# Archaeology Resources

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## Background

Archaeological Resources are defined as "any prehistoric or historic district, site, building, structure, or object [including shipwrecks]…Such term includes artifacts, records, and remains which are related to such a district, site, building, structure, or object" (National Historic Preservation Act, Sec. 301 (5) as amended, 16 USC 470w(5)). Archaeological resources are either historic or prehistoric and generally include properties that are 50 years old or older and are any of the following:

- Associated with events that have made a significant contribution to the broad patterns of our history
- Associated with the lives of persons significant in the past
- Embody the distinctive characteristics of a type, period, or method of construction
- Represent the work of a master
- Possess high artistic values
- Present a significant and distinguishable entity whose components may lack individual distinction
- Have yielded, or may be likely to yield, information important in history

These resources represent the material culture of past generations of a region's prehistoric and historic inhabitants, and are basic to our understanding of the knowledge, beliefs, art, customs, property systems, and other aspects of the nonmaterial culture.

Further, they are subject to National Historic Preservation Act (NHPA) review if they are historic properties, meaning those that are on, or eligible for placement on, the National Register of Historic Places (NRHP). These sites are referred to as historic properties. Section 106 requires agencies to make a reasonable and good faith efforts to identify historic properties.

Archaeological resources may be found in the Proposed Project Area both offshore and onshore. Because the offshore Proposed Project Area was exposed (above sea level) in the late Pleistocene Epoch and up to, or even after the mid-Holocene, there is the potential to discover ancient archaeological sites associated with early hunters and gatherers who, tens of thousands of years ago, once occupied these now submerged lands. This is part of what is called Beringia, tens of thousands of years ago. During the time that humans may have first entered Beringia, which included the submerged Chukchi Sea and submerged continental shelf off what is now the Beaufort Sea coastal margin, as well as portions of the continental shelf of Russia. Beringia connected the continents of Asia with the Americas, and stretched as far north as Wrangell Island and as far south as the Alaska Peninsula.

Onshore, there may be sites on land and at sea that are associated with human populations as Beringia became flooded with rising sea levels.

Offshore, there may be sites offshore which are described as underwater. Underwater archaeology can be divided into two discrete types of sites:

1. Submerged landscapes and prehistoric sites that may have been buried as long ago as when the Land Bridge (Beringia) was exposed during the late Pleistocene or inundated by rising sea levels at the end of the Pleistocene. It should be noted that no archaeological resources have been discovered yet from submerged lands in Arctic Alaska, although the potential exists.
2. Vessel wrecks, both shipwrecks and air plane wrecks, and any remains associated with them.

At an early planning stage, BOEM worked with operators so that archaeological surveys could be performed in conjunction with geological and geophysical analyses. This paper discusses potential offshore sites in the context of (1) a cultural chronology proposed for the coastal and offshore Arctic providing the scaffolding for structuring a reasonable interpretation of past human occupation and use of

the land- and seascape; and (2) a description of the potential land use and occupancy of Beringia, (which includes the now submerged Land Bridge across which the first peoples gained entry into the Americas). This is followed by a description of archaeological surveys performed at various stages proposed Liberty Development Project, to include the current Development and Production Plan (DPP).

## Context: Cultural Chronology

Archaeological sites span a huge time period, and the temporal range, added to the vast size of Alaska, its divergent physiographic regions, and the similarity or differences in artifacts, requires archaeologists to organize sites into cultural chronologies. A cultural chronology would have the oldest securely dated sites with similar types of artifacts separated into a different category than more recent sites. Inter- and intra-site variability would be described and differentiated, if needed. Specific types of tools would be identified as markers for the specific time period, or diagnostic of a specific occupation. This leads to seeking to understand what would compel a shift in tool types, and if this change would represent a new technology introduced by an upstream user or a population or cultural shift. This seemingly simple construct has been challenging for archaeologists working in what is called eastern Beringia (Holmes 1996, 2011; Rasic, 2011), that northern swath of land that would have been ice free during the Pleistocene and suitable for human occupancy and use, including the submerged Chukchi Sea and submerged Continental Shelf off what is now the Beaufort Sea coastal margin.

The oldest securely dated archaeological sites in the Americas were occupied approximately 15,000 years ago during the late Pleistocene epoch. They include the Clovis sites found in the continental United States and Mexico, sites found in eastern interior Alaska in eastern Beringia, including Swan Point and Broken Mammoth, and Bluefish Cave in the Yukon Territory, Canada (Bourgenon et al., 2017; Holmes, 1996, 2011). Because it is highly probable that humans crossed Beringia (commonly referred to as "the Land Bridge") from the Asia to the Americas, the potential exists for finding prehistoric archaeological sites. Of more recent origin, wrecks of ships and airplanes may exist offshore.

To facilitate detailed discussion of the cultural chronology, it is important to clarify definitions for the terminology, as emphasized by Dixon (2011). Standard archaeological convention describes the term "type" as a description derived from one or more sites that generally provides the name and comparative bases for subsequent discoveries. The term "tradition" describes groups of artifacts that are similar over a large geographic area and persist for a long time. This concept implies that a common way of life and economic pattern were passed from generation to generation (Willey and Phillips, 1958). The beginning and the end of an archaeological tradition are marked by a major change of the artifact types spurred by a change in the economy (Dumond, 1982). The concept of an archaeological complex is similar to that of tradition, but a complex lasts for a shorter period of time and is more restricted geographically; it correlates with or is identical to the concept of a phase (Willey and Phillips, 1958).

In Alaska, two clear typological classes of artifacts have been discovered pointing to an origin in either or to a strictly North American origin.

For example, a wedge-shaped core from which microblades were struck was discovered on the newly formed University of Alaska campus in Fairbanks in 1934. The discovery of this core, which bore remarkable similarity to wedge-shaped cores that had been discovered in Asia, was first thought to be 8,000 to 12,000 years old, but was later securely dated as being 3,000 years old. It was determined that many of the artifacts on the site had been reworked ("palimpsest"), and that the site had been reoccupied on multiple occasions (Mobley, 1991).

In addition, artifacts having great similarity to the Diuktai culture of Siberia, have been identified in many archaeological sites in Alaska (Giddings, 1965; Larsen, 1968; Rainey, 1939; Solecki, 1950; and West, 1967; to name a few). These discoveries, combined with contemporaneous tools found in association with them, only added to the theoretical framework that humans had transected Beringia from the Old World. Since then, microblades and the small polyhedral cores from which they were struck have been securely

dated to 13,900 Cal B.P. (Holmes, 1996). Microblades are thought to have been shafted for use as projectiles or knives, and are associated with archaeological sites containing Pleistocene megafauna, but whether they were used as weapons or for butchering is unknown. Some artifacts discovered in northern Alaska have a clear association with bifacial Clovis and Folsom points, however. The Clovis and Folsom points discovered in the continental United States were obviously of North American origin. Consensus is emerging that these tools were introduced in Alaska by hunters following prey northward to more favorable habitat during the massive Pleistocene-Holocene regime shift (Dixon, 2011; Dumond, 2011; Goebel et al., 2013). The dichotomy between sites containing microblades or bifaces and sites containing an earlier component comprised of bifaces with subsequent occupations containing microblades led some researchers to suggest that all assemblages older than 13,000 cal B.P., collectively referred to as the East Beringian Tradition, be divided on the basis of the presence or absence of microblades (e.g., West, 1996; Holmes, 2001, 2011). Other archaeologists observed that distinct cultural affiliations could be attributed to the presence or absence of microblades (e.g., Hoffecker, 2011; Dumond, 2011).

Several traditions are represented in the northern Alaska chronology, though it is very difficult to assign a specific tradition to early Arctic archaeological complexes and the distinction is often blurred by overlapping technological traditions found in seemingly contemporaneous contexts:

The American Paleoarctic tradition (also referred to as the Siberian American Paleoarctic, the Beringian Tradition, the Denali Tradition and the Paleomarine Tradition [Rasic, 2011) was to be considered the earliest tradition in Alaska but that may no longer be the case, since radiocarbon dates from the Mesa site and Tuluaq Hill (a Sluiceway site) are older than microblade sites found in Eastern Beringia (Rasic, pers. comm., 2/22/2016). First defined by discoveries at Onion Portage and Trail Creek, this tradition has a clear relationship with the Duiktai Complex of Siberia (USDOI, BLM, 2014; Jensen, 2014; Rasic, 2014). The earliest date in excess of 14,000 years was obtained from Swan Point, a late Pleistocene site in the Tanana River region in interior Alaska that has correspondences with the Dyuktai phase (Holmes 1996, 2011). The PaleoAlaskan tradition derives from archaeological analyses of a number of sites in the Brooks Range region, including the Mesa, Bedwell, Putu, and Hilltop sites (Alexander, 1974, 1987; Jensen, 2014; Kunz et al., 2003; Kunz and Reanier, 1994, 1995; Reanier, 1995) that documented the presence of a transitional Pleistocene-Holocene occupation by people using long, bifacial spear points that are stylistically and technologically identical to the earliest stone tools used by the Clovis peoples, residents of southwest and High Plains of North America (USDOI BLM, 2014). The Northern Archaic tradition was defined from artifact assemblages found by Giddings at the Palisades Site (1967, 1968) and Anderson at Onion Portage (1968) primarily on the basis of side- and corner-notched and stemmed projectile points first appearing in the archaeological record. Other tools include notched, flat waterworn oval stones presumably used as net sinkers or percussors (hammers), bifacial knives, end scrapers and side scrapers (Anderson, 1968, 1988 summarized by Jensen, 2014). This tradition was originally believed to exist in forested conditions but subsequent discoveries in Arctic tundra environments resulted in acknowledgement that this was a widespread, adaptive tradition (Jensen, 2014). However, the fact that the Northern Archaic tradition has been identified in only one coastal site, the aforementioned Palisades discovered by Giddings, indicates that it has a strong association with the interior. Although, as pointed out by Jensen, this may be masked by the destruction of coastal sites by erosion or rising sea levels (Jensen, 2014).

The Arctic Small Tool tradition (ASTt) is associated with the signature assemblage of the Denbigh Flint Complex, discovered and described by Giddings (1951, 1964) at Norton Sound. It is comprised of small, prismatic delicately flaked side- and end-blades, end scrapers, bifacial knives, ground slate adze blades and notched stones thought to represent percussion tools rather than net weights. ASTt sites are widespread, found as far south as Kodiak and into eastern Arctic Canada and Greenland, and have been found in the interior as well as the coast. In Alaska, the tradition is rarely found in association with organic artifacts, rendering exact function of tools somewhat elusive. The significance of this tradition is that it is the earliest identified that made use of marine environment (Ackerman, 1968) as evidenced by

the possible presence of a harpoon and seal bone fragments in sites (Giddings, 1964) as well as numerous sites located in marine/coastal environments including sites across the Central Arctic and in Greenland, and a few marine mammal bones in sites like Iyatayet and Cape Espenberg [Mason, 2016]).

The Norton tradition includes the Choris, Old Whaling, and Ipuitak cultures (Dumond, 2000). Assemblages include pottery, stone lamps, chipped adze blades, and distinctive stemmed and shouldered projectile points (Anderson 1984, 1988; Giddings and Anderson, 1986). Another distinctive attribute was the clear mastery of the marine environment, as evidenced by the quantity of seal bones found in archaeological sites, and the advent of whaling, as evidenced by harpoon heads in The Old Whaling culture included in this tradition (Giddings and Anderson, 1986). Ground slate tools began to replace chipped stone tools in the Norton culture. Ipiutak culture lacks pottery, ground slate, lamps, and whale-hunting equipment found in Norton and succeeding cultures (Jensen, 2014). It is only since the turn of the millennium that Ipiutak sites have been described as having a widespread distribution in interior northern Alaska (Mason, 2006, 2014); along the coast, Ipiutak has been discovered south of Platinum, fronting the Bering Sea (Larsen, 1950).

The Northern Maritime tradition is the earliest that expresses the full development of Iñupiat culture, including bowhead whaling, and is primarily distributed along the coast, with interior incursions in riverine systems (J. Rasic, pers. comm., 2016). This tradition is typified by ground slate weapons and knives, flaked chert knives, discoidal scrapers and projectile points, spur harpoon heads some of which were barbed and some of which included stone side blades, pottery and lamps, and a continuation of a subsistence economy that included interior hunting as well as coastal hunting. Siberia;

## Beringia

BOEM's archeological interest in the Beaufort Sea OCS has been high because the shallow offshore area had once been the northeastern extension of Beringia ("the Land Bridge," in popular vernacular), a broad continental-scale land mass that connected what is now Siberia with Alaska, running from northward of Wrangell Island to the Alaska Peninsula during the Pleistocene Epoch (Hopkins, 1996). Although massive ice sheets blanketed much of the continental United States (Laurentide Ice Shield) and western Canada extending northward into Alaska to include the Alaska Range (Cordilleran Ice Sheet), most of Arctic Alaska was ice-free with localized glaciation in the Brooks Range that expanded into the Arctic Plain during colder periods. It was during the Pleistocene that modern humans evolved with an adaptive capacity to withstand cold, through manufacture of clothing and shelter, and technology. This allowed the populations residing in East Asia to expand northward and eastward, presumably hunting herds of large animals (megafauna) including mammoths, horses, and bison.

These grazers depended on the steppe environment that afforded long distances for their migration patterns and habitat dispersal. A recent study correlating dated bones with climate records made several important findings: (1) megafauna population dynamics suggest abundance peaked during transitions from cold to warm periods; (2) melting ice sheets and resultant flooding of Beringia, which severed the connection from Alaska to Siberia, resulted in severe reduction in habitat; and (3) the warming trends at the advent of the Holocene transformed the environment from a mammoth-steppe habitat to peat moss. These factors contributed to the decline, if not the demise of some of the megafauna species in the area, although mammoth were still existing approximately 14,000 years before present (B.P.) (Geggel, 2017; Mann et al., 2015).

It is conservatively estimated that prehistoric human populations entered North America by 14,500 (B.P.) (Goebel and Buvit, 2011; Holmes, 2011; Potter, 2011).There are two prevalent theories regarding human populations crossing the Bering Land Bridge to populate the Americas. One theory of migration across Beringia focused on the importance of hunting these herd animals, entering Alaska between the Brooks Range and the Alaska Range and, following herds of beasts, moving south through an ice free corridor between the Laurentide and Cordillera ice sheets or crossing a more northerly route across the Chukchi Sea (Dikov, 1983). This was followed by rapid population dispersal as far south as South America within

1,000 years (Fiedel, 2005) suggesting that groups were highly mobile with few, if any, long-term occupation sites, leaving only traces of hunting sites or camps (Rogers, 2013).

The second theory the Beringian Standstill hypothesis, considers the likelihood that humans occupied Beringia for thousands of years prior to moving to Alaska. This is called the Beringian Standstill hypothesis. This theory would not have humans rapidly transecting Beringia from what is now Siberia to Alaska, but instead considered that ancestral Native Americans occupied the Beringia for at least 10,000 years during the Pleistocene before rising sea levels displaced people to what is now the Alaskan Bering or Arctic Sea coasts (Tamm et al., 2007). The Beringian Standstill hypothesis is now taking hold based upon multiple lines of evidence supporting the view that ancestral Native Americans were isolated genetically for about 10,000 years on Beringia during the Pleistocene (Hoffecker et al., 2014; Hoffecker et al., 2016 ; Tamm et al., 2007). This would mean that humans migrated to Beringia about 25,000 years ago. It would also mean that future archaeological surveys will need to be performed to the shelf break in what formerly had been Beringia.

Evidence supporting the Beringian Standstill hypothesis includes pollen data and fossil insect remains from both sides of the Bering Strait, indicating that milder temperatures prevailed during the coldest phases of the Last Glacial Maximum of the Pleistocene (LGM). This may have been attributable to the North Pacific circulation, which brought comparatively moist, warm air to southern Beringia during the LGM and may have upgraded temperatures in northern Beringia which would otherwise have been harsh. This would have resulted in habitat suitable for megafaunal grazers (Hoffecker et al., 2016).

Additionally, recent analysis of DNA from human skeletal remains dating to 24,000 BP found in southern Siberia appears to validate the pre-LGM divergence of Native Americans from their Asian Parent haplogroups. (A haplogroup is a genetic population group of people who share a common ancestor on the patrilineal or matrilineal line.) (Hoffecker et al., 2014). This analysis identified genetic similarities common to both Europeans and Indigenous Americans (Lazardis et. al., 2014).

Recent genomic analysis of two infants ceremoniously buried 11,500 years ago at Upper Sun River supports the Beringian route into the Americas and indicates substantial interior Beringian genetic variation in the Late Pleistocene, as would be anticipated of the Beringian Standstill Model (Tackney et al., 2015). However, as Hoffecker stated, “To confirm the Bering Standstill hypothesis, archaeological sites of LGM age must be documented in Beringia…although most such sites presumably would be underwater” (Hoffecker et al., 2014).

As conditions on Beringia deteriorated, residents are believed to have migrated to the uplands of what is now Alaska. A sea level curve of the Beaufort Sea (Table 1) suggests that sea levels rose over a 6,000 year period in the early- to mid-Holocene (Hopkins 1996; West 1996; Darigo et al. 2007). The rates of sea level rise between 7,500 and 4,500 years before present (B.P.), at 0.3 to 0.6 cm/yr. were more than 10 times the present rate of 0.3 mm/yr. (D. Thurston, pers. comm., March, 2013). There is every reason to believe that in the past as in the present, subsistence practices were undertaken from shoreline or riverine sites with better drainage, such as elevations or terraces, or on barrier islands, and that the people settled in seasonal communities with the best access to subsistence resources.

**Table1. Beaufort Sea Level Curves Relative to Present**

| Sea Level in relation to present in meters (m) | Elapsed time in thousands of years (ka) |
|---|---|
| ~50 m below present | ~11 ka |
| ~44 m to 16 m below present | ~9 ka |
| ~12 m to 2 m below present | ~5 ka |

Source: Thurston, D. 2011, pers. Comm.; Darigo et al., 2007.

Despite the compelling lines of evidence indicating that stratified archaeological sites could be buried below the seabed in the former Beringia, it should be noted that to date, no archaeological remains have been found offshore. However, their potential has been a subject of interest and archaeological surveys in the Liberty prospect area for the past 17 years.

Prior to data collection in support of this DPP, two archaeological baseline studies were completed for the Beaufort Sea, the first in 1978 followed by an update in 2007 (Dixon et al., 1978; Darigo et al., 2007). This was followed by an archaeological study that focused on reviewing geological and geophysical cores to assess the existence and archaeological potential of submerged and buried terrestrial paleo-landforms beneath the Beaufort Sea; (Darigo et al., 2007). Both studies identified the potential for finding submerged archaeological resources in the OCS (Outer Continental Shelf, commencing at the 3-mile limit) and noted that some of the oldest archaeological sites in North America have been found in the Arctic, providing the possibility that early humans could have utilized the now submerged landmass, Beringia. The first archaeological baseline report identified that the potential for their discovery would be greatly reduced due to processes such as ice gouging (Dixon et al., 1978) but the more recent archaeological baseline report stated that there were instances where late Pleistocene sites would have been protected from ice gouging, such as inshore of barrier islands or areas between major river systems under shorefast ice (Darigo et al., 2007).

## Liberty Project Archaeological Surveys

The Liberty project area has been archaeologically surveyed and assessed during the past seventeen years because of industrial interest in the potential for extracting oil from the Liberty prospect. As described in greater detail below, archaeological surveys specifically linked to this project have been performed on land and at sea.

The archaeological surveys have identified sites on land, although none will be directly affected by the project and all will be avoided. There is also the potential for the presence of archaeological resources offshore because the shallow waters of the Shelf once were part of Beringia, until the Holocene, and because these areas were protected from ice gouging (Hopkins, 1996; Darigo et al., 2007)

### *Marine Archaeological Surveys*

Because of the potential for the presence of archaeological resources, seismic surveys have been conducted and archaeological analyses have been performed on the geological and geophysical (G&G) data to evaluate the proposed island location and pipeline route to shore (Rogers, 2014, 2015). A report entitled “Liberty, Cultural Resource Assessment, Foggy Island Bay in Stefansson Sound, Alaska” (Marmaduke and Watson, 1998), was prepared for British Petroleum Exploration Alaska (BPXA) in 1998.

This study found that the seafloor in the project area has been subjected to surface disturbance from ice gouging and other processes. It indicated that seismic reflectors could represent buried stream channels, the most prominent of which were interpreted as being Pleistocene in age. The report concluded that if any terrestrial archaeological sites were associated with this or any other extant paleo-landforms, they would be protected because they are deeply buried. Lessor paleo-channels and buried peat deposits would also be protected by a veneer of Holocene marine sediments.

In their review of the report and associated data, the BOEM Archaeological Working Group (AWG) noted that the area of Foggy Island Bay, shoreward of the position of the wintertime ice pressure-ridge, generally has the potential for archaeological resources due to the presence of paleo-stream channels, drowned islands, paleo-lagoons, and paleo-shore features, all of which signal archaeological potential (Thurston et al., 2000 Memorandum). They also questioned the purported dating of organic peat, instead pointing out that no age dating had been performed on the peat or any of the sediments or paleo-landforms.

Moreover, the very presence of these paleo-landforms argued against destructive erosional processes caused by wave action, instead supporting the AWG’s theory that the intact paleo-landforms had been submerged by flooding or drowning without significant destructive wave action. Before the differing interpretations were addressed, however, BPXA revised its plan, proposing to access the oil through directionally drilling from shore.

In 2013, BPXA revised its plan again to propose construction of an artificial island and pipeline. This reversal raised the earlier archaeological questions and concerns that called for archaeological analysis of collected G&G data.

Four separate G&G surveys were performed, three during the winters of 2013-2015 and one during the open-water season of 2015. Two alternate pipeline routes were analyzed as was the proposed island development in Foggy Bay. No archaeological or shipwreck remains were identified, and no potential archaeological remains or buried landforms that might represent archaeological sites were identified in the subseabed. However, three samples of organic materials found in 2013 in two boreholes buried below the seabed were analyzed and radiocarbon dated. Two samples obtained from one borehole on the coastal plain included moss and a type of snail (*Succinid* sp. gastropod) and dated to the mid-Holocene (7,420 ±30, or 8,180 ±8,330 calibrated BP) (Rogers, 2014).

The third sample was found in a borehole located farther offshore. It was of water-worn birch fragments, postulated to have been driftwood from the MacKenzie River and dates to 47,350 ±540, which is beyond the calibration curve. It should be noted that the date compares with wood samples taken that were taken from the Chukchi seafloor at much great depths (Rogers, 2014). Mackenzie River.

Additionally, subsurface organic material samples also were encountered in several individual cores collected in March, 2015. Speciation and AMS radiocarbon dating analysis were undertaken on two of them recovered from a single bore (L15-08) (Table 2).

**Table 2: Marine core sample analysis summary (2013 and 2015)**

| Sample and Lab No. | Provenience (bore hole and depth) | Material | Age Determination (BP) | Calibrated Date (BP), $2\sigma^2$ | Speciation | Year Reported |
|---|---|---|---|---|---|---|
| BPL-001 UGAMS 14749 | L13-13/E3 -9.8 ft/-3.1m MLLW 38.5 ft/11.7 m bm | Wood fragments | 47,350 ± 560 | Beyond calibration curve | *Betula* sp. | Rogers, 2014 |
| BPL-004 UGAMS 14750 | L13 – 22/E3 -2.9 ft/-0.9 m MLLW 30-30.8 ft/9.1-9.4 m bm | Gastropod shell | 7420 ± 30 | 8180-8330 cal 1 BP | *Succinid* sp. | Rogers, 2014 |
| BPL-005 UGAMS 14751 | L13-22/E1 2 -2.9/-0.9 m MLLW 30-30.8 ft/9.1-9.4 m bm | moss | 6230 ± 30 | 7020-7250 cal BP | *Drepanocladus* or *Entodon* sp. | Rogers, 2014 |
| HCL-01 UGAMS 2177 | L15-08 -5.1 ft/-1.6 m MLLW 8.5 ft/2.6 m bm | wood | 7670 ± 30 | 8400 – 8540 cal BP | *Betula* sp. | Rogers, 2015 |
| HCL-02 UGAMS 21778 | L15-08 -5.1 ft /-1.6 m MLLW 7.5 ft/2.3 m bm | wood | 1140 ± 20 | 970 – 1170 cal BP | *Alnus* sp. | Rogers, 2015 |

The dating results and contexts suggest Holocene deposits that were re-worked by near-shore ocean dynamics. Wood samples, either birch (*Betula*) or alder (*Alnus*) appear to represent driftwood in a secondary context. Both species were established on the North Slope by the Pleistocene-Holocene transition (Oswald et al. 1999; Mann et al., 2002). The wood fragments were found at a depth ranging from 11.7 m to 2.3 m, with ages ranging from of 2.6 m. The uncalibrated dates range from 47,350 ±560 to 1140 ±20 BP, (Rogers, 2015; 2014). The wood samples obtained in 2015 were found when coring the pipeline route connecting with the Badami Pipeline approximately 426.72 m offshore (Rogers, 2015). It should be noted that organic materials were not found in borings of the proposed island site or farther offshore than this (Jason Rogers, pers. comm., April 28, 2015).

Geologists from Hillcorp, Alaska LLC (HAK, successor to BPXA for the Liberty project) mapped subseabed paleochannels that may be associated with remnant geomorphological features capable of containing archaeological material (Figure 1) with no historic properties were found in or adjacent to the paleochannels:

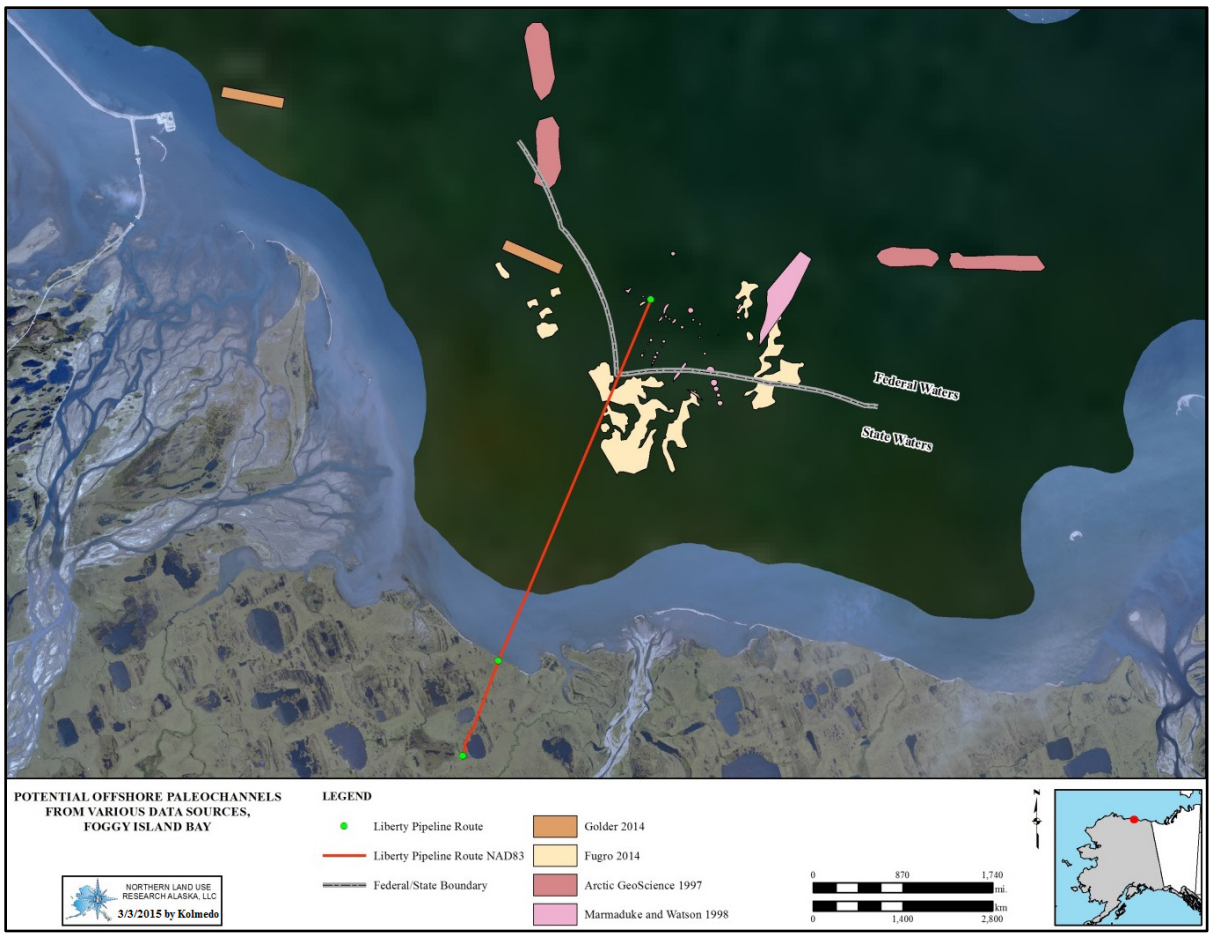


**Figure 1. Potential Offshore Paleochannels**

### *Historic Resources*

Only one shipwreck is known to have occurred in the area, a whaling ship, the *Reindeer*, was lost in 1894, presumably off Reindeer Island which was subsequently named after the vessel. However, the precise site of the shipwreck is unknown, with various potential locations given, including Cross Island, "Midway Island" (Reindeer and Argo islands), or "Return reef" (the Return Islands west of Gwydyr Bay. If the shipwreck occurred in the vicinity of Reindeer Island, it would be about 14 miles northwest of the project area. Thus, it is unlikely that the proposed project would affect any intact shipwreck, although an associated debris field may exist (http://www.boem.gov/Alaska-Coast-Shipwrecks/; Reanier, 2008).

### *Terrestrial Archaeological Surveys*

Several terrestrial archaeological surveys have been conducted in the vicinity of the Liberty project since the mid-1970's (as summarized by NLURA, in correspondence dated November 5, 2014 to Kate Kaufman, Hilcorp) (Campbell 1974; Higgs, 2013; Lobdell 1980, 1987, 1998a, 1998b; Reanier 2004, 2008, 2014; Rogers 2013). Four of these reports were specifically linked to the current Liberty DPP (Higgs, 2013; Reanier, 2008 and 2014; Rogers 2013). Although sites on land identified through previous archaeological surveys were found again on the ground, the proposed gravel mine sites were intensively archaeologically surveyed, and boreholes from G&G corings were archaeologically inspected, no new archaeological sites either on- or offshore have been identified. As described in detail in Chapter 4, proposed HAK ground disturbance will occur within the boundaries of one large gravel mine site. The proposed actions would avoid all documented terrestrial archaeological sites.

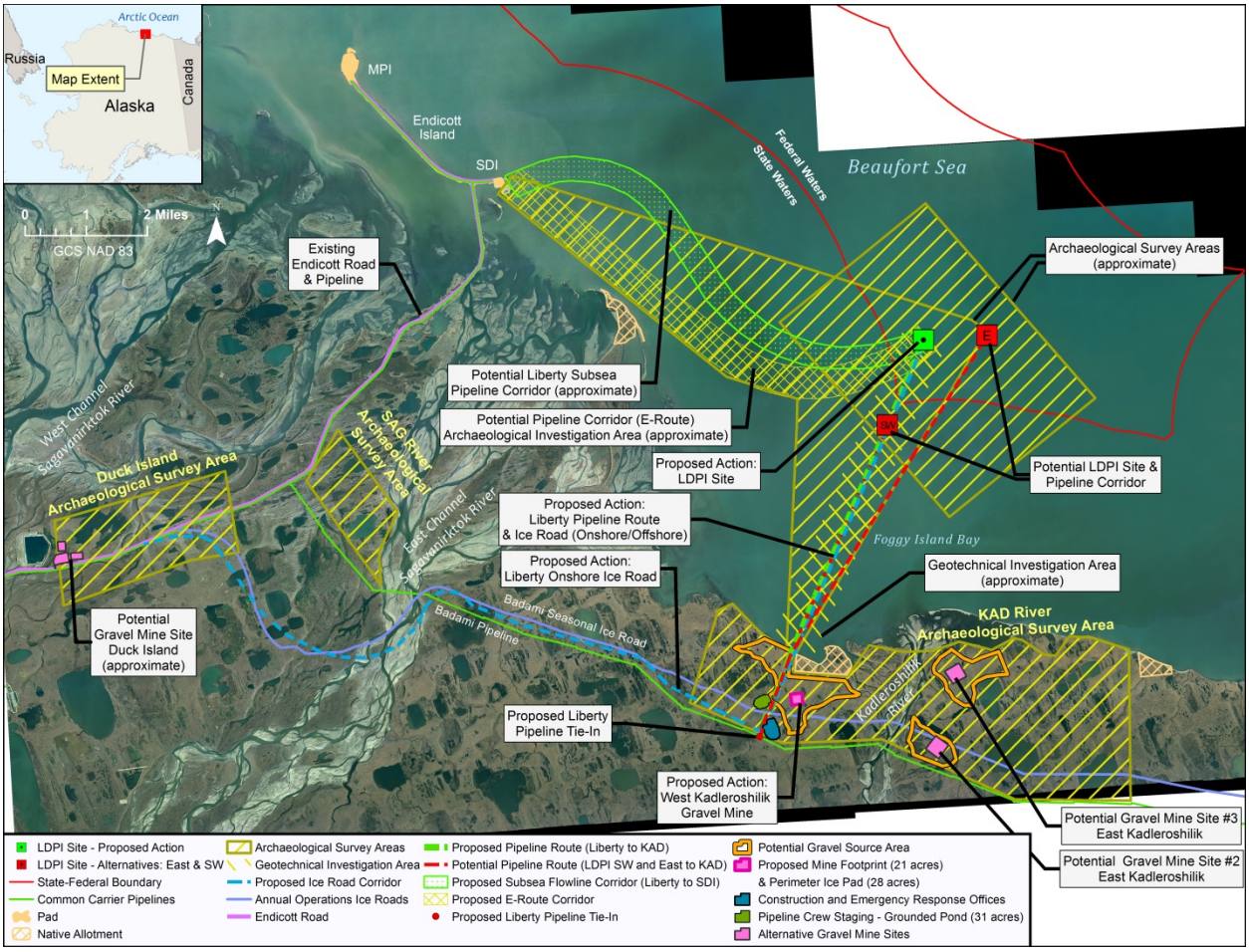


**Figure 2. Composite of All Archaeological Surveys Performed for the Liberty Development and Production Plan**