatory mitigation statement submitted in support of its Section 404 application (OASIS 2012c), describes steps taken by MDP to comply with USACE compensatory mitigation requirements. The categorization results presented in this report were used to calculate the compensatory mitigation offsets required for permitting of the MDP.
- The Mustang Development Project Environmental Report (OASIS 2012a) is a comprehensive assessment of the biological resources in the project area.

1.1. Regulatory Requirements

Under Section 404 of the Clean Water Act (Section 404), activities that adversely affect wetlands and aquatic resources must be authorized through a Section 404 permit issued by USACE, and adverse impacts must be mitigated to the extent practicable. Wetland functional assessments are required as per general policies associated with USACE Section 404 permits (33 Code of Federal Regulations [CFR] 320), and the United States Environmental Protection Agency's (EPA) 404(b)(1) guidelines for specification of disposal sites for dredged or fill material (40 CFR 230). In addition, the Final Rule on Compensatory Mitigation for the Losses of Aquatic Resources (USACE 2008) governing compensatory mitigation for activities authorized by Section 404 permits went into effect in 2008, requiring developments to avoid, minimize, and compensate for unavoidable impacts to aquatic resources. The USACE Alaska District Regulatory Guidance Letter RGL-09-01, (USACE 2009) further defined the Alaska District application of Final Rule (USACE 2008) with regards to compensatory mitigation. USACE 2009 states that a wetland functional assessment is also important to the wetland evaluation process because the "Alaska District will determine what level of mitigation is appropriate based upon the functions lost or adversely affected by permitted activities" (USACE 2009).

1.2. Study Area

MDP is located in Alaska's Arctic Coastal Plain (ACP) eco-region (United States Geological Survey [USGS], 1995), a poorly-drained, treeless coastal area that rises gradually from sea level to the northern foothills of the Brooks Range. The nearly level to gently rolling topography is underlain by thick permafrost, one to four feet below ground surface. This relatively impermeable permafrost acts as a shallow aquitard, creating a generally moist to wet environment with numerous ponds and lakes (as observed within the proposed project area).

The 2,014 acre area investigated for the proposed MDP spans approximately nine kilometers, and ranges from 500 to 1,500 meters wide, between the Tarn/Meltwater Road near DS2M and west to the Miluveach River (Figure 1). The "assessment area" (wetland mapping, functional assessment and categorization area) includes all of the proposed project infrastructure, proposed gravel mine, access roads, as well as potential alternatives, and a surrounding "buffer area" (extending a minimum of 250-meters from proposed infrastructure centerlines) that may be affected by project activities (Figure 1). The wetland assessment area was slightly larger than the buffered project area and alternative road corridor. This was because the wetland assessment area included additional areas in the project vicinity, such as the area between the proposed and alternative road alignments in the eastern portion of the project area.

Note that proposed and alternative alignments have changed since the original field assessment, and a proposed gravel mine has been added north of the project area, thus there are wetland determination points located outside of the current assessment area.

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2. FUNCTIONAL ASSESSMENT METHODS

Wetland functions are the natural chemical, physical and biological processes occurring within a wetland, and between a wetland and adjacent non-wetland areas, that support overall ecosystem processes. Commonly-assessed wetland functions include the ability to moderate or convey floods, or to provide habitat for sensitive wildlife or plant species. Due to variables such as geomorphology, primary water source, and plant and animal communities, not all wetlands perform these functions equally.

Since many wetland functions are difficult and time-consuming to measure directly, ecosystem characteristics (e.g. vegetation, hydrologic regime, soil and landscape variables) have traditionally been used as a guide to determining wetland function. Functional assessments are typically done at the scale of an individual wetland, where wetland characteristics are documented in the field, and the presence or absence of each function is assigned. However, in the case of large project areas or abundant wetlands, the presence or absence of particular wetland functions can be modeled in a GIS using an integration of field data and digital spatial data. This modeling approach, rather than the more traditional field approach, was used for the MDP wetlands functional assessment presented in this report.

Numerous wetland functional assessment methodologies exist (e.g. Adamas et al. 1987), but few are applicable to the unique high-latitude environment of Alaska. Additionally, few functional assessments have been performed on Arctic Coastal Plain wetlands. Because of the lack of an established, USACE-endorsed functional assessment modeling method for use in the project area, OASIS looked to other similar projects on the Arctic Coastal Plain on which to base our functional assessment and categorization approach. The Point Thompson Project (PTP), a proposed oil and gas development located along the coast of the North Slope (www.pointthompsonprojecteis.com), is located in a very similar environment, with the same wetlands and vegetation types as the Mustang Development Project (with the exception of the coastal vegetation found in the PTP study area). HDR Inc. (HDR), the third-party PTP Environmental Impact Statement (EIS) contractor, developed and performed a functional assessment of the wetlands associated within the PTP using a GIS-based modeling approach, as part of the EIS process (Point Thompson Project EIS [USACE 2011], Appendix K, Wetland Functional Assessment [HDR 2011]). The HDR (2011) functional assessment for PTP was a GIS-based modeling exercise using land cover classifications (Walker [1983] vegetation types) of the entire project area, including field verification of vegetation types and professional judgment.

Each function and its respective indicators evaluated by HDR for PTP were reviewed and approved by the USACE and are fully described in the Point Thomson DEIS (Appendix K of the EIS [HDR 2011]). In addition, OASIS completed the categorization of the wetlands within the PTP for compensatory mitigation purposes, per the USACE Alaska District Regulatory Guidance Letter RGL-09-01, (USACE 2009), using the outputs from HDR's PTP functional assessment modeling. Due to the USACE's acceptance of the HDR (2011) functional assessment for use on the PTP, and OASIS's familiarity with the method through completion of the wetlands categorization for PTP, the BRPC Mustang Development Project evaluated wetland functions using the same methodology developed for the Point Thomson Project (HDR 2011).

The HDR PTP functional assessment methodology determined the presence and aerial extent of each function based on one or more function-specific indicators (i.e., the presence of wetter vegetation types would indicate the presence of the "waterbird support" function). The approach was largely based on existing datasets with discretionary selection of individual functions or indicators using best professional judgment. In contrast to other wetland functional assessment methods (e.g. Adamus et al. 1987), the purpose of this functional assessment evaluation was to ascertain a given wetland's capacity to perform a given function, and not whether it is actually performing the function at the time of the assessment.

Due to several factors, including the smaller size of the project area and the lack of large river, or coastal/marine habitats, the BRPC functional assessment method deviated from the HDR (2011) method in certain ways. For example, only Walker codes that were present within the MDP project area were included in the model descriptions below (i.e., no coastal/marine Walker codes were included in the descriptions). In addition, the HDR model subdivided the depressional basins into three basin types, while this project compiled all basins into a single depressional basin type. Further deviations from the HDR (2011) method are described in more detail in each of the function description sections that follow.

Eleven ecological functions were assessed for MDP wetlands. The definition of each function, model inputs, and any modifications that were made from the HDR (2011) method, are described in detail below in Section 2.3 (Functions Evaluated). Function definitions are taken directly from the HDR (2011) method. Please see HDR (2011) for a more detailed description of the rationale for the development of each function.

1. Flood Flow Moderation and Conveyance
2. Shoreline and Bank Stabilization
3. Maintenance of Natural Sediment Transport Processes
4. Production and Export of Organic Matter
5. Maintenance of Soil Thermal Regime
6. Waterbird Support
7. Terrestrial Mammal Support
8. Fish Support
9. Threatened or Endangered Species (T&E) Support (Polar bears)
10. T&E Species Support (Spectacled eiders)
11. Scarce and Valued Habitats

2.1. Functions Not Evaluated

The Alaska District Regulatory Guidance Letter RGL-0901 (USACE 2009) lists additional functions that are not evaluated as part of this functional assessment.

- Nutrient and toxicant removal and sediment retention: Because the project area is located in a relatively pristine watershed, there are currently no un-natural sources of nutrients, toxins or sediment. The HDR (2011) method was designed to evaluate the existing performance of a function (which is not applicable for this function), not the potential to perform a function.
- Native plant richness: Plant biodiversity is assessed primarily as part of the Scarce and Valued Habitats function listed above, which captures *Arctophila fulva* wetlands, as regionally-unique (although not necessarily "diverse") habitats. Furthermore, because wetlands are so ubiquitous on the North Slope of Alaska, non-wetland habitats are often characterized by more unique and more diverse plant communities, as they are dominated by non-wetland plants that are not found in the surrounding wetlands.
- Educational or scientific value: Due to the remote location of the project area on the North Slope, there is no specific, direct educational or scientific value of the wetlands within the project area.

2.2. Development of GIS Input Layers

In addition to existing digital spatial data (e.g. contour lines, topographic mapping, hydrography, USFWS NWI mapping and NRCS soils mapping), four additional GIS layers were created as input for the functional assessment modeling: (1) wetland mapping layer, (2) floodplain layer, (3) basins layer, and (4) polar bear and brown bear denning habitat layer.

2.2.1. Wetland Mapping Layer

Wetlands and waters within the entire assessment area were mapped using a combination of desktop and field techniques. This wetland mapping layer was used for all other wetland reports, including the jurisdictional determination report, the Section 404 application, and the Environmental Report. As part of the 2011 wetland delineation effort, field data was collected to map vegetation community types and boundary locations. Vegetation throughout the assessment area was mapped to Level C of Walker's (1983) hierarchical vegetation classification ("Walker") (Figure 2, Table 1), which describes communities based on site moisture regime, dominant plant growth form, and physiognomic descriptor. This level of mapping relies on aerial photo interpretation with extensive ground reference data. Thirty field determination points were established within the proposed project corridor and alternate corridor, to groundtruth the desktop vegetation mapping. At each determination point, a wetland determination was completed using USACE (1987, 2007) standard wetland delineation methods. In an effort to classify vegetation using Walker (1983), the following vegetation data was collected at each determination point: plant species and percent cover, dominant growth forms (e.g. sedge, dwarf shrub, forb, etc.), site moisture regimes (dry, moist, wet, or aquatic), and physiognomy (e.g. tundra, sand dunes). Desktop analysis was then used to complete the vegetation mapping effort, and included an analysis of determination point data, existing vegetation mapping, NWI mapping, aerial photographs and surface hydrology data. USFWS NWI (Cowardin 1979) class codes, and hydrologic modifiers, were also assigned to each wetland polygon.

For the purposes of mapping within the project area, wetland or vegetation types were based on the predominant ecosystem and vegetation of the wetland as a whole and not necessarily narrow bands or inclusions of other wetland/vegetation types or uplands. Most habitat in the project area consisted of mosaics of wetland/vegetation types. Dominant vegetation types were typically used to characterize habitats, but sometimes a combination of vegetation types was used to describe habitat within the project area, with multiple vegetation communities comprising a single wetland type.

Fourteen Walker (1983) "vegetation" types were identified within the MDP assessment area (Figure 2 and Table 1). Of these, ten were actual vegetation types. The remaining four were non-vegetated classes (waterbodies, river gravels, barren mud and gravel pads/roads). For the purpose of this assessment, the waterbody vegetation type (Ia) initially mapped during the field effort, was further parsed into three water codes, streams/rivers (Ia2), lakes (lentic habitats greater than 20 acres, Ia3), and ponds (lentic habitats less than 20 acres, Ia4), resulting in a total of 16 Walker codes that were used in the assessment. Two types of non-wetlands (uplands) were identified in the assessment area (Figure 2: a small pingo classified as Walker code Vc vegetation located in the eastern portion of the project area, and an existing gravel pad and road).

TABLE 1: ACREAGES OF NWI CLASS, HYDROLOGY MODIFIER (COWARDIN 1979) AND WALKER (1983) VEGETATION CLASSES

Walker Clasification Level C	Description	NWI Class/ Subclass	NWI Hydro Modifier	Cumulative Assessment Area	
				Acres	Percent
Ia2	Rivers/streams	R2UB	H	4.4	0.2%
Ia3	Lakes: waterbodies >20 acres	L1UB	H	0.8	0.0%
Ia4	Ponds: waterbodies > 20 acres, lacking vegetation	PUB	H	65.1	3.2%
IIa	Shallow water: shallow ponds w/aquatic vegetation	PAB	H	26.7	1.3%
IId	Water/Tundra Complex (pond complex)	PEM1	F	4.2	0.2%
IIIa	Wet Sedge Tundra	PEM1	E, F, H	68.4	3.4%
IIIc	Wet Sedge Tundra/Water Complex (pond complex)	PEM1/AB	F, H	344.5	17.1%
IIId	Wet Sedge/Moist Sedge. Dwarf Shrub Tundra Complex (wet patterned-ground complex)	PEM1/SS1	B, E, F	670.1	33.3%
IVa	Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex (moist patterned-ground complex)	PEM1/SS1	B, E	584.8	29.0%
Va	Moist Sedge, Dwarf Shrub Tundra	PEM1/SS1	B	25.2	1.3%
Vb	Moist Tussock Sedge, Dwarf Shrub Tundra	PEM1/SS1	B	196.6	9.8%
Vc	Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra)	U		1.4	0.1%
Ve	Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar complex)	PSS1/EM1	B	10.4	0.5%
Xa	River Gravels	R2US	C	7.8	0.4%
Xe	Gravel Roads and Pads	U		1.8	0.1%
XIa	Wet Mud	PUB	E	1.8	0.1%
			Total	**2014.0**	

2.2.2. Floodplain Layer

Floodplain delineation differed from the HDR (2011) PTP method in that the MDP method did not create initial stream buffers based on distance from the stream, to be used as part of floodplain delineation. Rather, the floodplain layer was created using the aerial photo, two-foot topographic contours, and best professional judgment, to extract (copy) all of the polygons from the wetlands mapping layer (Section 2.2.1) that were located directly adjacent to the Miluveach River, or low-lying areas that were assumed to be flooded during high water events. Floodplain polygon boundaries were located at visible break points between the floodplain and higher terraces. The floodplain layer did not include the active river (Ia2) polygons, but did include the river gravels (Xa). No hydrologic modeling was done to model the floodplain.

2.2.3. Basins Layer

A single basins layer, consisting of two depressional basin areas was identified within the assessment area, using the aerial photo and the two-foot topographic contours. All moist/wet vegetation types (Walker codes II, III and IV) that were located within these depressional basins were extracted from the wetland mapping layer (as described in Section 2.2.1). In addition, three moist/dryer wetland polygons (Walker code V) that were located within the lake basin in the eastern portion of the project area were also included in the basins layer, because of their location in a topographic low area of the lake basin. Walker code V polygons were excluded from the other basin, located in the middle of the project area, because they were located on convex, topographic high areas on the landscape.

The method of developing the depressional basins layer described above was a simplified version of the HDR (2011) for developing the basin layers. As described above, the HDR (2011) method subdivided the depressional basins into three basin types: (1) drained lake basins: wet vegetated wetlands with low vegetation/water interspersion; (2) basin wetland complexes: wet vegetated wetlands with high vegetation/water interspersion (25-75% interspersion); and (3) lakes with banks: depressional basins with discernible banks. Due to the limited project area, and in turn limited vegetation types, this method did not differentiate low versus high vegetation/water interspersion for determination of drained lake basins versus basin wetland complexes. In addition, only a single “lake with bank” was identified within the project area. Therefore, the two depressional basin areas identified within the project area were included in a single feature class called “basins.”

2.2.4. Polar Bear and Brown Bear Denning Habitat Layers

Potential polar bear denning habitat within the project area was identified using the GIS layer of polar bear denning habitat modeled by USGS (Durner et al. 2001). No denning habitat lines were added or deleted, but lines were edited to better match the topography, based on the aerial photo and two-foot topographic contour lines.

Brown bear denning habitat used the USGS polar bear denning habitat lines (Durner et al. 2001), and added a limited number of additional lines to better represent brown bear denning habitat. These additional denning lines were added based on three-year study conducted by the Alaska Department of Fish and Game (ADFG) (Shideler 2012) that found brown bears 1) preferentially select southwest-facing locations due to their likelihood of more reliably accumulating snow drifted by the northeasterly prevailing winds common on the North Slope, and 2) select pingos for denning at a much higher proportion than their availability on the landscape. Thus, in addition to the modeled polar bear denning habitat (Durner et al. 2001), the southwest-facing side of two pingos in the eastern portion of the project area, as well as a southwest-facing terrace along the Miluveach River floodplain were also included as potential brown bear denning habitat. The polar bear and brown bear denning habitat lines were then buffered by 50 feet to create a polygon layer of denning habitat for each bear species.

2.3. Functions Evaluated

The following functions were evaluated for the MDP.

2.3.1. Hydrologic Functions

2.3.1.1. Flood Flow Moderation and Conveyance

Definition: "A wetland's capacity to reduce flood peak flows in streams by temporarily storing or slowing water passage en route to stream channels, or by retaining the water without later release downstream. This function does not include the absorption of snowmelt and precipitation in soil" (HDR 2011).

Flood flow conditions primarily exist during the period of spring break-up when vegetation is largely dormant and soils remain frozen. The Miluveach River is the only river or stream within the project area. This function is therefore assigned to all floodplain wetlands associated with the Miluveach River, including river gravels, all vegetated wetlands, and shallow ponds, as these areas would be expected to detain and slow flood waters. Much of the central portion of the project area consists of a large depressional basin. A depressional basin is also associated with a lake in the eastern end of the project area. These depressional basins were also assigned this function, as they would be expected to detain water flowing from south to north, during spring and summer high flow events.

Model:

Included: [floodplain polygons + basins]

Excluded from above: Xe (gravel pads and roads)

Modifications from HDR Model: The HDR (2011) model included all three depressional basin types for the flood flow moderation and conveyance model (drained lake basins, basin wetland complexes, and lakes with banks), while the MDP functional assessment method included a single depressional basin type which was a conglomerate of the three HDR (2011) basin types.

2.3.1.2. Shoreline and Bank Stabilization

Definition: "Wetland vegetation's role in binding substrates and dissipating erosive forces of moving water in the form of waves and stream bank overflow…" (HDR 2011).

This function primarily focused on soil binding and stabilization occurring within the root zone of plants, which limit erosion. Similar to flood flow moderation, high flow events are primarily seasonal during the period of spring break-up. Frozen soils dominate the landscape during this period of high flow. This physical characteristic of the landscape (frozen soils) is likely more responsible than the identified biological function (rooted plants) in providing shoreline and bank stabilization during spring break-up. However, spatial permafrost data is not available digitally at a resolution usable for modeling shoreline and bank stabilization, therefore all wetlands located along streams and shorelines were assumed to have the capacity to contribute to shoreline and bank stabilization.

Specifically, this function was assigned to the vegetated habitats within the shorelines and banks present within the project area, which are associated exclusively with the Miluveach River, and the single lake in the central portion of the project area. River gravels, ponds, shallow water habitats, and the Miluveach River and the lake itself, were excluded from the model, as these unvegetated habitats would contribute minimally, if at all, to stabilizing the lake shoreline or river bank.

<u>Model:</u>

Included: [floodplain polygons + 30 ft buffer around lake]

Excluded from above: Ia4 (ponds); IIa (shallow water)

<u>Modifications from HDR Model:</u> A single Ia3 (lake >20 acres) polygon existed within the project area, and Walker code IIId was the only vegetation type within 30 feet of the lake. Therefore, it was not necessary to indicate which Walker codes to include near lakes. Walker code IIa (shallow water) was not mapped as part of the HDR (2011) effort. These shallow water areas would not contribute to the shoreline and bank stabilization function and were thus excluded from the assessment of this function.

2.3.1.3. Maintenance of Natural Sediment Transport Processes

<u>Definition:</u> "The natural process of entrainment of particulates by flowing water, transport of particulates to downstream and coastal areas, and deposition of suspended particulates generated at natural sources. This function does not include capture or retention of airborne particulates or coastal sediment transport processes" (HDR 2011).

<u>Model:</u>

Included: [floodplain polygons]

Excluded from above: nothing within the floodplain polygon was excluded

<u>Modifications from HDR Model:</u> No modifications were made to the model inputs of this function.

2.3.2. Biogeochemical Functions

2.3.2.1. Production and Export of Organic Matter

Definition: "A high-level of production of organic carbon via photosynthesis and consumption of that material by microbes, and subsequent flushing of this organic matter to downstream ecosystems where it may support various trophic pathways. This definition does not include transport of organic materials during the early snowmelt period of widespread sheetflow across the tundra" (HDR 2011).

This function was assigned to (1) vegetated wetlands with a surface water outlet, (2) all vegetated wetlands within the Miluveach River floodplain, (3) vegetated, flooded wetlands (Walker codes II and III) adjacent to the floodplain, (4) vegetated wetlands within the depressional basins, and (5) the Miluveach River (Ia2). While all vegetated wetlands were included if they were within the floodplain, only wetlands that were flooded for a portion or all of the growing season (Walker codes II and III) were included if they were adjacent to, but not within, the floodplain, as only flooded wetlands would have the necessary connection to the stream for organic matter export.

Shallow water habitats (IIa) were included as "vegetated wetlands", as they typically supported a certain amount (although limited) of aquatic vegetation. In contrast, lakes and ponds (Ia3 and Ia4) which are characterized by sediment bottoms, and did not generally support aquatic vegetation except in limited littoral areas along pond edges were not included in the analysis. In addition, such lentic habitats (lakes and ponds) would be more likely to entrain organic matter rather than to export it to downstream wetlands. Therefore, ponds and lakes were excluded from this function as they contribute only minimally to the production and export of organic matter. The Miluveach River was considered instrumental to this function within the assessment area because it was the primary means of export of organic matter from assessment wetlands, to downstream wetlands.

Model:

Included: [vegetated wetlands w/surface outlet] + [floodplain polygons] + [Walker code II and III polygons adjacent to floodplain] + [basins with surface water outlet] + Ia2 (Miluveach R)

Excluded from above: Ia4 (ponds); Xa (river gravels)

Modifications from HDR Model:

- The HDR model included only "flooded productive" wetlands (Walker codes II and III) within the floodplain. This model did not make this distinction, because the Miluveach River floodplain (the only floodplain in the project area) contained only wetlands that would be flooded at some point during the growing season (Walker codes II and III), and no moist/dry wetlands (Walker code V).
- The HDR model included only Walker codes II and III as part of the depressional basins layer. This project included Walker code IV (moist patterned ground complex) as a transitional habitat, consisting of a mosaic of moist and flooded

vegetation. Therefore, Walker code IV was also included in the depressional basins layer, and was considered to contribute to the production and export of organic matter.

- The HDR model excluded any of the moist/dry habitats (Walker code V) from this function, as they were not considered to export organic matter sufficiently to downstream wetlands. In contrast, this model included three well-drained moist/dry (V) habitats in one of the depressional basins located in the headwaters of a lake basin in the eastern portion of the project area, as these habitats would likely export organic matter during subsequent high water events following spring breakup when the lake basin was full.

2.3.2.2. Maintenance of Soil Thermal Regime

Definition: "The role of wetland soil and vegetation in maintaining a stable soil thermal regime, as indicated by presence of permafrost, surface topography, and soil moisture typical of the site's plant community. Loss of this maintenance function would be indicated by development of thermokarst, or thaw of permafrost, ground subsidence, drainage into the thawed area, drainage of adjacent areas, and proliferation of thawing and collapse conditions" (HDR 2011).

The presence and condition of permafrost is the defining characteristic of the Arctic Coastal Plain, and permafrost and vegetation are intrinsically linked in this environment. Vegetation is a key component influencing the thermal regime associated with permafrost conditions. Similarly, permafrost conditions are a key in determining the type of vegetative communities present. Moist to wet (but not ponded) wetlands with dense groundcover (Walker codes IIIa, IIId, Iva, Va, Vb) contribute to the maintenance of the soil thermal regime. Studies indicate that the maintenance of permafrost is directly related to the depth and density of vegetation groundcover and organic matter within the active layer, as well as with the soil moisture regime (Walker et al. 2003). Dense vegetation and organic matter insulates permafrost, decreasing the active layer, while wetter, ponded environments provide poorer insulation than non-ponded environments. Therefore wetter habitats (e.g. Walker code IIa, IId, and IIIc) with ponded water for most of the growing season, as well as dryer habitats with sparser vegetation or areas of bare ground (Walker codes Vc and Ve), were not included in this model.

Model:

Included: [Walker codes IIIa, IIId, IVa, Va, Vb]

Modifications from HDR Model: No modifications were made to the model inputs of this function.

2.3.3. Habitat and Faunal Community Support Functions

2.3.3.1. Waterbird Support

Definition: "Capacity of a wetland or waterbody to provide a high or moderate level of support to waterbird species" (HDR 2011). Spectacled eider support is evaluated separately in the T&E species (spectacled eider) function.

The waterbird support function includes all wet, flooded, ponded, and open water habitats within the project area that would be expected to provide breeding, nesting, rearing, and forage habitat to waterbirds during the breeding and migration staging seasons (see the USFWS 2010 guidance document (as cited in HDR 2011) for details on waterbird species-habitat associations in Northern Alaska). Although the assessment area does not include estuary, marine or nearshore habitats that are important to waterbirds, the large 200-400 acre lakes surrounding the assessment area also provide open water habitat for birds. This function was assigned to the single lake polygon in the central portion of the project area, as well as all ponds, emergent marshes and wet vegetated wetlands (Walker codes II and III, including *Arctophila* wetlands), as well as the depressional basin complexes.

Model:

Included: [lakes (Ia3) and ponds (Ia4)] + [emergent marshes/*Arctophila* wetlands (IIa, IId)] + [wet vegetated wetlands (IIIa, IIIc, IIId)] + [depressional basins]

Excluded from above: Xe (gravel pads/roads)

Modifications from HDR Model:

- The HDR (2011) model included only ponds (Ia4) associated with emergent wetlands or wet vegetated wetlands (Walker codes II or III). Because the initial wetland mapping was completed using a poor-quality aerial, we included all ponds in an effort to not inadvertently exclude ponds located in polygons mistakenly coded as a vegetation type other than Walker code II or III.
- The HDR (2011) model included only Walker codes II and III as part of the depressional basins layer. This project included Walker code IV (moist patterned ground complex) as a transitional habitat, consisting of a mosaic of moist and flooded vegetation. Therefore, Walker code IV was also included in the depressional basins layer, and was considered to contribute to waterbird support by providing breeding and rearing habitat for several waterbird species.
- The HDR (2011) model excluded any of the moist/dry habitats (Walker code V) from this function, as they were not considered to export organic matter sufficiently to downstream wetlands. In contrast, the MDP model included three well-drained moist/dry (Walker code V) habitats in one of the depressional basins located in the headwaters of a lake basin in the eastern portion of the assessment area, as these habitats would likely provide breeding and rearing habitat due to its location within the lake basin and proximity to the lake.

2.3.3.2. Terrestrial Mammal Support

Definition: "The capacity to support denning, foraging, movement and insect escapement behavior of terrestrial mammals of cultural or subsistence interest. Polar bears are not considered under this function but are considered in Threatened or Endangered Species Support" (HDR 2011).

The public scoping for the Point Thompson Project Draft Environmental Impact Statement (USACE 2011) identified caribou, muskoxen and brown bears as terrestrial mammal species of cultural and/or subsistence interest within the Point Thompson Project area. Because the Mustang Project area is also located in a very similar environment on the North Slope as the Point Thompson Project, it was assumed that the same terrestrial mammal species would be of cultural and subsistence interest. Therefore, this function was assigned to wetlands providing habitat for foraging, movement, and insect escapement behavior for caribou, muskoxen, and brown bears, as well as denning habitat for brown bears. The Miluveach River and associated floodplain, including the active channel (Walker code Ia2), river gravel bars (Walker code Xa), for their support of movement and travel. The Miluveach River active channel and river bars would also be expected to provide a certain degree of refuge from insects (Reynolds 2012), although less than might be provided by larger rivers on the North Slope. Caribou tracks were noted as common on the river gravels along the Miluveach River during the wetland investigation.

Caribou and muskoxen distribution studies conducted on the North Slope of Alaska have not documented a strong correlation between vegetation type and forage habitat. Studies indicate that tussock tundra (Walker code Vb) is important forage habitat for these species. Research also indicates that on the North Slope, caribou and muskoxen preferentially use dryer vegetation types (Reynolds 2012). Therefore, all of the moist to dry tundra vegetation types (Walker codes IVa, Va, Vb, Vc, and Ve) are considered important for caribou and muskoxen and were assigned to this function, and wet and ponded habitats were not included in the model. Caribou were also observed in several other habitat types during the wetland investigation (Walker codes IIIa, IIIc, Iva, Va, Vb, and Ve), yet to maintain consistency with existing studies and the HDR method, we included only the moist/drier habitats that were considered to be more important for caribou foraging. The rational being that caribou likely travel through all vegetated habitats, but preferentially forage in the moist/drier areas. Muskoxen were not observed within the assessment area during the wetland evaluation.

A single brown bear was observed in the assessment area during the wetland evaluation. Polar bears and brown bears use similar denning habitat within the assessment area, denning along terraces, stream banks and pingos (Durner et al. 2001, 2003). However, because polar bears are listed as a T&E species, wetlands providing polar bear support are categorized as higher priority and were therefore evaluated under a separate T&E species function (described below). Potential brown bear denning habitat within the project area was identified using the GIS layer of polar bear denning habitat modeled by USGS (Durner et al. 2001). Additional denning lines were then added to the Durner (2001) polar bear layer to better represent brown bear denning habitat, based on ongoing ADFG research of optimal brown bear denning habitat. This was based on a three-year study conducted by ADFG indicating brown bears 1) preferentially select southwest-facing locations due to their likelihood of more reliably accumulating snow drifted by the northeasterly prevailing winds common on the North Slope, and 2) select pingos for denning at a much higher proportion than their availability on the landscape (Shideler 2012). Thus, in addition to the modeled polar bear denning habitat, the southwest-facing side of two pingos in the eastern portion of the project area, as well as a southwest-facing terrace along the Miluveach River floodplain were also included as potential brown bear denning habitat. The resulting potential brown bear denning habitat lines within the project area included terraces and bluff areas along the Miluveach River, and two large lakes, as well as stream banks, and two pingos, all buffered by 50 feet.

Model:

Included: [brown bear denning habitat lines buffered by 50 ft] + [moist/dry Walker codes (IVa, Va, Vb, Vc, and Ve)] + [Miluveach River floodplain] + [Miluveach River (Ia2)]

Excluded from above: Xe (gravel pads/roads)

Modifications from HDR Model:

- HDR (2011) used polar bear denning habitat as a surrogate for brown bear denning habitat; this model also added southwest-facing areas along pingos, stream channels and lake shores within the project area (as described above).
- HDR (2011) included only the floodplains of larger rivers originating in the Brooks Range in this function, and did not include the active channel of these rivers (Ia2). Because caribou tracks were commonly observed on the Miluveach River floodplain, and there were no large rivers located within the immediate vicinity of the project area, the Miluveach River and its floodplain was considered to provide habitat for movement and insect refuge for caribou, muskoxen and brown bears, and was therefore included in this function.
- In addition to the areas described above, HDR (2011) included only tussock tundra (Walker code Vb) in the terrestrial mammal support function. Based on communication with biologists indicating that all of the moist to dry vegetation types would be important for caribou and muskoxen within the project area, all of the moist to dry vegetation types were included in this model.

2.3.3.3. Resident and Diadromous Fish Support

Definition: “Wetlands and waterbodies known or suspected to directly support freshwater or diadromous fish by providing habitat at some life stage. Diadromous fish include both amphidromous and anadromous fishes, which migrate between freshwater and saltwater environments” (HDR 2011).

The Miluveach River is the only ADFG-listed waterbody (ADFG 2011) within the project area coded as a fish-bearing water in the ADFG GIS anadromous waters layer.

Therefore, the Miluveach River and its floodplain were assigned this function. In addition, the lake basin in the eastern portion of the project area is connected via a surface water connection to the Miluveach River, therefore all vegetation types within this lake basin were also assigned this function. No other streams, ponds or wetlands within the project area had a direct fish-bearing surface water connection to the Miluveach River, or to the Colville River (also an ADFG-listed anadromous water).

Model:

Included: [waterbodies (rivers/streams (Ia2), lakes (Ia3), ponds (Ia4)), w/direct surface water connection to an ADFG anadromous water] + [river/lake floodplains of waterbodies w/direct surface water connection to an ADFG anadromous water]

Excluded from above: Xe (gravel pads/roads)

Modifications from HDR Model: No modifications were made to the model inputs of this function.

2.3.3.4. T&E Species Support (Polar Bears)

Definition: "Wetlands and waterbodies… having the potential to provide polar bear denning habitat..." (HDR 2011).

Polar bears and brown bears use similar denning habitat within the project area, denning in snow drifts along terraces and stream banks (Durner et al. 2001, 2003). However, because polar bears are listed as a T&E species, wetlands with polar bear denning habitat are categorized as higher priority and were therefore evaluated under this separate T&E species function. Potential polar bear denning habitat within the project area was identified using the GIS layer of polar bear denning habitat modeled by USGS (Durner et al. 2001). Polar bear denning habitat lines within the project area included terraces and bluff areas along the Miluveach River, and two large lakes, as well as stream banks, all buffered by 50 feet. Note that due to a lack of coastal habitat, polar bear denning habitat for the MDP project area was a subset of the brown bear denning habitat lines, with brown bear denning habitat extending to include pingos and a few additional bluffs along the Miluveach floodplain.

Model:

Included: [USGS polar bear denning habitat lines buffered by 50 ft]

Excluded from above: Excluded from above: Xe (gravel pads/roads)

Modifications from HDR Model: The HDR (2011) model for this function included extensive polar bear habitat along the coast and barrier islands, which is not found within the MDP project area.

2.3.3.5. T&E Species Support (Spectacled Eiders)

Definition: "Wetlands and waterbodies known or suspected to provide important habitat to spectacled eiders…" (HDR 2011).

For the purpose of the MDP functional assessment, the Waterbird Support Function and the T&E Species Support (spectacled eider) functions are identical models, with identical inputs. In the HDR (2011) model the inputs and resulting outputs were distinguished (only slightly) by differences in inputs of certain Walker codes (e.g. vegetation types associated with coastal areas). These differentiating codes were not present in the Mustang project area, thus removing any distinction between the two models.

As with the waterbird support function, the spectacled eider function includes all wet, flooded, ponded, and open water habitats within the project area that would be expected to provide breeding, nesting, rearing, and forage habitat to spectacled eiders during the breeding and migration staging seasons (USFWS 1996). Although the project area does not include estuary, marine or nearshore habitats that are important to waterbirds, the large 200-400 acre lakes surrounding the project area provide high quality open water habitat. This function was assigned to: the single lake polygon in the central portion of the project area, as well as all ponds, emergent marshes and wet vegetated wetlands (Walker codes II and III, including *Arctophila* wetlands), as well as the depressional basin complexes.

Model:

Included: [lakes (Ia3) and ponds (Ia4)] + [emergent marshes/*Arctophila* wetlands (IIa, IId)] + [wet vegetated wetlands (IIIa, IIIc, IIId)] + [depressional basins]

Excluded from above: Xe (gravel pads/roads)

Modifications from HDR Model:

- The HDR model included only ponds (Ia4) associated with wet or moist pattered ground complex (Walker codes IIId and IVa). Because the initial wetland mapping was completed using a poor quality aerial, we included all ponds in an effort to not inadvertently exclude ponds located in polygons mistakenly coded as a vegetation type other than Walker code IIId and IVa.
- The HDR model included only Walker codes II and III as part of the depressional basins layer. This project included Walker code IV (moist patterned ground complex) as a transitional habitat, consisting of a mosaic of moist and flooded vegetation. Therefore, Walker code IV was also included in the depressional basins layer, and was considered to contribute to waterbird support by providing breeding and rearing habitat for several waterbird species.
- The HDR model excluded any of the moist/dry habitats (Walker code V) from this function. In contrast, this model included three well-drained moist/dry (V) habitats in one of the depressional basins located in the headwaters of a lake basin in the eastern portion of the project area, as these habitats would likely provide breeding and rearing habitat due to its location within the lake basin and proximity to the lake.

2.3.3.6. Scarce and Valued Habitats

Definition: "Habitats that are widely recognized as highly valuable on the Arctic Coastal Plain: … ponds supporting pendent grass, *Arctophila fulva*." (HDR 2011).

Arctophila fulva wetlands (Walker codes IIb and IId) are high value, scarce habitats that are becoming rarer on a regional and national scale (USFWS 2010).

Model:

Included: [Walker codes IIb and IId]

Excluded from above: No modifications were made to the model inputs of this function.

Modifications from HDR Model: The HDR model also assigned this function to brackish meadows associated with Beaufort Sea coastal marshes, which were not found within the MDP project area.

3. CATEGORIZATION METHODS

The functional assessment method described above ultimately determines whether a particular wetland has the capacity to perform a particular function, but does not rank or categorize each wetland into the category I, II, III, or IV required by the RGL-0901 (USACE 2009) for application to USACE compensatory mitigation. This section describes how the results of the functional assessment method were converted into the functional categories as defined by RGL 0901 (USACE 2009).

3.1. Category Determination

Categories were assigned to all assessment area wetlands based on the type and number of functions performed by individual wetlands, using the USACE RGL 09-01 guidance (USACE 2009), and experience with wetlands in the Arctic Coastal Plain. Categories for individual wetlands were adjusted to reflect the additive ecosystem services of wetlands performing multiple functions. The classification system used by the USACE (2009) guidance contains four categories:

- Category I – High Functioning Wetlands. These are valuable, high functioning wetlands that may be regionally rare, difficult to replace, and are generally less common than wetlands in other categories.
- Category II – High to Moderate Functioning Wetlands. These wetlands may provide habitat for very sensitive or important wildlife or plants; be difficult to replace; or provide very high functions, particularly for wildlife.
- Category III – Moderate to Low Functioning Wetlands. These wetlands can provide important functions and be important for a variety of wildlife. These wetlands are generally less diverse than Category II wetlands.
- Category IV – Degraded and Low Functioning Wetlands. These wetlands are typically the smallest, often isolated with very little vegetation diversity, and generally already degraded by human activities. Regional differences allow for a more narrow definition of this category.

Each function was assigned a category based on an understanding of habitat sensitivity and uniqueness within the landscape (Table 2). Categories assigned to each function, along with the rationale, are provided below. The highest category represented within a given wetland was assigned as the wetland's "base," or starting category (Table 2).

In addition to the discrete categorization of each function ("base category"), described below and presented in Table 2, additional value was provided to areas where multiple functions may overlap, recognizing the additive ecosystem services of wetlands supporting multiple functions.

The lands associated with the Project are relatively undisturbed and generally represent baseline conditions. Lands performing multiple functions were evaluated for the application of additional functional service credits. The majority of lands (about 67%) support between one and four functions out of the 11 functions that were evaluated. If a particular parcel supports four or fewer functions no additional credit was applied as this was considered commonplace within the landscape. Nearly 25% of lands support between five and seven functions. These lands were considered to be somewhat unique, and if a parcel supports five to seven functions the area was automatically elevated one category class above the highest rated function. About 7% of lands support eight to nine functions. These areas were determined unique and a bonus of two category levels was applied to any areas that met this criteria.

TABLE 2: BASE CATEGORY ASSIGNED TO EACH FUNCTION FOR WETLAND CATEGORIZATION

Wetland/Waterbody Function	Base Category
Resident and diadromous fish support	I
T&E Species support: polar bear	I
Scarce and valued habitats	I
Shoreline and bank stabilization	II
T&E Species support spectacled eider	II
Flood flow moderation and conveyance	III
Maintenance of natural sediment transport processes	III
Production and export of organic matter	III
Maintenance of soil thermal regime	III
Waterbird support	III
Terrestrial mammal support	III

The rationale for assignment of a base category to each wetland function is described below. The functions themselves (including wetland attributes that were assigned to each function) are described in Section 2, Functional Assessment Methods, above.

<u>Flood Flow Moderation and Conveyance</u>—Category III, Moderate to Low Functioning

The criteria and rationale used to ascribe this function were identified based on stream floodplains, ponds, and lakes in large topographic basins. The majority of land area within the coastal plain provides this function in the spring. Due to the distinct seasonality of flood flow conditions and prevalence of widespread overland flow due to minor topographic relief, this function was assigned to Category III.

<u>Shoreline and Bank Stabilization</u>—Category II, High to Moderate Functioning

It should be noted that lakes, streams, and rivers are transient across the landscape and the process of erosion is largely governed by thermal regime—a larger complex system that cannot be solely captured by the attributes of vegetative cover. Planning and mitigation for impacts to wetlands stabilizing banks is, however, essential. Once disturbance has been initiated in these areas, mitigating the impacts may be challenging due to ground ice and potential issues with thermokarst.

<u>Maintenance of Natural Sediment Transport Processes</u>—Category III, Moderate to Low Functioning

The moderate to low categorization of this function is primarily due to the limited sources of sediment input within or upstream of the project area on the Miluveach River. Mitigation to ensure proper conveyance along stream channels in the design of bridges and culverts is, therefore, important to maintaining the limited sediment inputs. Induced erosion and deposition adjacent to roadways has been observed to influence both natural sediment characteristics as well as channel migration and flow conditions.

Production and Export of Organic Matter—Category III, Moderate to Low Functioning

Similar to other described functions (flood flow moderation and bank stabilization) organic material transport is mostly likely to occur during high flow events—primarily during spring break-up. This function does not account for the period of spring break-up when material may be transported due to widespread sheet flow across the landscape. Mitigation for established stream flows remains important for this and other described functions.

Maintenance of Soil Thermal Regime—Category III, Moderate to Low Functioning

The presence and condition of permafrost is the defining characteristic of the Arctic Coastal Plain. Permafrost and vegetation are intrinsically linked in this environment. Vegetation is a key component influencing the thermal regime associated with permafrost conditions. Similarly, permafrost conditions are a key in determining the type of vegetative communities present. Mitigation is essential to maintain this balance whether it is to limit the degradation of permafrost in densely vegetated areas (wet and moist communities), or to protect more sensitive vegetation in areas of active thermokarst (high-centered polygons). Maintenance of the thermal regime is the defining function of the ecosystem. Because there do not appear to be any distinct or unique identifiers to limit the extent of this function across the landscape, it was assigned to the moderate to low functioning category.

Waterbird Support—Category III, Moderate to Low Functioning

Indicators for this function were based on USFWS classification of habitat types and include coastal marshes and barrens, emergent marshes, basin wetlands, patterned low-centered polygons, wet sedge meadows, high-centered polygons, and lakes. These indicators are unique and identify specific habitat types within the landscape to support a variety of species. The moderate to low ranking of these wetlands appeared appropriate due to the fact that these habitat types are not particularly scarce or limited across the Arctic Coastal Plain.

Terrestrial Mammal Support—Category III, Moderate to Low Functioning

Indicators for this function were identified as areas of known brown bear denning habitat, riparian corridors, tussock tundra, and moist to dryer tundra. Species of interest were brown bears, caribou and muskoxen. The Arctic Coastal Plain provides forage habitat for caribou and muskoxen with some preference for movement along river corridors and use of barren gravel bars for insect relief. Given the opportunistic and nomadic nature of these species across the entire Arctic Coastal Plain as well as their documented coexistence with other industrial operations in the region, the moderate to low functioning classification of identified wetlands is appropriate.

Resident and Diadromous Fish Support—Category I, High Functioning

This is one function that, when degraded, will have direct and immediate impacts on fish species present. Due to the generally high service level of streams, rivers, ponds and associated wetland habitat headwaters, a Category I rating is appropriate.

T&E Species Support—Spectacled Eider, Category II, High to Moderate Functioning

Habitats important to spectacled eiders were identified based on historical and ongoing scientific investigation and are discussed in detail in the Mustang Development Project Environmental Report (OASIS 2012a). Habitats that support spectacled eider were identified in the functional assessment based on aerial surveys of nesting eiders conducted on the Arctic Coastal Plain (Larned 2011), as well as on general species descriptions and life history characteristics described in the spectacled eider recovery plan (USFWS 1996). Nesting aerial surveys (e.g. Larned 2011) show that the highest density of spectacled eiders is found in northwestern Alaska (near Barrow and westward). These nesting surveys found that the density of eiders in the Project area was low to moderate (Larned 2011). As summarized in the Mustang Development Project Environmental Report (OASIS 2012a), the Project area is within the range of breeding spectacled eiders. A survey of the Kuparuk oilfield (Stickney 2010) documented individual eiders and nests just east and north of the project area.

The presence of nests and individuals at moderate concentrations in areas adjacent to the project area, coupled with the consideration that there is no terrestrial USFWS-designated critical habitat for spectacled eiders on the Arctic Coastal Plain, and that the long-term trend for the northern Alaska population is stable or slightly declining (Federal Register 2001), warrants a Category II ranking for wetlands performing this function within the Project area.

T&E Species Support—Polar Bear, Category I, High Functioning

Polar bear habitats were also identified based on modeled denning sites as well as specific habitat conditions (topography) that could support denning. As summarized in the Mustang Development Project Environmental Report (OASIS 2012a), review of den sites indicates that the number of bears denning in the immediate vicinity of the assessment area is likely low. Suitable denning habitat in the Project area will likely remain limited due to the relatively flat topography that is generally unsuitable for denning. However, the assumption adopted is that the limited habitat could be used, and a Category I ranking was therefore afforded to the identified polar bear denning habitat.

Scarce and Valued Habitats—Category I, High Functioning

Wetlands supporting Arctic pendant grass (*Arctophila fulva*) have been assigned this function. This functional class is unique in that the associated wetlands were identified based on their relative scarcity and/or widely recognized value to many species of wildlife—classification was less of a true functional assessment and more of an inclusion of unique habitats that have traditionally been recognized as high value.

4. RESULTS

4.1. Functional Assessment Results

Table 3 details the acreages of wetlands and waterbodies that were assigned each function that was evaluated in this assessment. The total assessment area was 2,014 acres. Of this, 2,011 acres were included in the functional assessment, slightly less than the total assessment area because non-wetland areas (gravel pads and roads, and the pingo) were not included in the functional assessment. Acreages presented in Table 3 sum to greater than the acreage included in the functional assessment, as most wetlands are predicted to perform multiple functions. Of the area included in the functional assessment, only approximately 0.2 acres were not assigned a single function. All other areas were modeled as supporting one or more functions. Figures 3 through 14 present the areas modeled as supporting each of the eleven functions.

Six individual functions were each performed in greater than 40% of the assessed area: T&E species support for spectacled eider, floodflow moderation and conveyance, production and export of organic matter, maintenance of soil thermal regime, and waterbird support (Table 3). In contrast, the remaining five functions were each represented in less than 10% of the project area.

TABLE 3. ACREAGES OF WETLANDS AND WATERBODIES PERFORMING EACH EVALUATED FUNCTION, AND THE ASSIGNED BASE CATEGORY

Wetland/Waterbody Function	Acres performing function	Percent of assessed area
Resident and diadromous fish support	153	8
T&E Species support: polar bear	19	1
Scarce and valued habitats	4	0.2
Shoreline and bank stabilization	108	5
T&E Species support spectacled eider	1321	66
Flood flow moderation and conveyance	881	44
Maintenance of natural sediment transport processes	115	6
Production and export of organic matter	1304	65
Maintenance of soil thermal regime	1545	77
Waterbird support	1321	66
Terrestrial mammal support	943	47

4.2. Categorization Results

Table 4 and Figure 14 present the results of the categorization of wetlands into USACE categories for the entire (cumulative) assessment area. Acreages of categories are also presented for the proposed and alternative project corridors as a point of information, but are not analyzed or discussed in this report; rather, this is discussed in the MDP Environment Report, Chapter 3 (OASIS 2012a). Note that the cumulative assessment area includes areas that were outside of the proposed and alternative project corridors, that were included in the assessment area for ease of wetlands mapping, for example because they were located between the two corridors, or were mapped as part of the initial assessment prior to reduction in the project area.

Thirty-two percent of the assessment area was modeled as category I wetlands, 34% as category II, 33% as category III, and only 0.01% was modeled as category IV. Category IV wetlands were those that were not assigned any function in the functional assessment.

TABLE 4: ACREAGES OF USACE FUNCTIONAL CATEGORIES WITHIN THE ENTIRE ASSESSMENT AREA, AND PROPOSED AND ALTERNATIVE PROJECT CORRIDORS

Final Category	Cumulative Assessment Area[1]		Proposed Project Corridor		Alternative Project Corridor	
	Acres	Percent	Acres	Percent	Acres	Percent
I	646	32	398	30	386	30
II	693	34	474	36	521	41
III	672	33	447	34	368	29
IV	0.27	0.01	0.00	0.00	0.24	0.02
Total	**2011**		**1318**		**1274**	

1: cumulative assessment area includes areas mapped that were outside the proposed and alternative corridors. Non-wetland areas were not assigned to a category

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FIGURES

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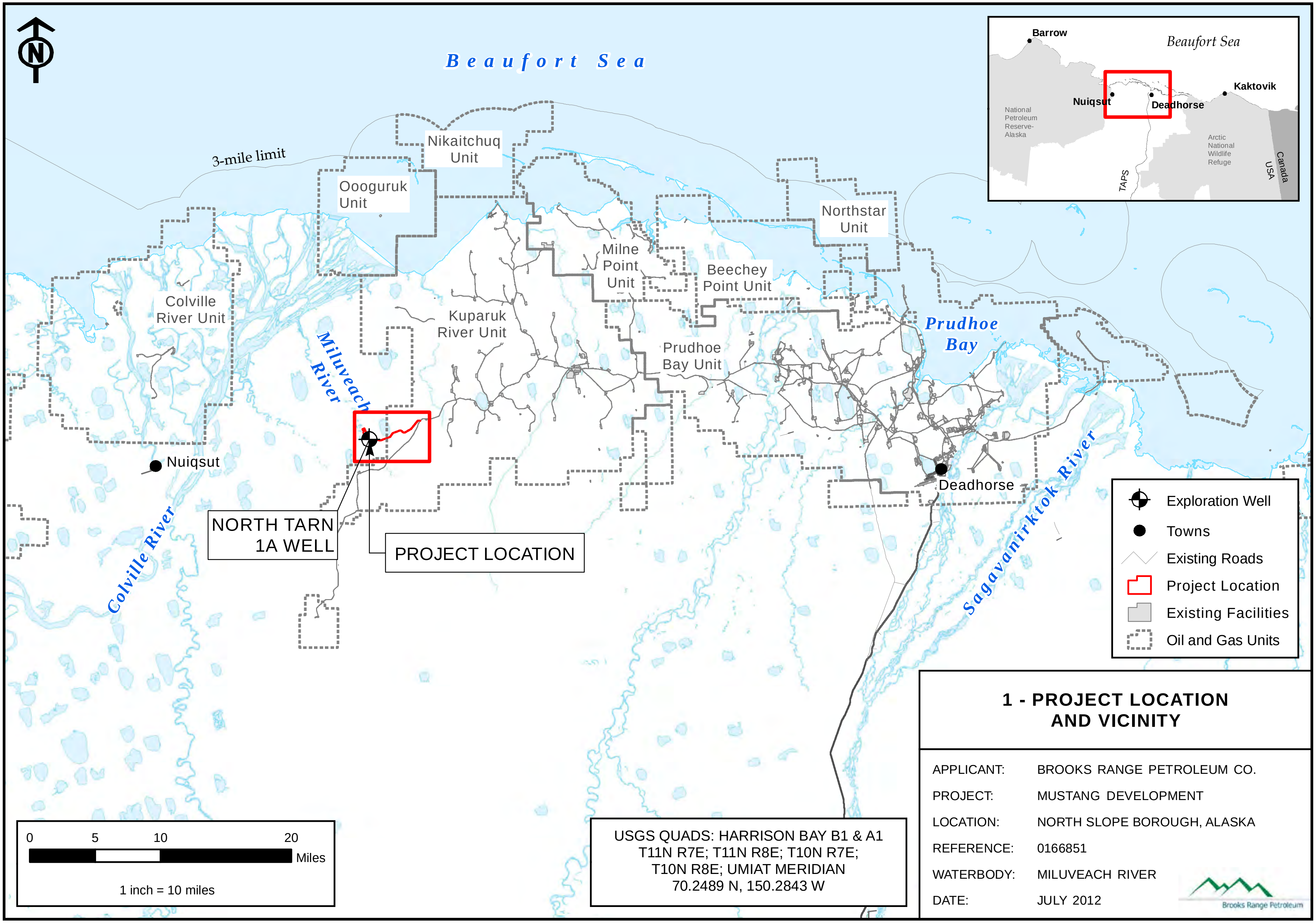

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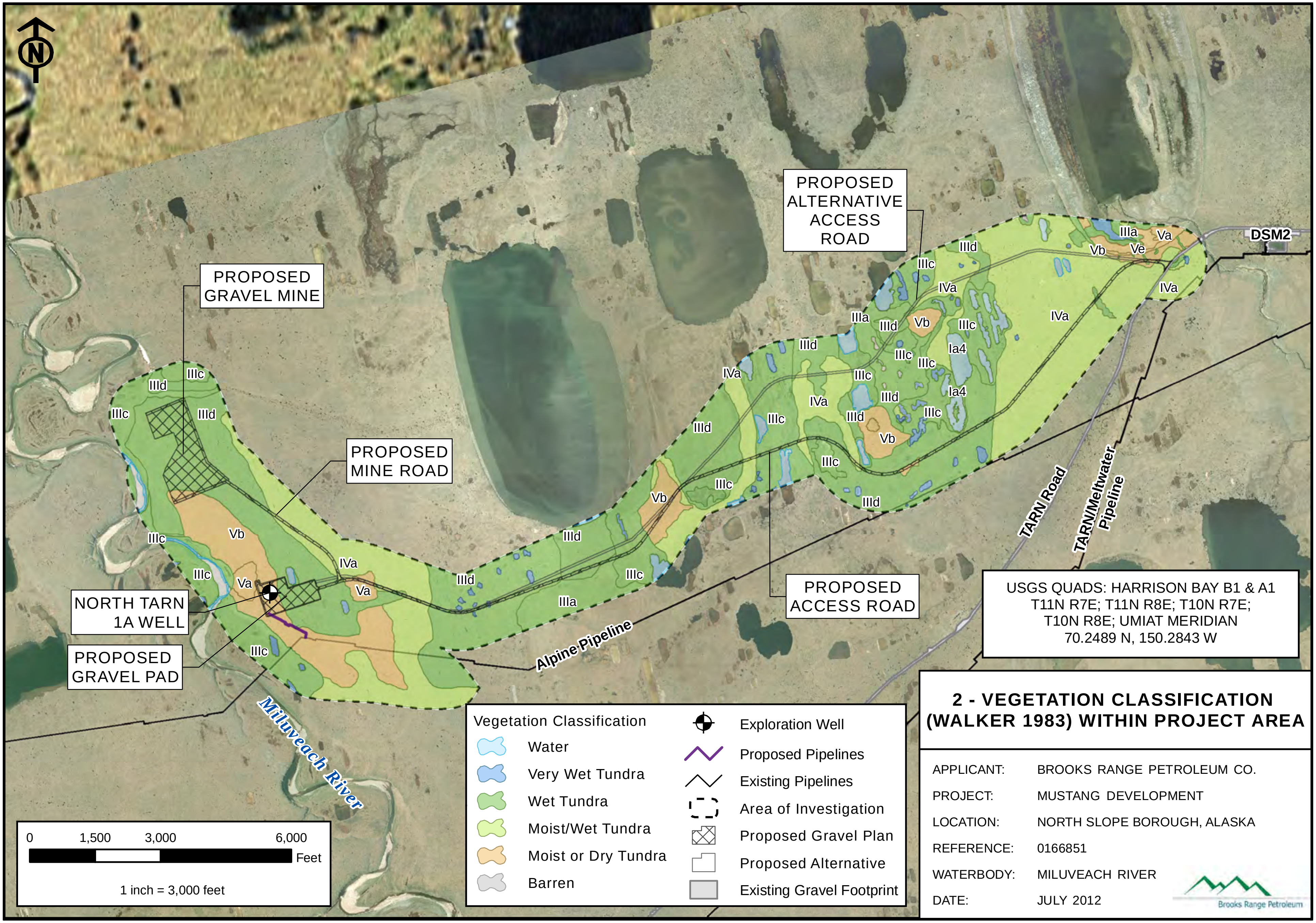

2 - VEGETATION CLASSIFICATION (WALKER 1983) WITHIN PROJECT AREA

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

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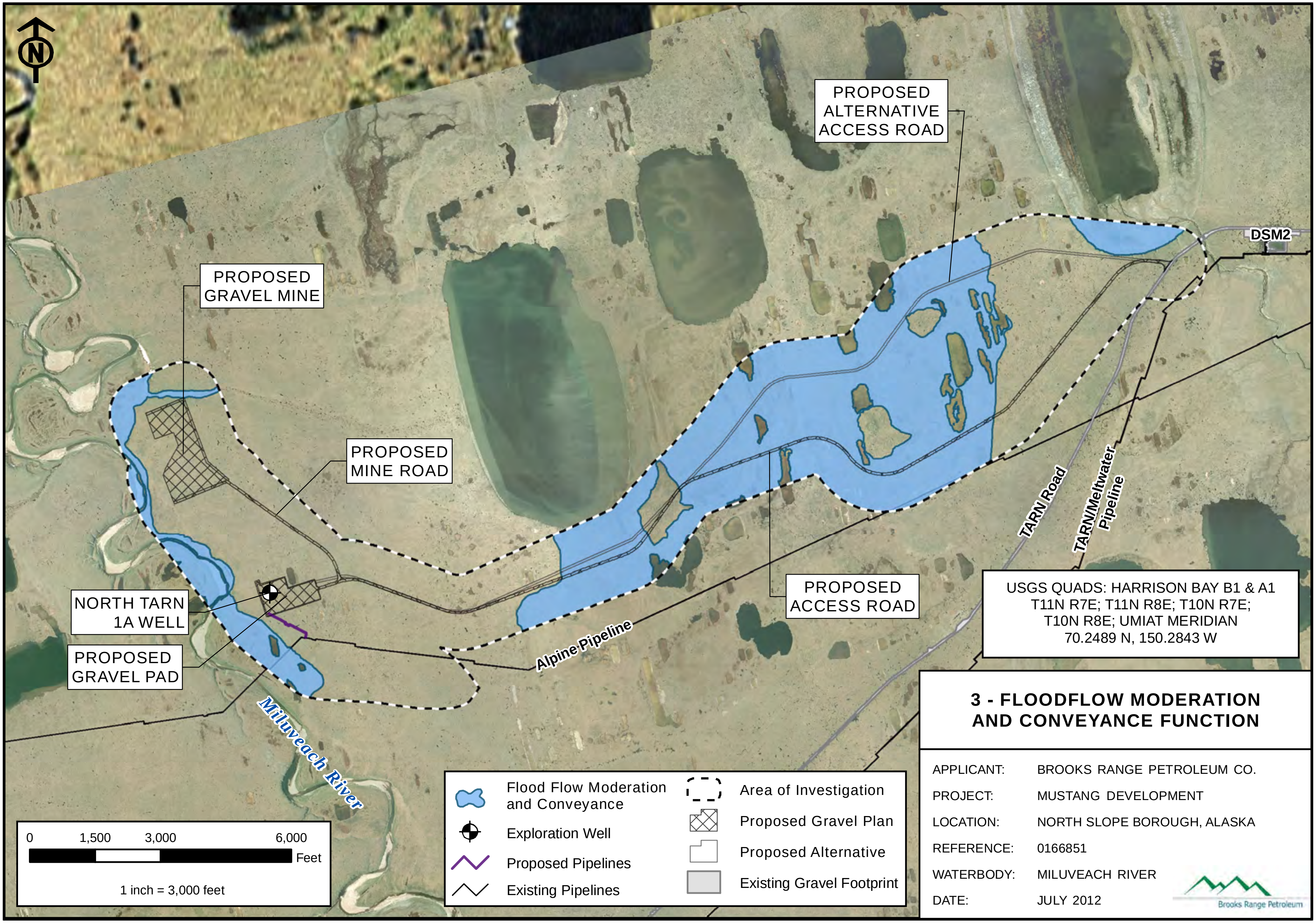

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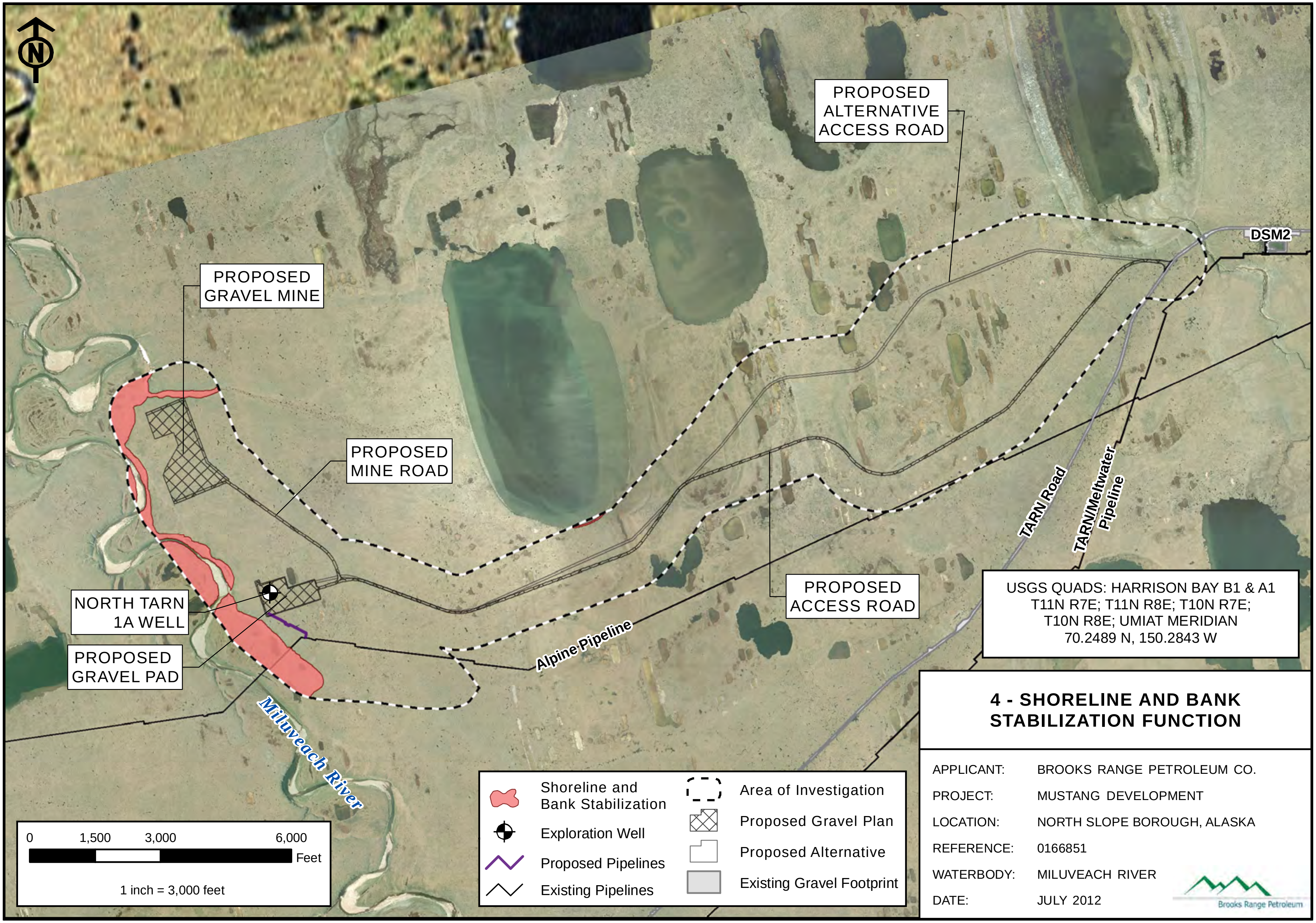

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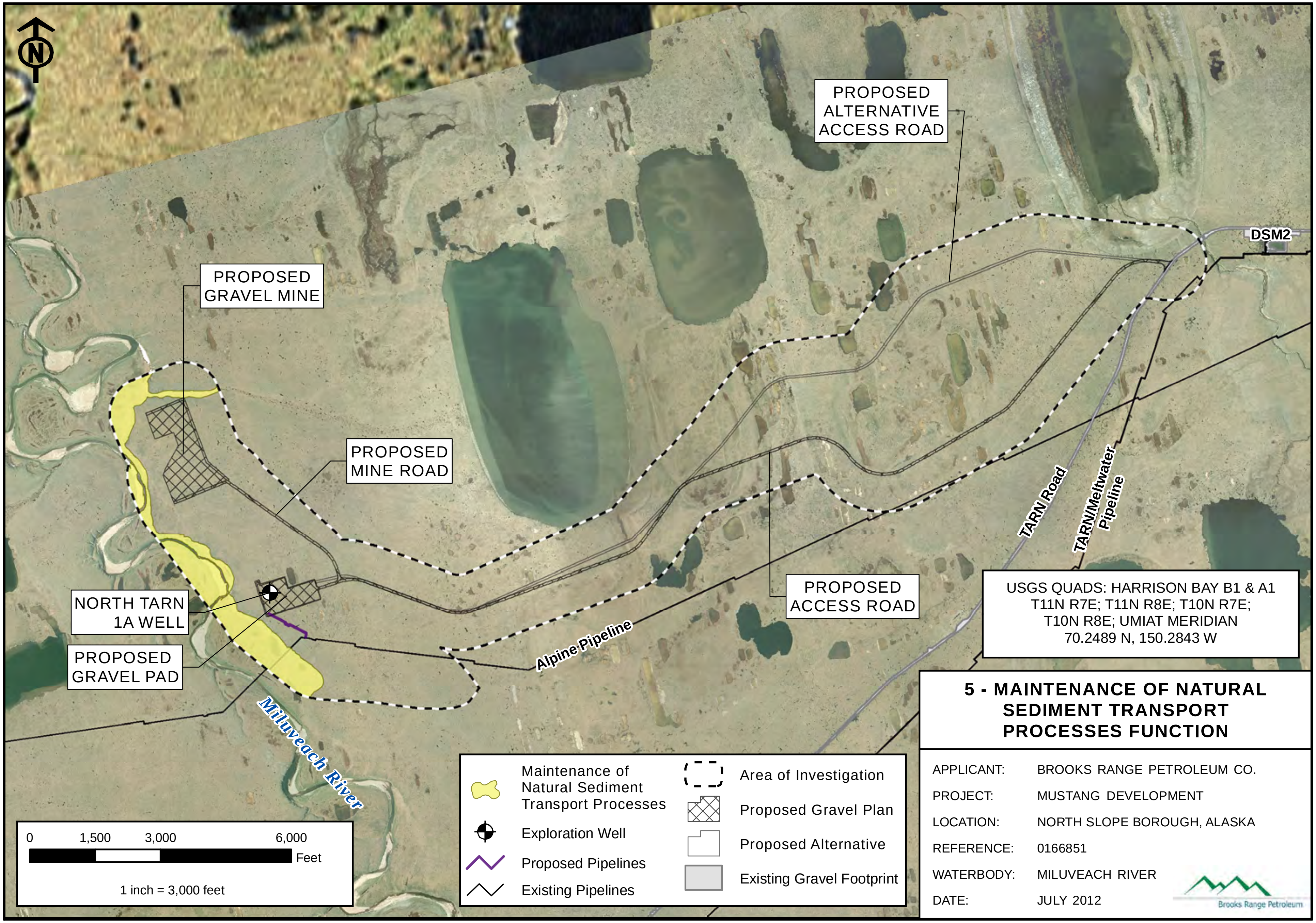

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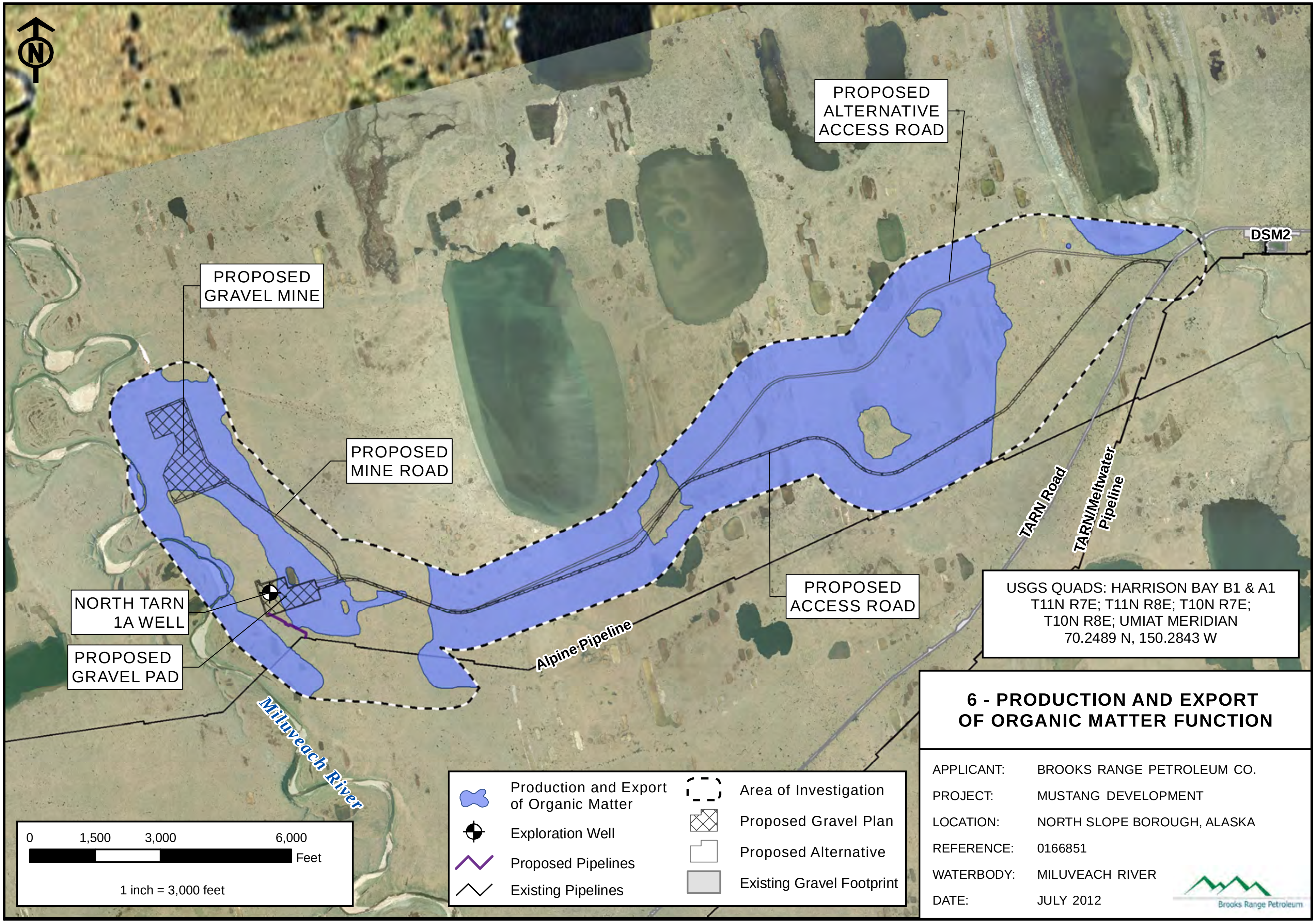

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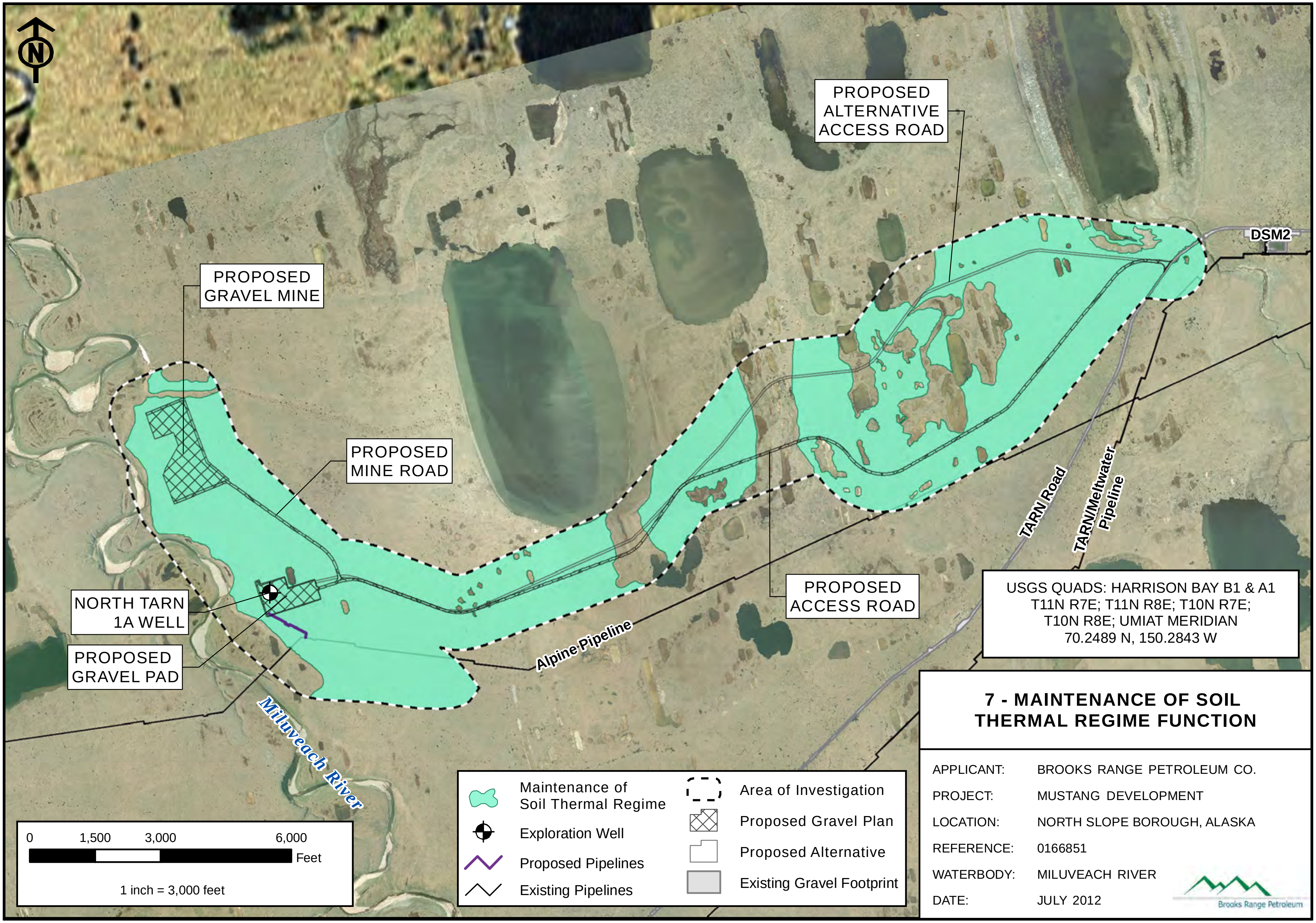

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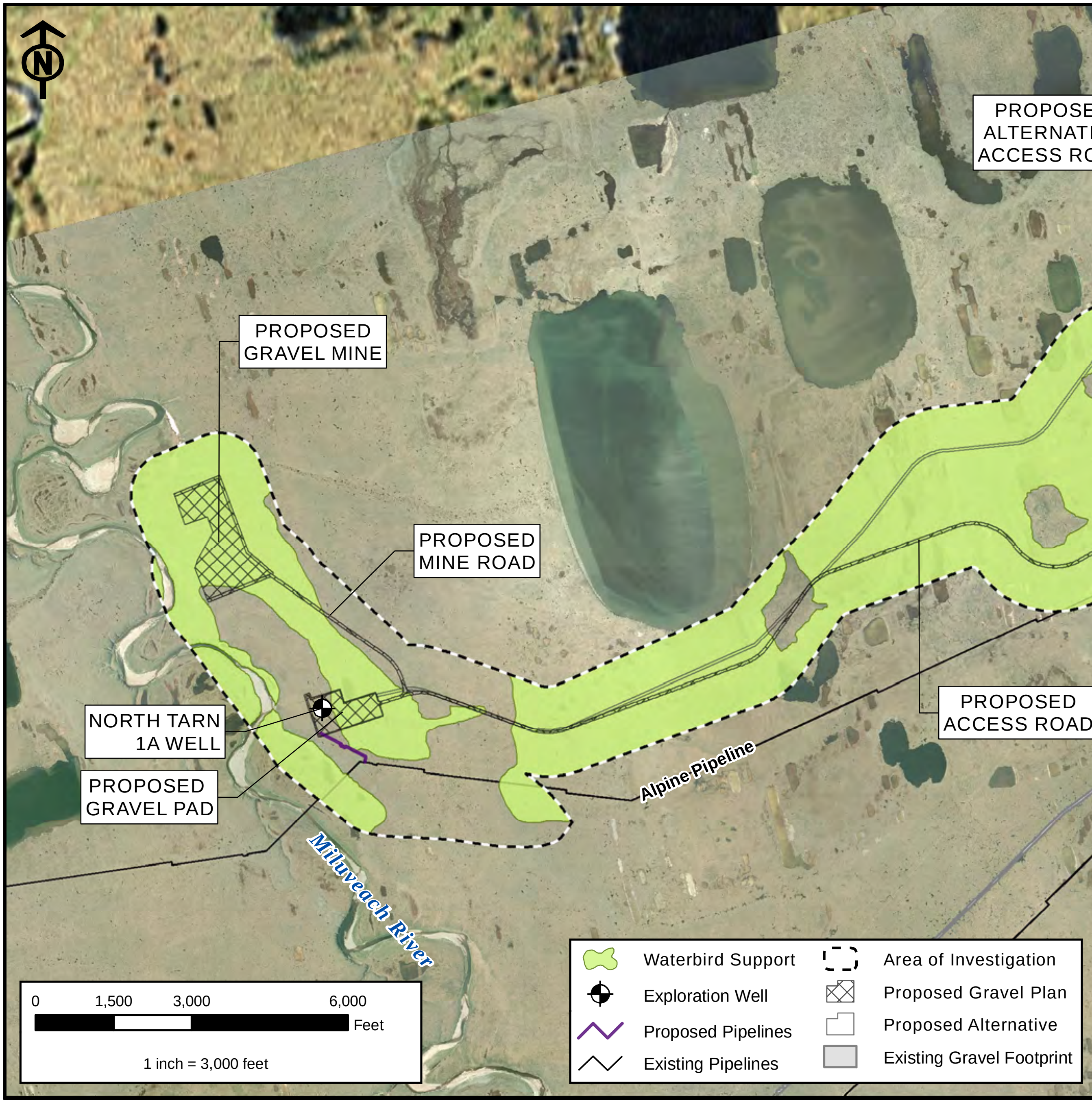

8 - WATERBIRD SUPPORT FUNCTION

APPLICANT: BROOKS RANGE PETROLEUM CO.
PROJECT: MUSTANG DEVELOPMENT
LOCATION: NORTH SLOPE BOROUGH, ALASKA
REFERENCE: 0166851
WATERBODY: MILUVEACH RIVER
DATE: JULY 2012

Brooks Range Petroleum

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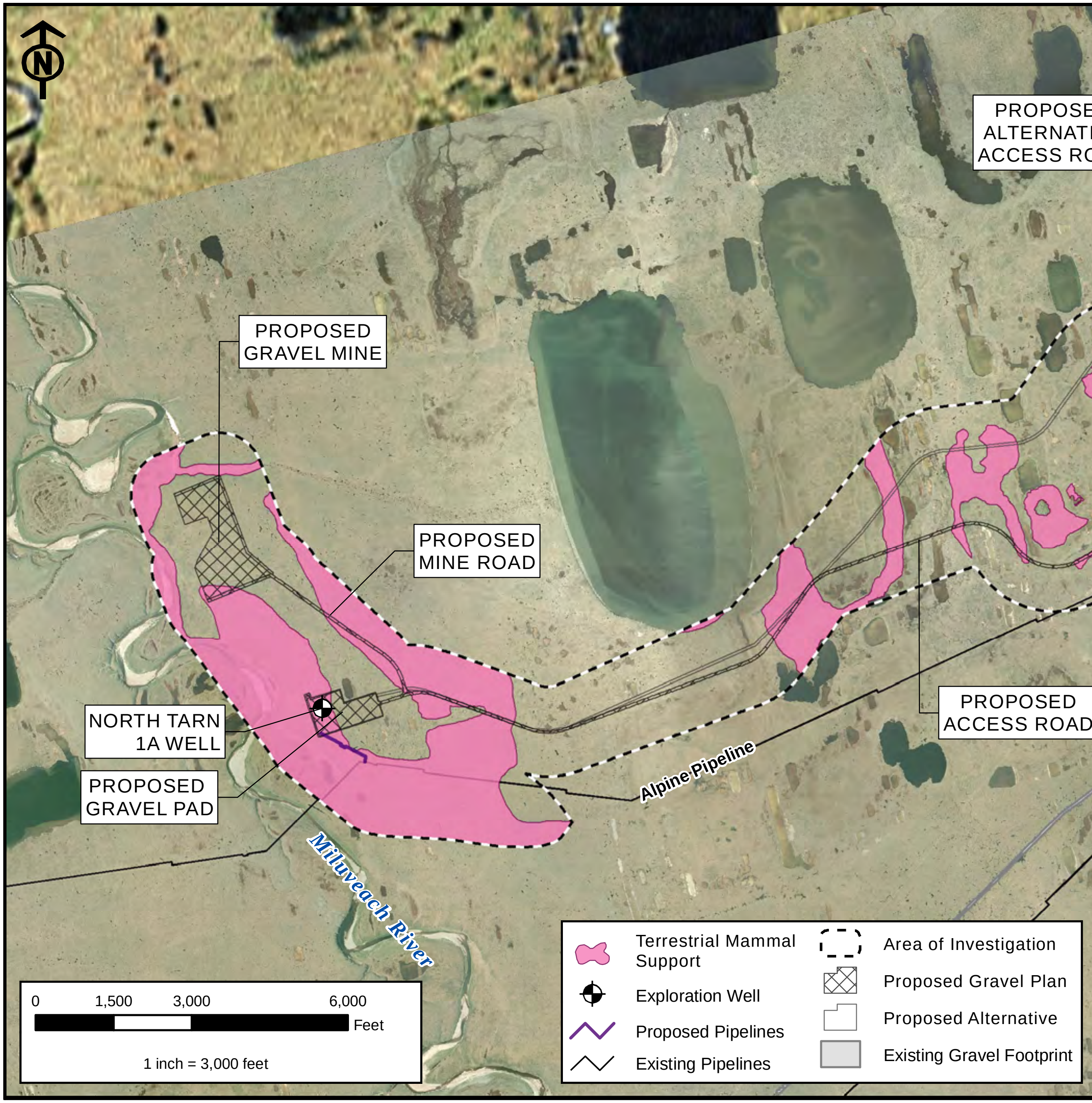

9 - TERRESTRIAL MAMMAL SUPPORT FUNCTION

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

Brooks Range Petroleum

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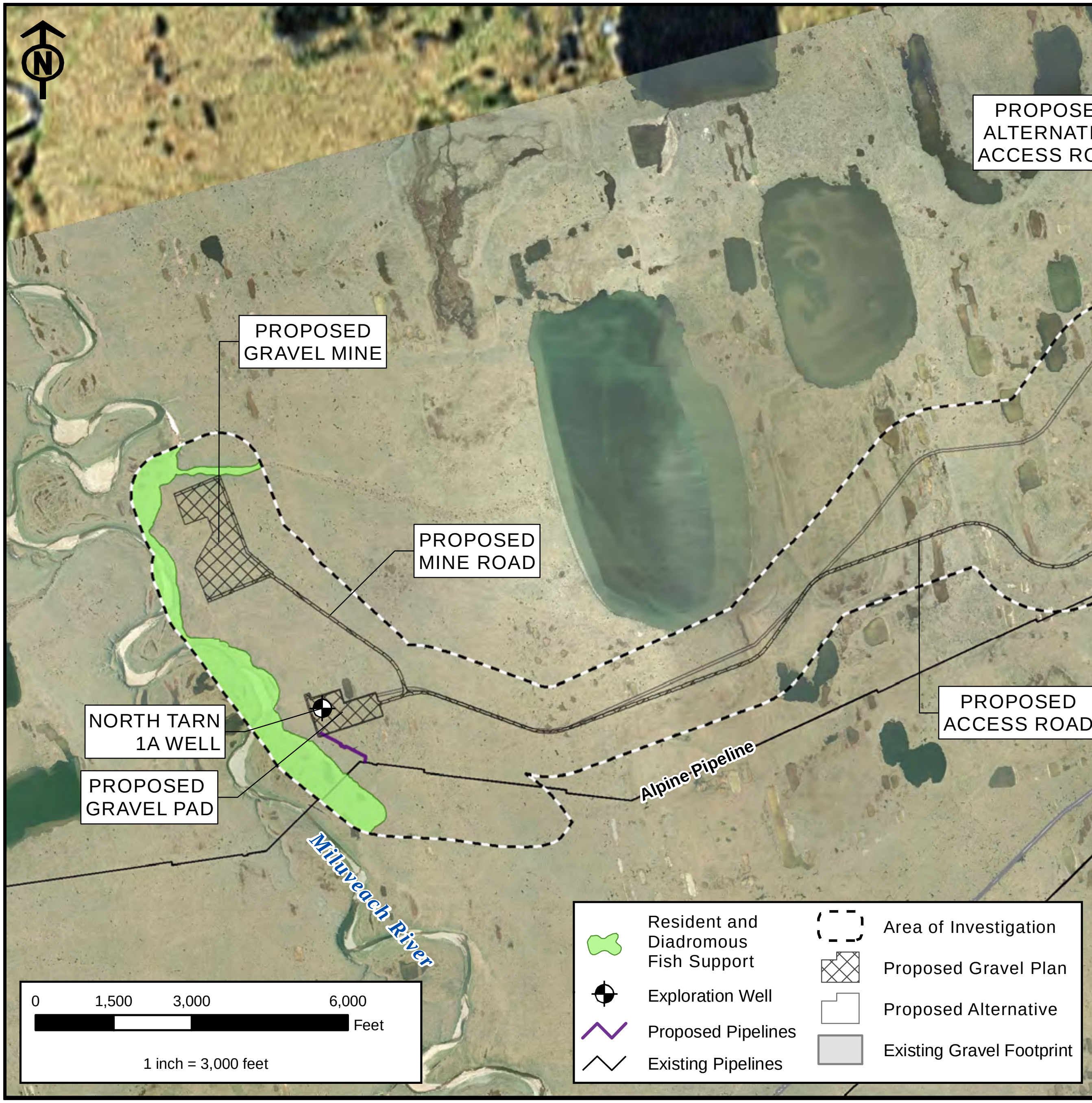

10 - RESIDENT AND DIADROMOUS FISH SUPPORT FUNCTION

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

Brooks Range Petroleum

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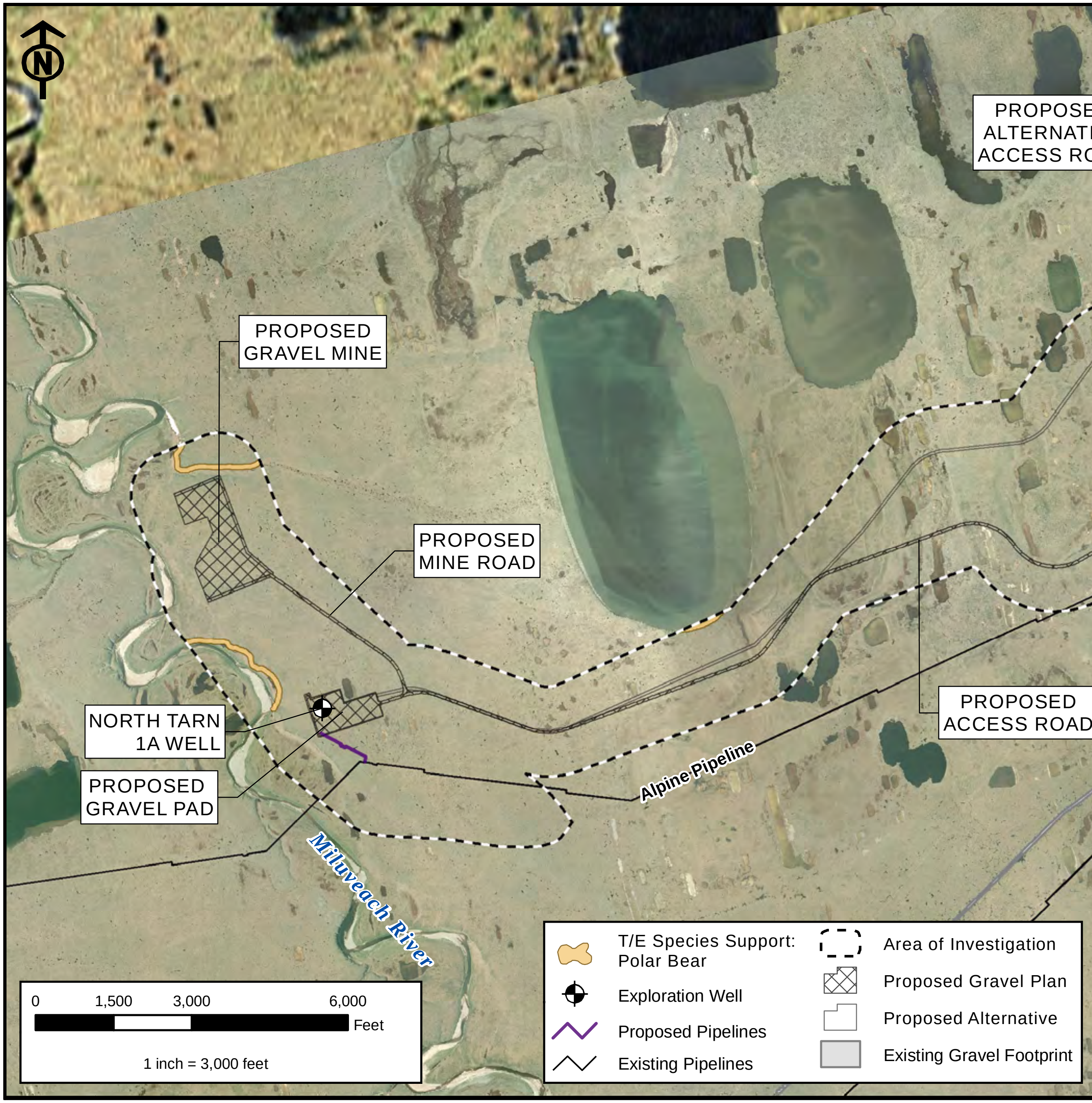

11 - T&E SPECIES POLAR BEAR FUNCTION

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

Brooks Range Petroleum

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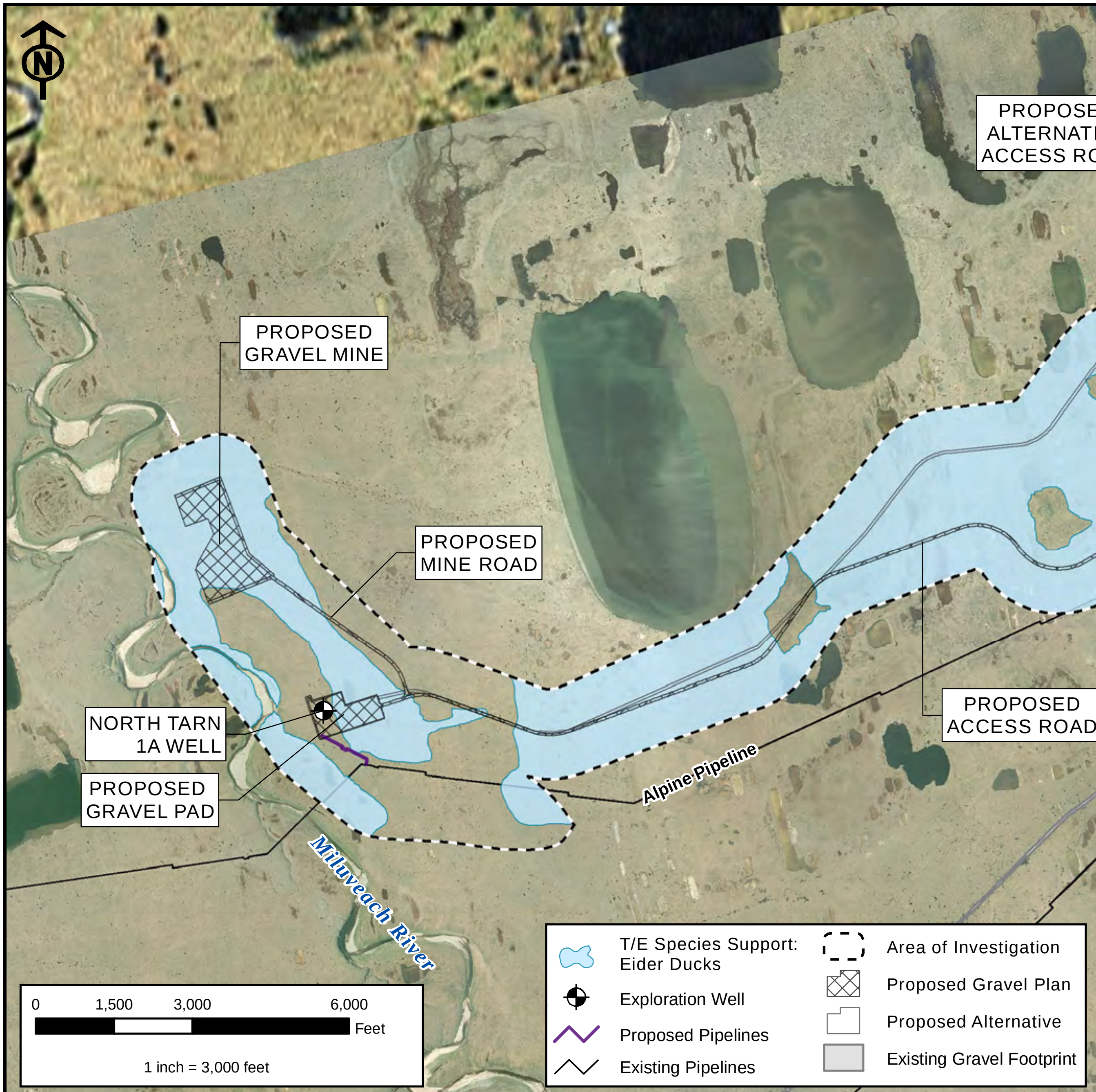

12 - T&E SPECIES
SPECTACLED EIDER FUNCTION

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

Brooks Range Petroleum

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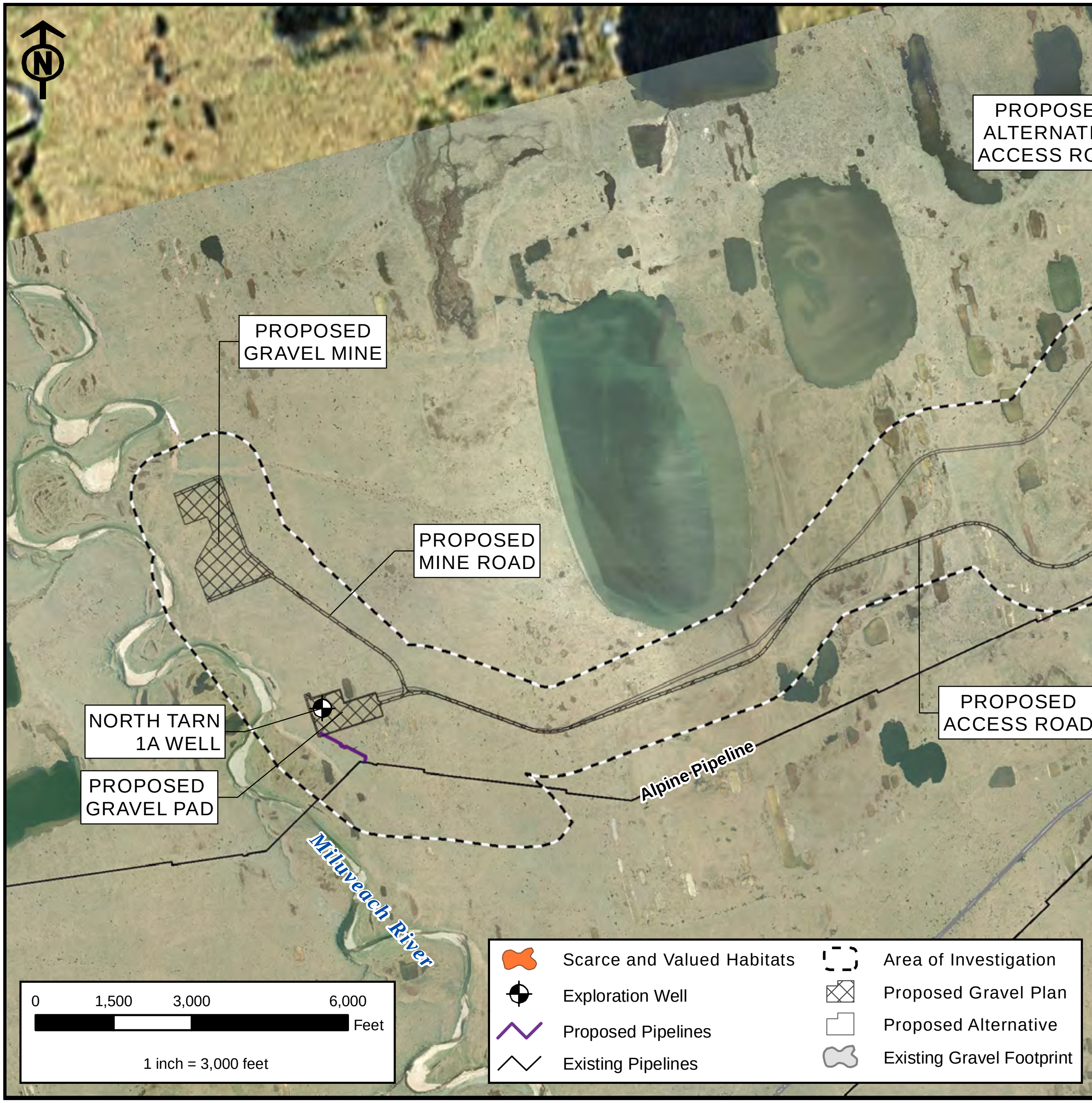

13 - SCARCE AND VALUED HABITATS FUNCTION

APPLICANT:	BROOKS RANGE PETROLEUM CO.
PROJECT:	MUSTANG DEVELOPMENT
LOCATION:	NORTH SLOPE BOROUGH, ALASKA
REFERENCE:	0166851
WATERBODY:	MILUVEACH RIVER
DATE:	JULY 2012

Brooks Range Petroleum

Path: J:\Projects\468_004_Brooks_Range_Wetlands\mxd\PERMITS\FxAs\Figure_14_Categories.mxd