Biological Evaluation

In Support of the Beaufort Sea Oil and Gas Exploration NPDES General Permit (NPDES Permit No.: AKG-28-2100)

United States Environmental Protection Agency

January 2012

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) proposes to issue a National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges associated with oil and gas exploration activities in the Outer Continental Shelf (OCS) area, located off northern Alaska. The Beaufort NPDES general permit will authorize discharges from exploratory operations in all areas offered for lease within the Beaufort Sea, including past leases and lease sale areas that may be offered in the immediate future (i.e., within the next 5 years). Lease sales within the next 5 years – if any – could occur within the Beaufort Sea Area of Coverage which includes approximately 65.1 million acres (about 101,750 square miles), and extends offshore from north of Barrow to the Canadian-U.S. border (see Figure 1). Existing leases within the Area of Coverage begin just offshore and encompass 2.7 million acres (about 4,250 square miles) in water depths ranging from approximately 20 to 170 meters. It is in this area (i.e., near existing oil and gas leases) where exploration activities are most likely to occur.

This Biological Evaluation (BE) is prepared in accordance with Section 7 of the Endangered Species Act of 1973, as amended (ESA). This BE assesses the impacts that oil and gas exploration activities related to the NPDES general permit could have on species listed under the ESA, those formally proposed for listing, as well as candidate species.

1.1 Project Information

Project Name:	Beaufort Sea NPDES General Permit for Oil and Gas Exploration
State:	Alaska
County:	North Slope
Proponent:	U.S. Environmental Protection Agency Region 10, Office of Water and Watersheds Seattle, WA
Preparer:	Tetra Tech EC, Inc. 19803 North Creek Parkway Bothell, WA 98011
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1.2 Background

EPA is reissuing the Arctic NPDES general permit as two distinct permits for discharges to the Beaufort and Chukchi seas that may occur during oil and gas exploration activities (one for the Beaufort Sea and one for the Chukchi Sea). This BE is prepared for the Beaufort Sea NPDES general permit (permit number AKG-28-2100). The area considered within this permit (i.e., the NPDES general permits' Area of Coverage) includes all areas under consideration by the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE; formerly known as the Minerals Management Service) for lease through the period of **DAY MONTH** 2012 through **DAY MONTH** 2017.

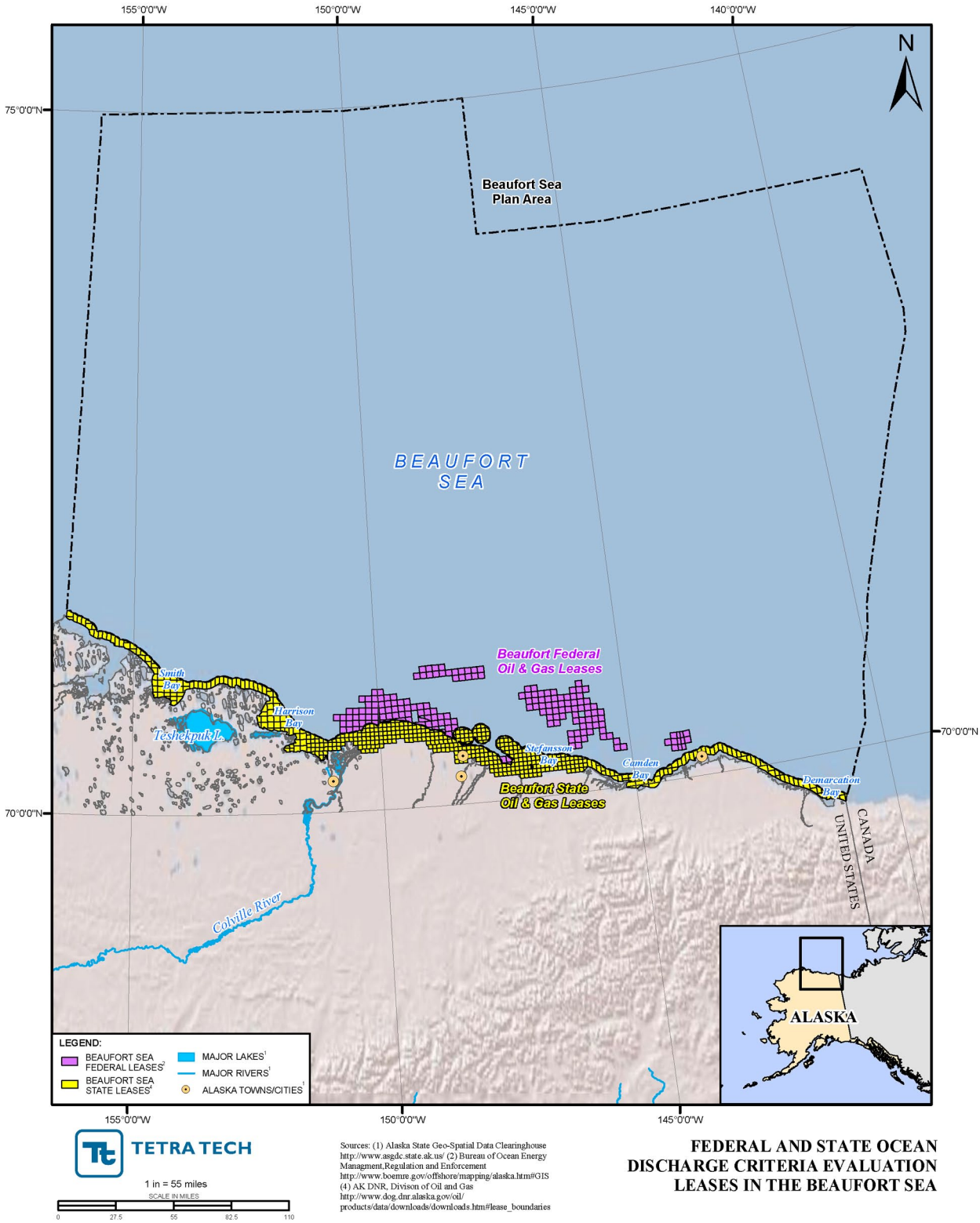

Figure 1. Beaufort General Permit Area of Coverage

1.3 Federal Nexus

This BE has been prepared to facilitate coordination between the federal action agency (i.e., EPA), the U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS). Section 7 of the ESA requires that, through consultation (or conferencing for proposed species) with the USFWS and/or NMFS, federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of critical habitat.

In addition, this BE addresses the proposed action's compliance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), which requires Federal agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). The objective of the EFH assessment is to determine whether or not the proposed action "may adversely affect" designated EFH for relevant commercial, federally-managed fisheries species within the proposed Action Area (see Section 3 for a definition of the Action Area). For the purpose of this assessment, the proposed action for the EFH assessment and BE incorporate the same project elements. The EFH Assessment is included as Appendix A to this document.

1.4 Consultation History

EPA has coordinated with the USFWS and NMFS in developing the NPDES general permit in order to address impact concerns; however, formal consultation has not occurred previously.

2.0 PROJECT DESCRIPTION

2.1 Project Location

The Area of Coverage considered within the Beaufort NPDES general permit is shown in Figure 1. This area is located in northern Alaska, directly offshore of an area commonly referred to as the Alaskan Arctic coastal plain. The NPDES general permit Area of Coverage extends from north of Barrow, to the Canada-U.S. border, and consists of approximately 65.1 million acres (about 101,750 square miles) of ocean.

2.2 Project Related Activities

The proposed action that would be conducted under the Beaufort NPDES general permit consists of drilling exploration and delineation wells in order to determine the location and extent of oil and gas deposits within the NPDES general permit Area of Coverage. An exploration well is a well that is drilled into a previously undrilled geologic formation to test for the presence of hydrocarbon accumulation. If an exploration well indicates positive results in terms of a resource, delineation well may be drilled at variable distances from that well to determine the spatial and vertical extent of the resource. The delineation well can also be used to estimate the production rate of a new oil or gas field. As there are no substantial differences between the activities conducted or the characteristics of discharges from exploration and delineation wells, the Beaufort NPDES general permit treats both types of actions the same. As a result, these two actions (i.e., drilling exploration wells and delineation wells) are treated identically within this BE. Wells would be drilled during the summer season when pack-ice is not present; however, as there are periodic incursions of pack-ice into the area during summer, ice breakers may be used in the vicinity of the drilling rig to control the levels and extent of ice (MMS 2002). Wells would be plugged at the end of the permitted activity. Plugging refers to the abandonment and closure of wells, and includes the backfilling of wells with cement in order to ensure that hydrocarbons are not released from the well.

Exploration activities (i.e., drilling exploration and delineation wells) in the offshore Arctic are most often conducted using floating barges, drill ships, jack-up rigs, or semi-submersible rigs; therefore, these are likely to be the methods used within the NPDES general permit Area of Coverage. Floating drilling units are typically used when drilling in deep waters, while jack-up rigs can be used in waters up to 91 meters deep (EPA 1993). Drillships and ship-shaped barges are vessels equipped with drilling rigs that float on the surface of the water, and maintain their position by dynamic positioning and anchors on the seafloor. A jack-up rig consists of a drill rig attached to a barge. Once the barge reaches its desired location, support legs are attached and jacked downward to the sea floor. Once the legs reach the sea floor, the downward pressure of the jacking process lifts the barge out of the water. Semisubmersible rigs are mounted to a hull with adjustable ballast, allowing the rig to be raised or lowered within the water via flooding its ballast-hull. The rig floats on top of the water when not in use; however, when the ballast-hull is flooded, it sinks to a depth that allows the rig to remain stable against wave motion (EPA 1993). All these drilling operations will result in similar if not identical type of discharges and associated impacts to listed species.

Drilling operations are expected to range between 30 and 90 days at different well sites. The time necessary to compete a single drilling operation (i.e., 30 to 90 days) will depend on multiple factors, such as the depth to the target formation, the time necessary to finalize logging/testing operations, and any unexpected difficulties experienced during drilling (MMS 2007). Considering the relatively short open water season in the Beaufort Sea (June-November) the BOEMRE anticipates that up to four wells could be started by one rig each drilling season (MMS 2007); however, this may be an overestimate. It is more likely that an operator, using a single rig, would be able to complete drilling, testing, and plugging of up to two exploration wells during a single season. BOEMRE estimated that 12 exploration and 11 delineation wells would be drilled in the Beaufort Sea between 2007 and 2018 (MMS 2006a). Since that time there have been submittals of several Notices of Intent (NOIs) by three companies in 2011 announcing exploration plans. Based on these recent submittals, NMFS is working with BOEMRE to determine a range of exploratory drilling activity scenarios, and any associated assumptions. For the purposes of this assessment, EPA estimates that between 18 and 34 exploration and delineation wells will be drilled during the five-year permit term (2012-2017).

One of the first steps in exploratory drilling in the Arctic is the establishment of a mudline cellar (MLC). The purpose of the MLC is to protect the well from ice gouging during ice-over periods. The MLC is drilled using a large diameter drill bit (e.g., one proposal calls for a MLC 6 meters in diameter and 12 meters deep). Cuttings and displaced sediments, generated during drilling the MLC, are jetted out of the well and fall back to the surface of the seafloor, settling within the direct vicinity of the well. The drilling process for the MLC does not use drilling fluid (only seawater) and can produce approximately 3,000 barrels (bbl) of drill cuttings[1], and can displace approximately 566 cubic yards of material from the ocean floor.

After the MLC is drilled, the process of preparing the first few hundred feet of a well is called "spudding." The spudding process typically requires a large diameter pipe, called the conductor casing, that is hammered, jetted, or placed on the seafloor, depending on the composition of the substrate (EPA 1993). The conductor casing (and eventually the casing) guides the "drill string" down from the drill rig to the drill hole, which will eventually become the exploration/delineation well. The drill string consists of lengths of pipe threaded together to connect the drill motor with the drill bit. During exploration drilling, drilling fluid (or drilling "mud") is pumped down through the drill pipe and ejected from the drill bit into the well. The drilling fluids lift cuttings off the bottom of the well away from the drill bit, and circulate the cuttings back to the surface through the annular space between the outside of the drill string and the borehole. Drilling fluids can be composed of water-, oil- or synthetic-based materials; however, the Beaufort general permit only authorizes the discharge of water-based drilling fluids to the environment (i.e., the sea). Operators may choose to use oil-based or synthetic-based fluids during exploration activities, but those drilling fluids cannot be discharged to the environment under the permit The cuttings and fluid are sent through a series of shaker tables and separators in order to remove the fluid from the cuttings. The processed drilling fluid is then returned to a tank for reconditioning and reuse in

[1] Drill cuttings are chips of the naturally occurring rock that are removed from the drill hole during the drilling process (Shell Gulf of Mexico 2009).

the drilling process. Barite (barium sulfate) is added to water-based drilling fluid as a weighting agent, which is used to counteract reservoir pressures and to prevent water from seeping into the well from the surrounding rock formation (Neff 2008; EPA 2000). Barite contains trace levels of several toxic heavy metals, such as mercury, cadmium, arsenic, chromium, copper, lead, nickel, and zinc (EPA 2000). See the Draft Ocean Discharge Criteria Evaluation, prepared by EPA for the Beaufort Sea general permit, for a list of metal concentrations within barite (EPA 2011).

Cuttings are either discharged or placed in containers for disposal onshore. Only cuttings generated with water-based fluids are authorized for discharge under the Beaufort NPDES general permit and are typically discharged to open water via a discharge pipe (outfall). During or following the drilling process, drilling fluids may need to be replaced or disposed of, which again is done in one of two methods. If the drilling fluids are water-based and free of oil, they can be disposed of through an outfall to the receiving water. If the fluids contain oil either because of their type (i.e., they are oil-based) or due to drilling operations, they would be placed in containers and disposed of onshore.

As the bore hole is drilled deeper, drilling is stopped periodically to run and cement additional sections or "strings" of cylindrical steel casing. The casing keeps the walls from collapsing and binding the drill string, and other than the open hole that is drilled before each string of casing is run, the drill string operates within the casing. To keep each string of casing in place, cement is pumped down through the new string of casing, forced out of the open hole and back up the annular space outside of the casing, between it and the open hole, to fill the voids and keep the casing in place. Once the cement is set outside the casing, the drilling process can continue. The initial casing may be on the order of 76 centimeters (cm) in diameter, and is gradually stepped down in size as the hole deepens. The addition of casing may be continued until final well depth is reached. If a stable formation is encountered in the process, drilling may be conducted "open hole" without a casing. To prevent well blowouts, blowout preventers (i.e., hydraulically operated high-pressure safety valves), are attached at the top of the well within the MLC. Cement is used to plug the well at the end of the operation, but only after it has been fully characterized and tested.

The discharge of drilling fluids and cuttings is an intermittent process, generally occurring only while the drill is in operation. The discharge of cuttings ceases during the process of adding more pipe-length to the drill string or conducting cementing operations; however, during these times it is possible that water-based drilling fluids will continue to be discharged. The discharge of drilling fluids and cuttings happens for approximately 50 percent of the time the rig is "on station."

As discussed above, drilling fluids contain quantities of coarse material, fine material, dissolved solids, and free liquids. As a result, the drilling fluids behave like slurry, in that the coarse material and solids are denser than water and sink rapidly towards the seafloor, while portions of the aqueous component remain in the water column (EPA 2000). The EPA used a model (originally developed by the Offshore Operators Committee) to predict the behavior of solid and soluble components of drilling-related discharges within the NPDES general permit Area of Coverage (EPA 2011). The dilution ratio for the aqueous component of the drilling fluids (referred to as "effluent dilution" in the model) was approximately 600:1 at the edge of the mixing zone (i.e., 100 meters from the discharge point), when assuming a discharge rate of 1,000

bbl per hour and a current speed of 40 cm per second (EPA 2011). The thickness of the settled discharge on the sea floor would depend on a variety of factors such as current speeds and discharge rates; the Ocean Discharge Criteria Evaluation for the Beaufort Sea NPDES permit contains predictions for the thickness of the settled discharge modeled under various conditions (EPA 2011). Under the worst-case scenario for accumulation, the maximum depth of deposition of the solids associated with drilling fluids was estimated at approximately 1 cm over an area of approximately 800 square meters in the vicinity of the outfall. Solids accumulation would decrease with distance from the outfall (Tetra Tech 2011).

In addition to drilling fluid, general operations on the drill rigs will result in other authorized discharges to the environment. Drainage waters from rainfall can runoff from deck surfaces; water generated during cleaning the deck is discharged via a discharge pipe (outfall). Domestic gray water is generated from showers, laundry, and liquid galley wastes. Sanitary water is generated from treated sewage. These wastes (i.e., domestic gray water and sanitary water) are combined and discharged via the caisson (i.e., a watertight structure used to retain liquids). Desalination wastewater (brine), bilge water, and ballast water are wastewaters that are also discharged via the outfall. Solid food wastes are generally incinerated onboard the ship, while other solid wastes (e.g., trash and debris) are stored and disposed of on land. Cooling water discharges may occur through the outfall or shunted directly to the sea from the individual pieces of equipment associated with the cooling system. The design of the blowout preventer is such that the fluid used to open it after it has been closed for testing must be forced through the system and discharged at the unit itself. These discharges would occur at lower volumes than the drilling fluids described above, and are expected to dissipate within the extent of the mixing zone (i.e., a 100-meter radius around the discharge; EPA 2011).

As described above, exploration activities would result in numerous sources of waste, many of which are commonly discharged from the drill rig or platform into the ocean. The Ocean Discharge Criteria Evaluation, prepared by EPA for the Beaufort NPDES general permit, contains a detailed assessment of the types and chemical composition of waste that would be discharged (EPA 2011). Table 1 lists the amount of each waste source that EPA estimates could be discharged under this permit (EPA 2011).

2.3 Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (50 CFR 402.02). Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Helicopters and support vessels may be used in order to transport supplies and personnel between the drill-vessels and the shore. The use of helicopters and support vessels during exploratory activities would be considered as interrelated/interdependent actions. No additional activities that are interrelated or interdependent have been identified at this time.

2.4 Direct and Indirect Effects (definitions)

The exploration activities covered by the NPDES general permit could result in both direct and indirect effects to wildlife and habitats. Direct effects are those that are immediate in space and/or time compared to their cause, while indirect impacts are those that would be separated in space or time from their cause. An example of a direct impact could be mortality resulting from a collision with a vessel, while an

Table 1. Estimated discharge quantities based on NOIs

Discharge	Discharge quantities[a] (bbl/well)
Water-based drilling fluids and drill cuttings (001)[a]	**5,071[b]**
Deck drainage (002)[b]	**244**
Sanitary wastes (003)	**1,022[b]**
Domestic wastes (004)	**11,390[b]**
Desalination unit wastes (005)	**5,390**
Blowout preventer fluid (006)	**42**
Boiler blowdown (007)	**0**
Fire control system test water (008)	**0**
Non-contact cooling water (009)	**2,187,000**
Uncontaminated ballast Water (010)	**212[b]**
Bilge water (011)	**652[b]**
Excess cement slurry (012)	**50**
Muds, cuttings, and cement at the seafloor (013)	**2,791**

Notes:

[a] Average estimated quantities based on Shell's NOIs for exploration activities in the Beaufort Sea.

[b] Shell's NOIs indicated zero discharge in Camden Bay at the Sivulliq and Torpedo prospects.

indirect effect could include a species eventual abandonment of a habitat due to degradation of habitat quality. The effects of permitted exploration activities would likely consist of habitat degradation/loss and the toxic effects of effluent discharges, general disturbances (e.g., from noise as well as the presence of vessel and helicopters); direct mortality; and indirect impacts to food availability/quality.

2.5 Impact Avoidance and Minimization Measures

There are multiple impact avoidance and minimization measures that would be employed to minimize, reduce, or eliminate the potential for adverse effects of the proposed action upon listed species and baseline conditions within the Area of Coverage / Action Area. Measures were developed as part of the Beaufort NPDES general permit, as well as measures that were required as part of the previous lease sales and the USFWS / NMFS Biological Opinions (BOs) on lease sales in the Beaufort. These measures are provided in Appendix B.

3.0 ACTION AREA

The ESA requires that potential effects to listed and proposed endangered and threatened species be evaluated in relation to the complete range of areas influenced by the proposed action (i.e., the Action Area; 50 CFR Part 402.02). The Action Area is defined as the complete extent where measurable direct and indirect effects resulting from the proposed action are foreseeable and are reasonably certain to occur (USFWS and NMFS 1998). The Beaufort Sea Arctic NPDES general permit area of coverage extends from the coastline seaward to include all areas offered for lease within the Beaufort Sea (i.e. Beaufort Sea Area of Coverage). This area encompasses all areas that could be affected by exploratory activities, and will therefore serve as the boundary of the Action Area for this BE (Figure 1).

As described in Section 2.2, exploration activities would be conducted from drill-ships or moveable platforms during the summer months, as this is the season when the extent of pack-ice would be the lowest; however, pack-ice would be present in at least some portions of the Action Area year round. Sections 4 and 5 examine species presence in this Action Area.

4.0 ESA SPECIES AND CRITICAL HABITAT

The ESA requires, under Section 7 of the Act, that "[e]ach Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical (16 U.S.C. 35 §1531-1544)." In addition to consultation with the USFWS/NMFS for listed species, another process called conferencing may be conducted for species proposed for listing under the ESA, where the lead federal agency feels that the an action may jeopardize the species. Candidate species (i.e., species that are warranted for listing under the ESA, but which have been precluded from listing due to higher priority species/actions) are not typically included in formal consultation or conferencing.

Proposed species will be evaluated within this BE in order to establish an effects determination that can be applied if these species become listed following the release of this BE. Candidate species will be discussed in general within this BE; however, an effects determination will not be established for these species, as they are not currently listed under the ESA and a potential listing is not expected (as may be the case for proposed species).

4.1 ESA Species List

Five species currently listed under the ESA, two proposed for listing, and two candidate species could occur within the Action Area (see Table 2).

Table 2. ESA listed, proposed, and candidate species potentially present within the Action Area

Common name	Scientific name	ESA status	Jurisdiction	Critical habitat designated within the Action Area
Bowhead Whale	*Balaena mysticetus*	Endangered	NMFS	No
Humpback Whale	*Megaptera novaeangliae*	Endangered	NMFS	No
Polar Bear	*Ursus maritimus*	Threatened	USFWS	Yes
Bearded Seal	*Erignathus barbatus nauticus*	Proposed	NMFS	No
Ringed Seal	*Phoca hispida hispida*	Proposed	NMFS	No
Pacific Walrus	*Odobenus rosmarus brevirostris*	Candidate	USFWS	No
Spectacled Eider	*Somateria fischeri*	Threatened	USFWS	No
Steller's Eider	*Polsticta stelleri*	Threatened	USFWS	No
Yellow-Billed Loon	*Gavia adamsii*	Candidate	USFWS	No

Source: http://alaska.fws.gov/fisheries/endangered/pdf/consultation_guide/4_Species_List.pdf

4.2 Description of Marine Mammals

4.2.1 Bowhead Whale

The Western Arctic stock of bowhead whales is listed by NMFS as endangered under the ESA. It is designated as "depleted" under the Marine Mammal Protection Act (MMPA); as a result, the Western Arctic stock is classified as a strategic stock[2].

4.2.1.1 Life History and Occurrence of the Species in the Action Area

Bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, typically between 54°N and 75°N latitude in the western Arctic Basin (see Figure 2). The majority of the Western Arctic stock migrates annually from wintering areas (November to March) in the northern Bering Sea through the Chukchi Sea in the spring (March through June) and into the Beaufort Sea, where they spend much of the summer (mid-May through September) before returning again in the fall (September through November; Braham et al. 1980; Moore and Reeves 1993). Breeding typically occurs during late winter or early spring. The bowhead whale spring migration follows fractures in the sea ice around the coast of Alaska, generally in the shear zone. Calves are typically born during this spring migration. Bowheads are most sensitive during their spring migration when calves are present and their movements are restricted to open leads in the ice. As the whales travel east past Point Barrow, their migration is somewhat funneled between shore and the polar pack-ice (Krogman et al. 1989). Most of the year, bowhead whales are closely associated with sea-ice (Moore and DeMaster 2000); only during the summer is this population in relatively ice-free waters in the southern Beaufort Sea (Richardson et al. 1987). Some bowheads are found in the Chukchi and Bering seas in summer, and are thought to be part of the expanding Western Arctic stock. Fall surveys show that the bowhead whales are found close inshore east of Barter Island and from Cape Halkett (in the Beaufort Sea) to Point Barrow generally in water depths less than 50 meters (MMS 2002). After passing Barrow, some of the whales head towards Wrangell Island and then south to the northeast coast of Chukotka and follow the Asian coast southeast to the Bering Sea, while others take a more direct route (MMS 2008). When returning in the spring, the whales pass through the Bering Strait and eastern Chukchi Sea from late March to mid-June through newly opened leads in the shear zone between the shorefast ice and the offshore pack ice. It is thought to occur after the peak of breeding, which is believed to occur in March-April (MMS 2008).

The Western Arctic stock is the largest remnant population worldwide, and the only stock that is found within U. S. waters. Prior to commercial fishing in the Bering Sea (mid-19th century), it is estimated that the Western Arctic Stock population was between 10,400 and 23,000. The population dropped to less than 3,000 at the end of commercial whaling. The Western Arctic stock has increased at a rate of 3.4 percent from 1978 to 2001, during which time abundance doubled from approximately 5,000 to 10,545 whales (George et al. 2004; Allen and Angliss 2010).

[2] A stock is considered strategic if direct human-caused mortality exceeds the potential biological removal, it is listed under the ESA, it is declining and likely to be listed under the ESA, or it is designated as depleted under the MMPA.

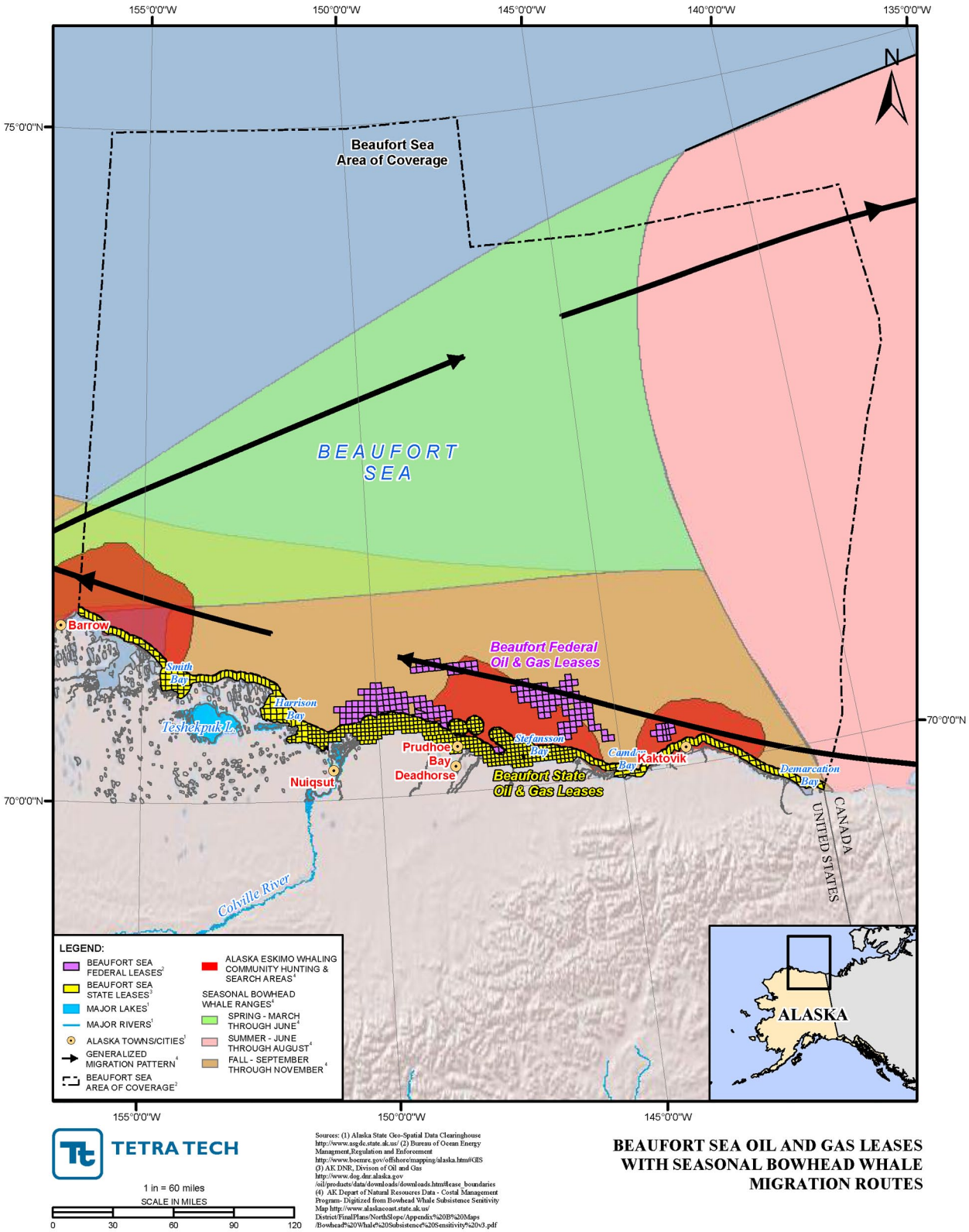

Figure 2. Bowhead Whale Migration Routes

Food items of bowhead whales include euphausiids, mysids, copepods, and amphipods. Since euphausiids are also the primary food for other whales found in the Action Area, the bowhead whale is in direct competition with other whale species for food. A single bowhead whale needs an estimated 100 metric tons of krill annually, consisting of copepods, amphipods, euphausiids, and other small crustaceans (NMFS 2008; ACS 2004). Bowheads feed at all depths, from the surface to the sea floor (ADF&G 1994); sometimes bring mud to the surface (Richardson and Thomson 2002). During feeding, bowhead whales concentrate at places and depths correlated with zooplankton concentrations (Griffiths and Buchanan 1982; Bradstreet et al. 1987; Richardson et al. 1987; Richardson et al. 1995a, b). Richardson and Thomson (2002) also found that bowhead whales feed regularly in the nearshore waters of the eastern, central, and western Alaskan Beaufort Sea during September and October as they make their fall migration. It is believed that bowhead whales feed little while wintering in Chukchi and Bering seas, based on behavioral observations (Lowry 1993); however, some studies have indicated that most of the annual food requirement of adults and sub-adults may actually be obtained from the Bering and Chukchi seas, and that only a minority of their food comes from the eastern and central Beaufort Sea (Lee et al. 2005), although this theory is uncertain.

Impacts to bowhead whale populations have included historic and current whaling operations, toxic pollution related to oil extraction, disturbances related to anthropogenic noise disturbances, and alterations to Arctic habitats resulting from climate change (Allen and Angliss 2010). Additional factors likely include collisions with vessels, entanglement in fishing gear, reduced prey abundance due to overfishing, and illegal whaling. These factors have all contributed to the listing of this species under the ESA.

Bowhead whales would be present near existing oil and gas leases from September through November while migrating to winter grounds, and present in offshore areas in summer and spring.

4.2.1.2 Critical Habitat

No critical habitat for bowheads has been designated in the Action Area.

4.2.2 Humpback Whale

The Western and Central stocks of humpback whales are listed by NMFS as endangered under ESA. They are designated as “depleted” under the MMPA; in addition, these stocks are classified as strategic stocks.

4.2.2.1 Life History and Occurrence of the Species in the Action Area

Humpback whales are widely distributed in all oceans, though they are less common in Arctic waters. Of the four currently recognized stocks, only two (the Central North Pacific stock and the Western North Pacific stock) are potentially present in the Action Area. The humpback whale distribution ranges from tropical wintering grounds near islands and continental coasts to open-ocean temperate and sub-polar summering habitats. The range of the central North Pacific stock is from the Hawaiian Islands to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak. The range of the western North Pacific stock is from Japan to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian

Islands). In addition, humpback whales have been sighted as far north as the Beaufort Sea during summer months (Hashagen et al. 2009). During 2007, Hashagen et al. (2009) photographed a cow/calf pair of humpback whales in the Beaufort Sea, located 87 km east of Barrow. This pair presumably traversed the length of the Chukchi Sea twice during their annual migration; indicating long-distance migration from either Japan or Hawaii to the Arctic Ocean is possible. There is no conclusive information on what population those humpbacks that enter the Beaufort Sea belong to, although Allen and Angliss (2010) suggest that they most likely belong to the Western North Pacific stock. Breeding does not occur in Arctic waters; it occurs in tropical waters during winter months.

Prior to commercial whaling, the worldwide population of humpback whales is thought to have been in excess of 125,000 individuals. The current estimate for the North Pacific population (which includes the California/Oregon/Washington stock, the Central North Pacific stock, and the Western North Pacific stock) is about 20,000 whales (NOAA 2011). Allen and Angliss (2010) provided a current population estimate for the Central North Pacific stock of between 7,469 and 10,103 whales. At least some portions of the stock have increased in abundance between the early 1980s and 2000, although recent trends indicate that the stock may be approaching its carrying capacity. The population size of the smaller Western North Pacific stock is estimated to be between 938 and 1,107 (Allen and Angliss 2010). There are no reliable estimates for the abundance of these stocks at feeding areas because the exact extent and location of feeding areas is unknown. Reliable information on trends in abundance is also currently unavailable.

The humpback whale diet consists of small schooling fishes (including herring, sand lance, capelin, mackerel, small pollock, and haddock) and large zooplankton, mainly krill. Since euphausiids are also the primary food for other whales potentially present in the Action Area, the humpback whale is in direct competition with these species for food.

Impacts to humpback whale populations have included historic and current whaling operations, entanglement in fishing gear, and disturbance from low-frequency noise (Allen and Angliss 2010). Additional factors likely include collisions with vessels and illegal whaling. These factors have all contributed to the listing of this species under the ESA.

Based on the distribution and migratory habitats of the humpback whale, it is possible that this species would be present in the Action Area during exploration activities; however, their extent within the Action Area is unknown.

4.2.2.2 Critical Habitat

No critical habitat has been proposed or designated for humpback whales in the Action Area.

4.2.3 Polar Bear

The Chukchi/Bering Sea and Southern Beaufort Sea stocks of polar bears are listed by the USFWS as threatened under ESA. They are designated as “depleted” under the MMPA; as a result, these stocks are classified as strategic stocks.

4.2.3.1 Life History and Occurrence of the Species in the Action Area

Polar bears have a circumpolar distribution in the northern hemisphere. There are two recognized polar bear stocks that could occur within the Action Area - the Southern Beaufort Sea and the Chukchi/Bering Sea stocks. These two stocks have a substantial overlap in their distributions between Point Barrow and Point Hope, with the center of this overlap located near Point Lay (Garner et al. 1990; Garner et al. 1994; Amstrup et al. 2000). As a result, most of the bears in the Action Area are likely from the Southern Beaufort Sea stock; however, some of the bears in the southwestern most edge of the Action Area could be from the Chukchi/Bering Sea stock. Analysis of mitochondrial DNA has shown that there is little genetic difference between these two stocks (Cronin et al. 1991; Scribner et al. 1997; Cronin et al. 2006); however, demographic and movement data indicates that these stocks have a high site fidelity, suggesting that the various stocks should be managed separately (Amstrup et al. 2004; Amstrup et al. 2005).

The polar bear's preferred habitat is the annual sea-ice that develops over the continental shelf and inter-island archipelagos that encircle the polar basin (Derocher et al. 2004). Recent research has indicated that the total sea-ice extent has declined over the last few decades in the Arctic. As a result, polar bear use of coastal areas during the fall period has increased in recent years (Kochnev et al. 2003; Schliebe et al. 2005). In fact, nearshore densities of polar bears can be two to five times greater in autumn than in summer (MMS 2008). For example, aerial surveys flown in September and October from 2000 to 2005 near the village of Kaktovik have revealed that 53 percent of the bears observed along the coast have been females with cubs (MMS 2008). These observed changes in polar bear distribution have been correlated with the distance to the pack ice at that time of year. The farther from shore the leading edge of the pack ice is, the more bears are observed onshore in fall (Kochnev et al. 2003; Ovsyanikov 2005; Schliebe et al. 2006).

Polar bears mate in late March through early May, and typically give birth in December or January. Mothers and cubs typically remain in dens until sometime around spring (Reeves et al. 2009).

The status of polar bears worldwide is declining, and the USFWS and USGS have predicted that some sub-populations of polar bears may become extinct within the next 40 to 50 years (MMS 2008). The most recent (2006) population estimate for the Southern Beaufort Sea stock is 1,526 animals (Regehr et al. 2006). There are no reliable population estimates for the Chukchi/Bering Sea stock. The best available estimate for this stock size is about 2,000 bears; however, this value is highly uncertain and is considered to have little value for management or to estimate status/trend of the stock (IUCN 2006).

Polar bears are opportunistic feeders, but prey primarily on sub-adult ringed and bearded seals, and walruses, but they can also feed on small whales, birds, seaweed, eggs, berries, lemmings, shrubs, lichens, grass, carrion, human refuse, garbage, and occasionally on other polar bears or humans (MMS 1991, 1993). Polar bears concentrate near open leads in winter during hunting. A polar bear has to catch approximately one seal a week to maintain itself. The mother does not eat while denning; both she and her cubs live off her fat reserves.

Global climate change and its effects on Arctic sea-ice is the primary impact to polar bear populations, and the primary cause for their listing under the ESA.

Based on the distribution and movement patterns of polar bears (correlated with the presence of pack-ice), it is likely that they would be present in the Action Area during exploration activities; however, as exploration activities would occur in areas relatively free of sea-ice, it is unlikely that polar bears would occur near these activities.

4.2.3.2 Critical Habitat

On November 29, 2010, the USFWS designated about 119,780,480 acres (187,157 square miles) of offshore sea-ice, terrestrial denning areas, and on-shore barrier islands as critical habitat for the polar bear. About 96 percent of the area designated as critical habitat consists of sea-ice habitat. Designated sea-ice consists of the area located over the continental shelf, in waters 300 meters or less, between about Cape Romanzof to the northern U.S.-Canadian border. The designated terrestrial denning areas include lands within 32 km of the northern coast of Alaska between the U.S.-Canadian border and the Kavik River and within 8 km of the coast between Kavik River and Barrow. The designated on-shore barrier islands consist of the barrier islands located along the Alaskan coast between about Cape Romanzof to the northern U.S.-Canadian border. The Action Area encompasses vast portions of designated polar bear critical habitat (see Figure 3).

4.2.4 Bearded Seal

NMFS has received a formal petition to list the bearded seal under the ESA; therefore, they are currently conducting a status review of this species to determine if it warrants listing. The bearded seal is not listed as a “depleted” stock under the MMPA, nor is it considered as a strategic stock.

4.2.4.1 Life History and Occurrence of the Species in the Action Area

The bearded seal has a circumpolar distribution, with a range that extends throughout the Arctic into Russian and Canadian waters; however, only the Alaska stock is recognized in U.S. waters. The majority of the bearded seal population in Alaska is found in the Bering and Chukchi seas, with summer migrations into the Beaufort Sea.

During summer, the most favorable bearded seal habitat is found in the central and northern Chukchi Sea, where they are found near the widely fragmented margin of the pack-ice; they are also found in nearshore areas of the central and western Beaufort Sea during summer (MMS 2008). This species typically prefers areas of less-stable or broken sea-ice, areas with 70 to 90 percent ice coverage, and tend to be found over shallow waters less than 200 meters deep (Burns 1967; Allen and Angliss 2010). They are most often found in areas 32 to 160 km from shore. During summer, many bearded seals do not follow the ice northward and instead remain in open waters of the Bering and Chukchi seas where they rarely haul out on land (Burns 1981; ADNR 2009a). In winter, they tend to inhabit broken pack-ice, but they are also found on shorefast ice (Smith and Hammill 1981). Bearded seals give birth on pack ice between April and May (Reeves et al. 2009).

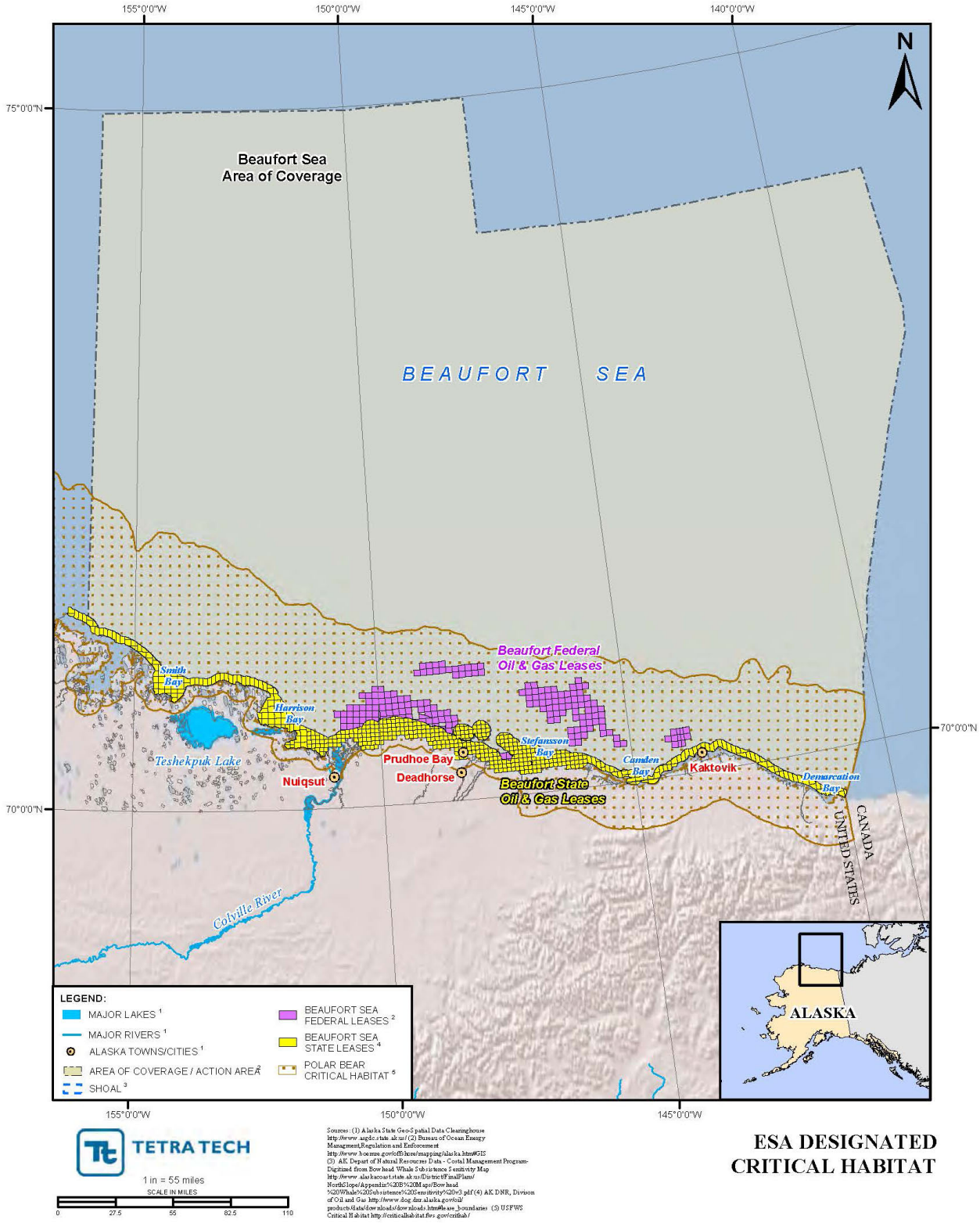

Figure 3. ESA Designated Critical Habitat

Early estimates placed the Bering and Chukchi seas populations of bearded seals at 300,000 to 450,000 seals (Burns 1981), but there are no recent estimates deemed reliable (Allen and Angliss 2009). It is uncertain how many bearded seals travel into the Beaufort Sea during summer months.

Bearded seals feed on the sea floor. They will eat a variety of food sources, including crabs, shrimp, mollusks, Arctic and saffron cod, flatfish, sculpins, and octopus. They have also been known to eat marine algae in some areas (Reeves et al. 2009).

Impacts to bearded seal populations include direct harvesting, indirect mortalities as a result of fisheries activities, mortalities resulting from marine mammal research activities, and alterations to habitat resulting from global climate change in the Arctic environment (Allen and Angliss 2009).

Based on the distribution and movement patterns of the bearded seal, it is highly likely that this species would be present in the Action Area during exploration activities.

4.2.4.2 Critical Habitat

No critical habitat has been designated for this ESA proposed species.

4.2.5 Ringed Seal

NMFS has received a formal petition to list the ringed seal under the ESA; therefore, they are currently conducting a status review of this species to determine if it warrants listing. The ringed seal is not listed as a “depleted” stock under the MMPA, nor is it considered as a strategic stock.

4.2.5.1 Life History and Occurrence of the Species in the Action Area

The ringed seal has a circumpolar distribution; they can be found from approximately 35º N to the North Pole, and occur in all waters of the Arctic Ocean. Ringed seals live on or near the ice year-round; therefore, the seasonal ice cycle has an important effect on their distribution and abundance (MMS 2008).

Ringed seals live on and under extensive, largely unbroken, shorefast ice (Frost et al. 2002), and they are generally found over water depths of about 10 to 20 meters (Moulton et al. 2002). This close contact with ice is thought to provide protection from predators. Density of ringed seals varies greatly depending on the extent of ice-flows, and changes in seasonal distribution appear to be correlated with changes in ice levels (Frost et al. 2002). During late April through June, ringed seal can be found from the southern ice edge northward (Burns and Harbo 1972; Burns et al. 1981; Braham et al. 1984). Surveys conducted in May through June in the Chukchi Sea have shown ringed seals occur more often in nearshore fast and pack-ice, then in offshore pack-ice (Bengtson et al. 2005). It is believed that ring seals move northward with the ice edge in late spring and summer as pack-ice melts (Burns 1970). Densities of ring seals in the Beaufort Sea during summer months are higher to the east of Flaxman Island (located mid-way along the Action Area’s coastline) than to the west (Frost and Lowry 1999). They give birth in pack-ice dens between March and April (Reeves et al. 2009).

The population size of ringed seals within the Arctic is currently unknown. The best estimate currently available is from Bengtson et al. (2005), which estimated that 252,488 ringed seals inhabited the eastern

Chukchi Sea in 1999 and 208,857 in 2000. Previous to that estimate, it is believed that approximately 1.0 to 1.5 million ringed seals may have inhabited the entire Bering and Chukchi seas during the winter (MMS 1982). Similar population estimates have not been established for the Beaufort Sea; however, Frost et al. (2002, 2004) observed ringed seal densities ranging from 0.81 to 1.17 seal/km^2 in the Beaufort Sea during surveys conducted in 1996-1999.

Ring seals primary diet during summer months consists of polar cod species. This prey selection is interesting as polar cod make-up only about 1 percent of the fish and pelagic crustacean biomass in their hunting grounds (Reeves et al. 2009).

Impacts to ringed seal populations have included direct harvesting, indirect mortalities as a result of fisheries activities, mortalities resulting from marine mammal research activities, and alterations to habitat resulting from global climate change in the Arctic environment (Allen and Angliss 2009).

Based on the distribution and movement patterns of the ringed seal (correlated with the presence of pack-ice), it is likely that they would be present in the Action Area during exploration activities; however, as exploration activities would occur in areas relatively free of sea-ice, it is unlikely that ringed seals would occur near these activities.

4.2.5.2 Critical Habitat

No critical habitat has been designated for this ESA proposed species.

4.2.6 Pacific Walrus

The USFWS received a formal petition to list the Pacific walrus under the ESA; however, after conducting a status review of this species, the USFWS determined that it was warranted for listing but that listing was precluded due to high priority listing actions. Therefore, the Pacific walrus was added to the ESA candidate list. The Pacific walrus is not listed as a “depleted” stock under the MMPA; however, it is classified as a strategic stock.

4.2.6.1 Life History and Occurrence of the Species in the Action Area

The Pacific walrus range throughout the continental shelf waters of the Bering and Chukchi seas, and will also occasionally move into the East Siberian Sea as well as the Beaufort Sea; however, the vast majority of the population congregates in the pack ice of the Bering Sea in winter. They are most commonly found in relatively shallow water areas, close to ice or land. The extent of their presence in the Beaufort Sea is uncertain; however, they have been found as far east as Holman Island and the Baillie Islands in the Beaufort Sea (east of the Action Area; Fay 1982).

Walrus migrate north and south following the annual advance and retreat of the pack ice. During the winter breeding season, Pacific walruses can be found in the Bering Sea (Fay et al. 1984). During this time, walruses generally congregate in two areas, one immediately southwest of St. Lawrence Island and the other in outer Bristol Bay (Fay et al. 1984). Mating usually occurs between January and March. Calves are born between April and June during the annual northward migration. As the Bering Sea pack ice begins to breakup in April, walruses begin to move northward and their distribution becomes less

clustered. During break-up, females, calves, and sub-adults migrate into the Chukchi Sea. By late April the distribution extends from Bristol Bay northward to the Bering Strait. The pack ice continues to recede northward as summer progresses and most of the population migrates into the Chukchi Sea, where the largest concentrations are found near the coasts, between 70°N and Pt. Barrow in the east (near the Action Area) and between the Bering Strait and Wrangell Island in the west. However, several thousand animals, primarily adult males, remain and congregate near coastal haulouts in the Gulf of Anadyr, south of St. Lawrence Island, and in Bristol Bay (Angliss and Lodge 2003).

The southward fall migration is thought to be the reverse of the northward migration. In October, as the pack ice develops in the Chukchi Sea, large herds begin to move southward. The animals tend to swim ahead of the pack ice because the ice is too thin to support the herds (Fay 1982). Many come ashore on haulouts in the Bering Strait region. Depending on ice conditions, those haulout sites continue to be used through November and into December; most of the herds move south of St. Lawrence Island and the Chukchi Peninsula by early to mid-December as ice develops. Solitary animals occasionally overwinter in the Chukchi Sea and eastern Beaufort Sea, but most of the population migrates south of the Bering Strait in the fall (October to December) with the southern advancement of pack-ice (Fay 1982).

Estes and Gilbert (1978) and Gilbert (1989) reported that walruses observed during fall aerial surveys were mostly within 20 nautical miles of the ice edge, associated with small floes near the southern boundary of the pack ice, and that walrus use of open water was considerably less than in the pack ice and higher near the ice edge. Fay (1982) also documented that the majority of walruses were found in areas of less than 80 percent ice cover. They will also use terrestrial haulouts in the Gulf of Anadyr, Bering Strait, and Bristol Bay; however, these areas are located outside of the Beaufort Sea area.

Pacific walruses do not normally range into the Beaufort Sea, although some individuals have been observed in this area. From 1994 to 2004, industrial monitoring programs have recorded 10 walruses in the Beaufort Sea area (USFWS 2011). Population estimates for Pacific walruses the Beaufort Sea are uncertain; however, previous studies documenting walrus abundance in the Bering and Chukchi Seas have been made. Surveys conducted in the Bering Sea by U.S. and Russian researchers in 2006 (using thermal imaging systems to estimate population size) estimated 129,000 walruses with a 95 percent confidence interval of 55,000 to 507,000 (Speckman et al. 2010). Surveys in the Chukchi Sea were based primarily on ship and aerial surveys conducted within this region during various times of the year from approximately 1975 through 1990. Surveys conducted in 1975 (Estes and Gilbert 1978) found the highest densities of walrus in the Chuckchi Sea during early September were between 162º and 165ºW. Johnson et al. (1982) surveyed the pack ice near the ice edge in mid-September and reported the highest numbers between 160º30’ and 166º30’W, although walrus were encountered throughout the survey area (from approximately 153º to 172º30’W). Gilbert (1989) reported during surveys conducted during late September and early October 1985 that although walrus use was widespread between 156°30’ and 174°W, densities were highest between 165º and 174ºW. Aerial surveys conducted in late-June to mid-July 1989 and 1990, during monitoring of drilling activities in the vicinities of the Klondike, Burger, and Popcorn Chukchi Sea prospects (within the lease block) reported that walrus were widely distributed along the ice edge between 160º and 165º30’W as the ice pack moved north above 73ºN, with nearly all walrus observations occurring approximately 54 nm southeast of the aforementioned prospects during this

period (Brueggeman et al. 1990, 1991). Aerial flights conducted in early October found few numbers of walrus along a dispersed ice pack and noted that most walruses had abandoned the pack ice in mid-September to early-October and were migrating south ahead of the ice in open waters (Fay 1982; Fay and Burns 1988). Brueggeman et al. (1991) noted during one aerial survey conducted on October 3, 1990 that no walruses were observed in open water between the drilling sites of Burger, and Popcorn and Cape Lisburne, but a total of 429 walruses were observed hauled out at Cape Lisburne.

Pacific walrus mainly feed on bivalve mollusks (clams) obtained from bottom sediments along the shallow continental shelf, typically in waters less than 80 m in depth. Fay (1982) suggested that feeding at these depths or less is most efficient, possibly because of higher productivity of their benthic foods in the shallower water. Walrus are also known to feed on a variety of benthic invertebrates, such as, worms, snails, and shrimp, and some slow-moving fish; and some individuals have been known to feed on seabirds as well as other pinnipeds. Pacific walruses can have a large influence on the structure and composition of benthic communities. They can eat more than 50 clams during a single 7-minute dive to the seafloor, and can consume 77 to 110 pounds of food per day (USGS 2008). Walrus feed by plowing/sifting through sea floor sediments; as a result, they remove large quantities of prey from the seafloor, affect the size structure of clam populations, mix bottom sediments while foraging, create new microhabitats from discarded shells, and generate food for seafloor scavengers (Oliver et al. 1983).

Impacts to walrus populations have included historic commercial hunting, pollution and noise disturbances related to the oil and gas industry, and the alteration of habitat (e.g. extent of ice) related to global climate change on the Arctic environment (CBD 2008).

Based on the distribution and movement patterns of the Pacific walrus, it is possible that this species would be present in the Action Area during exploration activities; however, numbers would likely be limited as the Action Area is on the most extreme eastern portion of their suspected range.

4.2.6.2 Critical Habitat

No critical habitat has been designated for this ESA candidate species.

4.3 Description of Seabirds

4.3.1 Spectacled Eider

The spectacled eider is listed by the USFWS as threatened under ESA.

4.3.1.1 Life History and Occurrence of the Species in the Action Area

Three breeding populations of spectacled eiders are recognized, one of which occur in Russia and two that occur in Alaska (i.e., the Yukon-Kuskokwim population, and the Arctic coastal plain population); however, only the range of the Arctic coastal plain population occurs within the Action Area.

Nearly all spectacled eiders within the Alaskan Arctic coastal plain breed north of 70 degree latitude, between Icy Cape and the Shaviovik River (USFWS 2001). They typically nest in shallow lakes with emergent vegetation and convoluted shorelines (Larned and Balogh 1997). Males leave the breeding

grounds as incubation commences (usually around mid-June) and begin a molt migration, stopping in bays and lagoons to molt and stage for fall migration. Females, whose nests failed, leave the nesting area to molt by mid-August. Breeding females and their young (i.e., females whose nests do not fail) remain on the nesting grounds until early September. Molting flocks gather in relatively shallow coastal water, usually less than 36 m (120 ft.) deep. Important late summer and fall molting areas in Alaska have been identified in Ledyard Bay, which is located in the Chukchi Sea outside of the Action Area. The spectacled eider is not known to molt within the Action Area (MMS 2009). Use of the Beaufort Sea by migrating birds is variable, with most travel over nearshore areas directly to the Chukchi Sea (many of which rest in Ledyard Bay within the Chukchi Sea to molt). A study conducted on migrating eiders found that of the 14 migrating birds, only 4 spent time resting in the Beaufort Sea (11 to 30 days) before heading to the Chukchi Sea (TERA 2002).

Spectacled eiders feed on bottom-dwelling mollusks and crustaceans while in marine waters, and aquatic insects, crustaceans, and emergent vegetation while nesting in inland waters.

Aerial surveys of spectacled eiders conducted in the summer of 2004 within the Arctic coastal plain of Alaska resulted in a population index of 5,985 birds (Larned et al. 2005a, b). This value increased during surveys conducted in the summer of 2005 (7,820 birds; Larned et al. 2005a, b). The USFWS (2010) reported that survey for the 2008 year resulted in an estimate of 6,207 “individual birds on breeding grounds” in the Arctic coastal plain of Alaska.

The causes of the spectacled eider’s population decline are currently unknown; however, it is likely due to loss of habitat (MMS 2009).

Based on the distribution and migratory habitats of the spectacled eiders, it is likely that this species would be present in the on-shore areas near the Action Area during exploration activities (in on-shore nesting habitat near lakes), but unlikely that they would be located in the Action Area for prolonged periods of time. If present in the Action Area, they would likely be found either flying over the area on their way to the Chukchi Sea, or resting in small number within nearshore portions of the Beaufort Sea for a short period (11 to 30 days).

4.3.1.2 Critical Habitat

On February 6, 2001, the USFWS designated critical habitat for the spectacled eiders in the Yukon-Kuskokwim Delta, Norton Sound, Ledyard Bay, and the Bering Sea (between Saint Lawrence and Saint Matthews Islands). This area is located west of the Action Area, in the Chukchi Sea (i.e., outside of the Action Area).

4.3.2 Steller’s Eider

The Alaskan population of Steller’s eiders is listed by the USFWS as threatened under ESA.

4.3.2.1 Life History and Occurrence of the Species in the Action Area

Three breeding populations of Steller’s eiders are also recognized, two of which occur in Russia and one in Alaska. The Alaskan breeding population occurs primarily along the Arctic coastal plain (between

Wainwright to about Prudhoe Bay), with a very small subpopulation occurring along the Yukon-Kuskokwim Delta; however, only the Arctic coastal plain portion of its range occurs within the Action Area.

Steller's eiders in Alaska nest on tundra adjacent to small ponds or within drained lake basins, generally near the coast but occasionally as far as 90 km inland. They typically arrive in their breeding rounds in Alaska between May and June. Within and near the Action Area, the current breeding population has been seen mainly in the northern half of the National Petroleum Reserve-Alaska and on private land near Barrow. The majority of the sightings in the last decade have occurred east of Point Lay, west of Nuiqsut on the Colville River, and within 90 km of the coast. While they occur over a vast area along the Arctic coastal plain, the density is much greater near Barrow, which is the core of the current Steller's eider's breeding range.

After breeding, Steller's eiders move to marine waters where they undergo a complete molt. During the autumn molt, winter, and spring migration, the Alaska-breeding population intermixes with the larger Russian-Pacific population in the marine waters of southwest Alaska. Concentrations of molting Steller's eiders have been observed near Bering Sea islands, and in bays and estuaries from southwest Alaska to the northern shore of the Alaska Peninsula (they are not known to molt within the Action Area; MMS 2009). Kessel (cited in MMS 2002) noted that eiders typically move through the Bering Strait between mid-May and early June. Steller's eiders gather in staging areas before beginning their spring migration; known staging areas occur at the Kuskokwin Shoals near the mouth of the Kuskokwin River (outside of the Action Area).

Johnson and Herter (1989) noted that paired male Steller's eiders depart the North Slope after nesting is initiated in mid- to late June. Female eiders and their young-of-the-year typically depart the North Slope from late September to early October. During molt migration, Alaskan breeding Steller's eiders stop and rest in areas of the Alaska Chukchi Sea, often in nearshore waters (within 2 km or 1 nm of shore) near Ledyard Bay and Icy Cape (east of the Action Area). There is less use at more northerly locations near Wainwright and Peard Bay (also east of the Action Area). More males than females migrate from Alaska to areas along the coast of Chukotka, while males that do not go to Chukotka spend more time on the coast of the Chukchi Sea.

The worldwide population of Steller's eiders may have decreased by as much as 50 percent over the last 30 years. Fredrickson (2001) estimated the world population size of Steller's eiders at about 200,000 birds. More recently, the worldwide population estimate was between 100,000 and 150,000 birds; most of which occurs within Russia (Quakenbush 2006). About 95 percent of the Alaskan population is believed to occur along the Arctic coastal plain. Mallek (2002) summarized annual breeding pair surveys of Steller's eiders from 1989 to 2000 in northern Alaska in order to determine population size point estimates for this species; population estimates from this effort ranged from 176 to 2,543 birds. However, these surveys likely underestimated actual population sizes during this period as these surveys were conducted from aircraft (likely resulting in a portion of the population not being identified), and no species specific correction factor was developed or applied (USFWS 2002). A more recent, yet still very rough estimate, place the population size of pairs nesting on the Alaskan Arctic coastal plain at 1,000

birds (USDOI and USFWS 2007). The calculated average nesting density across the Arctic coastal plain during 2002 to 2006 was 0.0045 birds/km2 (USDOI and USFWS 2007). Only 20 Steller's eiders were counted during migration counts conducted near Point Barrow from fall 2002 through spring 2004 (MMS 2008).

The Steller's eider diet includes crustaceans and mollusks; while breeding, they feed on aquatic insects and plants in freshwater ponds and streams.

The causes of the Steller's eider population decline include increased predation, over hunting, ingestion of lead shot, habitat loss, exposure to environmental toxins, scientific exploitation, and the effects of global climate change (MMS 2009).

Based on the distribution and migratory habitats of the Steller's eiders, it is likely that this species would be present in the on-shore areas near the Action Area during exploration activities (in on-shore nesting habitat near lakes), but unlikely that they would be located in the Action Area for prolonged periods of time. If present in the Action Area, they would likely be found either flying over the area on their way to the Chukchi Sea, or resting in small number within nearshore portions of the Beaufort Sea for a short period.

4.3.2.2 Critical Habitat

On January 10, 2001, the USFWS designated critical habitat for the Steller's eiders in the Yukon-Kuskokwim Delta, as well as four units in the marine waters of southwest Alaska (including the Kuskokwim Shoals, Seal Island, Nelson Lagoon, and Izembek Lagoon). However, no critical habitat for the Steller's eiders has been designated along the Arctic coastal plain, or within the Action Area.

4.3.3 Yellow-Billed Loon

The USFWS received a formal petition to list the yellow-billed loon under the ESA; however, after conducting a status review of this species, the USFWS determined that it was warranted for listing but that listing was precluded due to high priority listing actions. Therefore, the yellow-billed loon was added to the ESA candidate list.

4.3.3.1 Life History and Occurrence of the Species in the Action Area

The yellow-billed loon breeding range extends from Alaska (the Arctic coastal plain, northwestern Alaska, and Stain Lawrence Island), as well as portions of Russia and Canada. Breeding typically occurs sometime in June. Their wintering range includes coastal waters of Alaska (from the Aleutian Islands to Puget Sound in Washington) as well as coastal regions in Asia and Norway (USFWS 2009a).

In the Arctic coastal plain (which includes the Action Area), the yellow-billed loon nests exclusively in coastal and inland low-lying tundra that are in close association with permanent fish bearing lakes. Lakes considered to be of high quality habitat for yellow-billed loons are those that have 1) abundant fish populations that yellow-billed loons use as a food source, 2) contain water depths greater than two meters, 3) are at least 13.4 hectares in size, 4) are connected to other waterbodies that contain fish, 5) have highly convoluted and vegetated shorelines, and 6) have stable and clear water conditions (USFWS 2009a).

Yellow-billed loons are known to forage in nearshore marine environments during breeding; however, successfully breed adults typically forage and feed their young almost entirely from lake habitats (North 1994).

In total, there are fewer than 5,000 yellow-billed loons on the North Slope breeding grounds and nearshore marine habitat (Earnst et al. 2005 cited in MMS 2008).

Yellow-billed loons are vulnerable to population decline due to their small population size, low reproductive rate, and specific breeding habitat requirements (MMS 2009).

Based on the distribution and nesting habitats of the yellow-billed loon, there is a very low likelihood that this species will be present in the Action Area (most-likely occurring in on-shore lake habitats outside of the Action Area); however, they may be found foraging in the nearshore portions of the Action Area in low numbers/densities.

4.3.3.2 Critical Habitat

No critical habitat has been designated for this ESA candidate species.

5.0 ENVIRONMENTAL BASELINE

The existing conditions found within the Action Area are described in detail within the Draft Ocean Discharge Criteria Evaluation, prepared by EPA for the Beaufort Sea general permit (EPA 2011), and are summarized in the following sub-sections of this BE.

5.1 Abiotic Conditions

The Action Area is located in the Arctic climate zone. The average summer temperatures in this area range from 40 to 48ºF, while the area has an average winter temperature -18ºF (EPA 2011). The average precipitation in the Action Area ranges from 10.2 cm at Kuparuk to 15.7 cm at Barter Island (EPA 2011). Water depths in the Action Area vary, ranging from 1.5 meters to 3,500 meters below the Mean Lower Low Water level (i.e., the average of the lowest water levels for each day). Tides generally range from 2.3 to 6.0 cm.

Circulation in the Beaufort Sea can be divided into two main areas: nearshore (water depths less than 40 meters) and offshore (water depths greater than 40 meters). Offshore waters are primarily influenced by the large-scale arctic circulation known as the Beaufort Gyre, which is driven by large atmospheric pressure fields. In the Beaufort Gyre, water moves to the west in a clockwise motion at a mean rate of 5-10 cm per second. The southern portion of the Beaufort Gyre is found in the offshore region of the proposed Beaufort Sea sales area. The Beaufort Gyre expands and contracts, depending on the state of the Arctic Oscillation. Below the surface flow of the Beaufort Gyre, the mean flow of the Atlantic layer (is counterclockwise within the Canada Basin. Below the polar mixed layer, currents appear to be driven primarily by ocean circulation rather than the winds (EPA 2011).

5.1.1 Ice Conditions

Sea-ice is frozen seawater that floats on the ocean surface; it forms and melts with the polar seasons. In the Arctic, some sea ice persists year-round. In the Beaufort Sea, sea ice generally begins forming in late September or early October, with full ice coverage by mid-November or early December. Ice begins melting in early May in the southern part of Beaufort Sea, and early to mid-June in the northern region. Maximum open water occurs in September (MMS 2008).

The analysis of long-term data sets indicates a substantial reduction in both the extent (area of ocean covered by ice) and thickness of the Arctic sea-ice cover in the Beaufort Sea during the past 20 to 40 years. Simulations conducted for the trajectory of Arctic sea ice indicate decreasing September ice trends that are typically 4 times larger than observed trends, and predict near ice-free September conditions by 2040 (Holland et al. 2006).

5.2 Plankton

5.2.1 Phytoplankton

Phytoplankton in the Beaufort Sea includes diatoms, flagellates, dinoflagellates, and the diatom *Chaetoceros spp.* Studies conducted in Harrison and Prudhoe bays found that flagellates were most numerous at the surface with diatoms most numerous in the water column. The horizontal distribution of

diatoms in waters close to shore and river mouths suggests that light levels, rather than salinity or temperature, determine diatom distribution (Homer 1984). The highest concentrations of phytoplankton in the Beaufort Sea were observed near Barrow (Dunton et al. 2003). This could be attributed to more productive currents coming from areas such as the Chukchi and Bering seas passing through the area (MMS 2002). The highest levels of primary productivity of phytoplankton corresponded to the location in the water column where diatoms were the most abundant organisms, rather than at the surface. The coast near Kaktovik was identified as another productive area with upwelling of nutrient-rich water from offshore areas. The combination of regular upwelling from deep offshore waters in such areas and increased light intensity allow for increased productivity (Dunton et al. 2003).

Phytoplankton provides the food base for a variety of secondary producers, including herbivorous zooplankton. Previously, the short open-water period in the Beaufort Sea led to brief, intense phytoplankton blooms, after which an abundance of the organic matter (i.e., dead phytoplankton) sank to the sea-floor, creating a rich benthic food web that supported diving seabirds and marine mammals. A diminishing ice pack may alter food web dynamics within the Action Area by decreasing phytoplankton production, which would lead to declines in key cetacean prey species, such as copepods and plankton-feeding fish that are preferred food for some species of whale (MMS 2007).

5.2.2 Zooplankton

More than 100 species of zooplankton have been identified in the photic zone of Arctic Alaska waters. Copepods are the dominant zooplankton group, both in terms of numbers and biomass (Hopcroft et al. 2006). Zooplankton diversity and abundance increase with distance from the shore. Although production and growth of zooplankton does occur within the Beaufort Sea to some degree, water masses moving northward through the Bering Strait, through the Chukchi Sea, and into the Beaufort Sea are responsible for transporting additional zooplankton from the Bering Sea into the Action Area (MMS 2007).

Zooplanktons are heterotrophic and many species are major consumers of phytoplankton. Through their consumption and processing of the phytoplankton, zooplankton species act as an important link in aquatic food webs by transporting organic material from primary production sources to larger, carnivorous predators, including species of whales that feed on pelagic zooplankton (e.g., bowhead whale).

5.3 Algae

5.3.1 Macroalgae

Alaska's Beaufort Sea shelf is typically characterized by silty sands and mud with an absence of macroalgal beds and associated organisms (Barnes and Reimnitz 1974). A diverse kelp and invertebrate community was found in the Boulder Patch near Prudhoe Bay in Stefansson Sound. Several species of red and brown algae and one green alga have been documented. These algae are an important food source for many epibenthic and benthic organisms. Differences in biomass between surrounding sediment areas and the Boulder Patch demonstrate the importance of this biologically unique area (Konar 2006).

5.3.2 Microalgae

The microalgae community within the Beaufort Sea consists primarily of pennate diatoms and microflagellates, but centric diatoms and dinoflagellates may also be present (Homer and Schrader 1982). In general, attached microalgae are most likely to occur in areas not subjected to ice gouging and land fast ice, and where hard substrates suitable for attachment occur (MMS 1990). For example the Boulder Patch in Stefansson Sound provides substrate for microalgae to occur. Benthic microalgae occur in sediments and within the macroalgal communities. Benthic microalgae may be a significant source of primary productivity in nearshore areas; however in areas of kelp production, the contribution of benthic microalgae may be relatively small.

5.4 Benthic and Pelagic Invertebrates

The principal benthic invertebrates found in the Action Area include oligochaete worms, isopods, mysids, amphipods, bivalves, priapulids, chironomid larvae, dipterans, and hermit crabs (Broad et al. 1978). Echinoderms such as starfish are the most abundant benthic invertebrate in the western Beaufort Sea. Pelagic species include copepods and chaetognaths. Together with euphausiids, and planktonic amphipods, they constitute a substantial portion of the invertebrate biomass, especially in nearshore areas. Populations of nearshore epifauna do not appear to differ between the Beaufort Sea, Chukchi Sea, and the eastern Bering Sea (Broad 1979; Stoker 1981).

The distribution, abundance, and seasonal variation of benthic species in the Beaufort Sea are strongly correlated with physical factors (e.g., substrate composition, water temperature, depth, dissolved oxygen concentrations, pH, salinity, sediment carbon/nitrogen ratios, and hydrography). Ice gorging disturbance may limit infaunal biomass in the shear zone (MMS 1990). Biomass increases with depth and distance from shore with highest at approximately 140 meters deep. Benthic organisms are abundant and increase in numbers and diversity in the summer during open water conditions.

5.5 Fish

Conservative estimates report that at least 17 species of marine fishes, 14 species of freshwater fishes, and 12 anadromous species may be found in the waters of the Beaufort Sea (Wiswar 1992; Wiswar et al. 1995; Wiswar and Fruge 2006; MMS 2008; Scanlon 2008; ADNR 2009b). The number of fish species identified in the Beaufort Sea may be greater than these estimates, as much of the area has not been thoroughly surveyed (MMS 2008). Anadromous fish-bearing streams flowing through or into the Area of Coverage include the Sagavanirktok, Kuparuk, Colville Aichilik, Hulahula, Alaktak, Chipp, Topagoruk, Okpilak, Kogotpak, Egaksrak, Kongakut, Canning, Staines, Shaviovik, Kogru, Ikpikpuk, and Meade rivers.

A few of the most common fresh-water fish species in the Beaufort Sea include the Arctic blackfish, Arctic char, burbot, Arctic grayling, ninespine stickleback, and round whitefish. Common marine species include Arctic flounder, Arctic cod, saffron cod, fourhorn sculpin, snailfish, and Arctic staghorn sculpin. Common anadromous fish species include Arctic cisco, broad whitefish, Dolly Varden char, humpback whitefish, least cisco, and rainbow smelt; however, note that some species considered as “anadromous” can have populations that are freshwater only or anadromous (USFWS 2008).

During the open-water season, the nearshore portion of the Beaufort Sea area is dominated by a band of relatively warm, brackish water that extends across the entire Alaskan coast. The summer distribution and abundance of coastal fishes (marine and anadromous species) is strongly affected by this band of brackish water. The band typically extends 1.6 to 9.7 km offshore and contains more abundant food resources than waters farther offshore. The areas of greatest species diversity within this nearshore can be found in the river deltas. As the summer progresses, the amount of freshwater entering the nearshore area decreases, and nearshore waters become colder and more saline. From late summer to fall, migratory fishes move back into rivers and lakes to overwinter and to spawn (if sexually mature). In winter, nearshore waters less than 2 meters deep freeze to the bottom. Before they freeze, migratory fishes continue to use the nearshore area under the ice but eventually move into deeper offshore waters with the advancement of ice.

Anadromous fish typically leave the rivers and enter the nearshore waters during spring break-up in June. As the ice cover melts and recedes, these fish will migrate along the coast; smaller fish tend to stay near the mouths of rivers while larger fish may migrate distances of 130 km or more in search of feeding habitat (ADNR 1999). Migration back to rivers varies by species, but most anadromous fish return to freshwater by mid-September, where they spawn and overwinter (ADNR 1999).

The timing and location for spawning by marine fish varies. For example, fourhorn sculpin spawn on the bottom in nearshore habitats during midwinter. Snailfish also spawn in midwinter by attaching their eggs to rocks or kelp. Arctic cod spawn under the ice near the surface between November and February (MMS 1990). Eggs are found in water below 0°C to 2°C. Developing eggs are found in accumulations under the ice and hatching occurs when the ice begins melting. The larval period in Arctic cod lasts 3 to 4 months (ADNR 2009a, b).

5.6 Marine Mammals

Common (at least seasonally) marine mammals in the Action Area include: spotted, ringed, and bearded seals; bowhead whales; and polar bears. As previously described, some of these species are protected under the ESA, including the bowhead, humpback whales, the polar bear, as well as the bearded and ringed seals. All marine mammals in U.S. waters, including those also protected under ESA, are protected under the MMPA. In the MMPA, it was the declared intent of Congress that marine mammals "be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management, and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem." The polar bear is also protected by an international treaty (i.e., International Agreement on the Conservation of Polar Bears of 1976 between Canada, Denmark, Norway, the former U.S.S.R, and the U.S.).

Most of the marine mammals occurring in the Beaufort Sea can be grouped into two categories: 1) baleen whales that use the area as summer feeding grounds; and 2) pinnipeds (i.e., seals and walrus) and the polar bear that are ice-associated species and inhabit the Arctic year-round.

As described in MMS (1991), ice distribution determines the timing and route of migration for whale species, as well as the location of seals, polar bear, and walrus. In years with heavy ice, migration can be

delayed and depending on circumstances, redistribution of seal and bear populations may result. Because marine mammal species are often quite wide ranging, it is difficult to predict the exact location of animal concentrations or to predict populations at any given time or location.

Winter/Spring	Pack Ice:	polar bear
	Flaw Zone*:	bearded seal, polar bear
	Fast Ice:	ringed seal, polar bear
Summer/Autumn	Pack Ice:	ringed seal
	Pack Edge:	polar bear, bearded seal,
	Open Water:	seals, bowhead whales
	Coastal Lagoons:	spotted seal

*Note: The flaw zone is that region between the pack ice and the fast ice where polynyas (i.e., open-water leads) are commonly found.

5.7 Birds

Around 70 bird species are known to occur within the marine and coastal areas of the Beaufort Sea. Most of these species are migratory and are only present in the Arctic seasonally (from May through early November). Some species appear only during migration; others nest, molt, feed, and accumulate critical fat reserves needed for migration while in the area (MMS 1987). The main categories of species found in the Beaufort Sea area include waterfowl (e.g., duck, goose, swan), seabirds (e.g., loon, gull, tern), shorebirds (e.g., sandpiper, plover, crane), and raptors (e.g., hawks, eagles, falcons). The EPA's Draft Ocean Discharge Criteria Evaluation contains tables that list the known birds species found in the Beaufort Sea area (EPA 2011).

Birds occur out to at least 70 km (43.5 mi) offshore where open water is available, although bird densities generally are lower in offshore areas. Offshore, the highest bird density is associated with open-water leads (MMS 1991). Most avian species migrate eastward along a broad front, which may include inland, coastal, and offshore routes; arrival dates for various species range from late April to early June (MMS 2003). The availability of open water off river deltas and in leads determines migratory routes and distribution of waterfowl and seabirds. The Sagavanirktok, Kuparuk, Ikpikpuk, and Colville rivers, which flow into the Beaufort Sea, have been identified as important nesting and breeding areas for waterfowl (EPA 2011). Traditional knowledge workshop respondents confirmed the Colville River Delta, as well as the mouth of the Kalikpik River, Fish Creek, Teshekpuk Lake, and the barrier islands as important feeding grounds and nesting areas for birds (SRB&A 2011 as cited in EPA 2011).

Five types of habitat particularly capable of supporting a variety of marine and coastal avifauna include the barrier islands, coastal lagoons, coastal salt marshes, river deltas, and offshore areas. The coastal waters are primary habitat for nesting, molting, feeding, and resting activities of migratory marine birds. The highest nesting densities generally occur in areas of mixed wet and dry habitats, whereas birds often move to wetter areas for broodrearing. Islands in river deltas and barrier islands provide the principal nesting habitat for several waterfowl and marine bird species in the Area of Coverage. Shorebirds prefer wet-tundra habitats or well-drained gravelly areas for nesting, whereas loons use lakes, and geese prefer

deeper ponds or wet tundra near lakes. Lagoons formed by barrier islands, bays, and river deltas provide important broodrearing and staging habitat for waterfowl, particularly molting oldsquaws (ADNR 2009a).

The diet of birds in this area varies widely. Emergent and wetland vegetation such as various sedges are the primary food types for most waterfowl. Invertebrates in brackish and freshwater flats and ponds are the principal food sources for shorebirds. The black-crowned night heron is an opportunistic feeder; its diet consists mainly of fish, though it is frequently rounded out by other items such as leeches, earthworms, aquatic and terrestrial insects. It also eats crayfish, mussels, squid, amphibians, lizards, snakes, rodents, birds, eggs, carrion, plant materials, and garbage at landfills. Raptors feed on fish, small mammals, and other birds.

5.8 Factors Affecting the Action Area

5.8.1 Past and Ongoing Human Disturbance

Multiple anthropogenic factors have contributed to the current conditions within the Action Area. These include 1) historic commercial/sport hunting, 2) subsistence hunting, 3) oil and gas related activities, 4) marine vessel traffic, commercial fishing, and research activities 5) human settlements / developments, and 6) pollutants.

Historic commercial and sport hunting have occurred in the Arctic for many decades, and this activity has had a substantial effect on the populations of many of the species that inhabit this area. For example, commercial whaling between 1848 and 1915 had severely depleted the Western Arctic stock of bowhead whales. Woody and Botkin (1993) estimated that the historic abundance of bowheads in this population was between 10,400 and 23,000 in 1848 (i.e., before the advent of commercial whaling) and that an estimated 1,000 to 3,000 animals remained in 1914 (i.e., near the end of the commercial-whaling period). Following protection from whaling, this population (but not some other bowhead populations) has shown marked progress toward recovery (NMFS 2006). Sport hunting of other species, such as polar bears in the 1950s and 1960s, as well as seals, walrus, and various whale species have resulting in population declines. These population declines were the driving force for the development of programs such as the MMPA and the International Agreement on the Conservation of Polar Bears. However, both the MMPA and the International Agreement on the Conservation of Polar Bears provided provisions for the hunting of marine mammals by indigenous people (i.e., subsistence hunting).

The indigenous people of Alaska have been hunting whales for at least 2,000 years (Stoker and Krupnik 1993). There is no indication that, prior to commercial whaling, subsistence whaling caused significant adverse effects to the population of whales (NMFS 2006); however, modern technology has changed the potential for any lethal hunting of whales to cause population-level adverse effects if unregulated. Under the authority of the International Whaling Commission (IWC), the subsistence take of whales has been regulated by a quota system since 1977. Federal authority for cooperative management of the Eskimo subsistence hunt is shared with the Alaska Eskimo Whaling Commission (AEWC) through a cooperative agreement between the AEWC and the National Oceanic and Atmospheric Administration (NMFS 2003). In addition to hunting whales for subsistence, indigenous people hunt for other marine mammals and wildlife as well. Although the MMPA and the International Agreement on the Conservation of Polar

Bears does not place restriction on the number, season, or age of polar bears that can be harvested by Alaska Natives, there is a more restrictive Native-to-Native agreement between Inũpiat from Alaska and Inuvialuit in Canada that was developed in 1988 (USFWS 2009a). This agreement (i.e., the Inuvialuit-Inũpiat Polar Bear Management Agreement) established quotas and recommendations concerning protection of denning females, family groups, and methods of take. Presently it is thought that the current harvest levels, which have averaged 36 bears per years since 1980, will not impact the rate of recovery of the species (USFWS 2006). Recently, the level of subsistence harvesting of eiders (particularly Steller's eiders) has become a concern for regulatory agencies (USFWS 2009a). Continued efforts to eliminate harvest of eiders are being implemented in North Slope villages, and particularly at Barrow, where the greatest known concentrations of Steller‘s eiders occur. Intra-service consultations for the Migratory Bird Subsistence Hunting Regulations are conducted annually and harvest of all species, included listed eiders, is being monitored (USFWS 2009a).

Offshore petroleum exploration, development, and production activities have been conducted in Alaska State waters or on the Alaska OCS in the Beaufort and Chukchi seas as a result of previous lease sales since 1979. There has been extensive oil and gas development in the North Slope of the Beaufort Sea (see Figure 1) which has resulted in impacts to water quality and wildlife habitats.

The number of marine vessels, commercial fishing ships, and research vessels that use the Arctic waters has increased in over the last few decades. This is due in part to global climate change, which has opened up new areas for vessel traffic. These ships pose a threat of collisions with marine mammals, increased noise levels in open waters, and increased levels of pollution (NMFS 2006). NMFS (2006) noted that commercial fishing vessels had an added impact, in that they extract resources from the area, and can inadvertently kill non-targeted species. However, because of concerns about the expansion fishing activities in the area, commercial fishing in the Arctic Management Area, which includes the Action Area, has been prohibited since 2009 (74 FR 56734).

The presence of villages and industrial infrastructure in the Arctic has altered the landscape of this remote area. Populations of predators and scavengers may be increasing in this area as a result of these human developments (Eberhardt et al. 1983, Day 1998; Powell and Bakensto 2009). Researchers have proposed that reduced fox trapping, anthropogenic food sources in villages and oil fields, and the establishment of nesting/denning sites on human-built structures have resulted in increased fox, gull, and raven numbers in the North Slope (Day 1998). These increases in predator and scavenger populations may result in declines in some prey populations over time.

All of the factors discussed above have contributed to the level of pollutions and toxins in the environment to some degree. Contamination of the Arctic and sub-Arctic regions through long-range transport of pollutants has been recognized for over 30 years (Bowes and Jonkel 1975; Proshutinsky and Johnson 2001; Lie et al. 2003). The Arctic ecosystem is particularly sensitive to environmental contamination due to the slower rate of breakdown of pollutants, relatively simple food chains, and the presence of long-lived organisms with low rates of reproduction and high lipid levels. The persistence and lipophilic nature of organochlorines increase the potential for bioaccumulation and biomagnification at higher trophic levels (Fisk et al. 2001). The highest concentrations of organochlorines have been found in

species at the top of the marine food chains such as glaucous gulls (which scavenge on dead marine mammals) and polar bears (which feed primarily on seals; Braune et al. 2005). For example, the southern Beaufort Sea polar bear populations may have concentrations of mercury close to the toxicological threshold levels of 60 micrograms wet weight reported for marine mammals, above which an animal may exhibit adverse effects (USFWS 2009a). Initial studies of bowhead tissues collected from whales landed at Barrow in 1992 (Becker et al. 1995) indicate that bowhead whales have very low levels of mercury, polychlorinated biphenyls (PCB), and chlorinated hydrocarbons, but they have fairly high concentrations of cadmium in their liver and kidneys. High levels of pollutants in high trophic level species can also be achieved through direct contact with the chemicals, opposed to bioaccumulation. For example, Steller's eiders nesting near Barrow have shown concentrations of lead in their blood (greater than 0.2 ppm lead). Tests of the lead's isotope have confirmed that it came from lead shot during hunting that was left along the shore, and not from naturally occurring forms found in sediments (USFWS 2009a).

5.8.2 Climate Change

There are indications that regional-scale environmental shifts (due to climate change) may be underway in Beaufort Sea, which have important hydrologic and biologic connections (USFWS 2009a). An observed increase in Atlantic water in the western Arctic Ocean (Zangh and Hunke 2001) can warm surface water, which in turn thins Arctic sea-ice (Manabe and Stouffer 1995). An average 1 meter reduction in sea-ice thickness has been estimated in the Chukchi and Beaufort seas (Rothrock et al. 1999). Late summer Arctic sea-ice has declined 2 to 7.7 percent per decade (Stroeve et al. 2005) and the area of permanent sea-ice has declined 9.8 percent per decade since 1978 (Comiso 2006). Changes in the temperatures and sea-ice conditions in the Arctic may have profound impacts on Arctic marine mammals and diving seabird populations through ecosystem linkages that change food supplies. A similar trend may be underway in the Beaufort Sea as recent retrospective studies of benthic communities indicate a changing marine system in both the Bering and Chukchi seas (Iken and Konar 2003; Sirenko and Koltun 1992; Grebmeier and Dunton 2000).

6.0 EFFECTS OF THE ACTION

This section assesses the potential impact that oil and gas exploration activities (i.e., drilling exploration and delineation wells) within the Action Area (as covered under the NPDES general permit) would have on species that are listed under the ESA, as well as those that are formally proposed for listing and candidate species. Effects Determinations are discussed in Section 7 of this document. As discussed in Section 7, Effects Determinations have not been developed for the ESA Candidate species (i.e., the yellow-billed loon and Pacific walrus), but have been developed for species proposed for listed under the ESA (i.e., the bearded seal and ringed seal).

This BE does not address seismic surveys, development of permanent oil/gas wells, production/extraction of oil and gas, or abandonment of permanent wells / facilities as these actions would be covered under a separate permit and would therefore undergo a separate assessment. However, this document tiers to other assessments conducted within the Action Area that have assessed these potential actions, such as the Environmental Impact Statements (EISs) and BEs of oil and gas development within the Beaufort and Chukchi Sea Program Area developed by the MMS (MMS 2006b, 2008) and the BOs prepared by the USFWS and NMFS for the Beaufort and Chukchi Sea Program Area (USFWS 2009a; NMFS 2006, 2008, 2010).

The exploration activities covered by the NPDES general permit could result in both direct and indirect effects to wildlife and habitats. Direct effects are those that are immediate in space and/or time compared to their cause, while indirect impacts are those that would be separated in space or time from their cause. An example of a direct impact could be mortality resulting from a collision with a vessel, while an indirect effect could include a species eventual abandonment of a habitat due to degradation of habitat quality. The effects of permitted exploration activities would likely consist of habitat degradation/loss and the toxic effects of effluent discharges, general disturbances (e.g., from noise as well as the presence of vessel and helicopters); direct mortality; and indirect impacts to food availability/quality.

The impact avoidance and minimization measures described in Appendix B would be required for any exploration activities approved under the Beaufort Sea NPDES general permit. Several of these measures are discussed as they relate to reducing impacts from the actions.

6.1 Impacts to ESA Whale and Pinniped Species

In general, whale and pinniped species present within the Action Area during summer months could be displaced and/or disturbed due to the exploration activities. The magnitude of these impacts would depend on the specific species' sensitivity to these types of disturbances, when the disturbance would occur, and the proximity of the disturbance to sensitive areas (e.g., whale migration routes or seal denning areas). Based on the bowhead whales' known migration routes as well as the timing of their occurrence in the Arctic, this species is very likely to encounter exploration activities within the Action Area. Furthermore, the bearded seal is also likely to occur in areas where they could encounter exploration activities, and the ringed seal could occur in these areas if summer sea-ice conditions are sufficient (as they tend to occur near the edges of pack and sea-ice). Information on the migration routes or use of the Action Area by humpback whales is not sufficient to predict their likelihood of encountering exploration

activities. Walruses are unlikely to encounter exploration activities as the Action Area is on the very eastern edge of their suspected distribution; however, it is still possible that they could be encountered as they have been found in Canadian portions of the Beaufort Sea.

6.1.1 Effluent Discharge and Other Contaminants

As discussed in Section 2.2, as well as the Draft Ocean Discharge Criteria Evaluation conducted for the Beaufort Sea NPDES permit (EPA 2011), exploration activities conducted with the Action Area would result in the discharge of chemicals to open waters. The various waste streams likely to occur during exploration activities are listed in Table 1. The impact assessment for these discharges is broken-out into three parts, related to the various types of discharge: 1) drill cuttings and fluids, 2) other discharges, and 3) oil spills.

6.1.1.1 Drill Cuttings and Fluids

Drilling will result in the release of sea floor cuttings and drill fluids, which can contain toxic or hazardous substances (EPA 2011). EPA's Draft Ocean Discharge Criteria Evaluation (EPA 2011) describes the components, concentrations, and associated toxicity of the drilling fluid and cuttings the levels of these discharges would be required to conform to EPA standards. The effluent discharges from drilling fluid and cuttings can have impacts to biological systems within the general vicinity of the discharge. These effects are unlikely to have direct impacts to whales and pinniped species due to limited extent of the area affected compared to the area utilized by these species, as well as the short-term extent that any whale or pinniped species could be exposed (as they would at most, be passing through an affected area); however, there could be indirect impacts to these species due to effects to their prey species.

The settling of drill fluid and cutting discharge would result in physical disturbance of habitats through the smothering of benthic areas/species, as well as the disturbance of pelagic species. As the food supply for whales and pinnipeds consist of benthic and pelagic species, this could have a localized impact on their food supply; however, note that the Pacific walrus is the only ESA species considered in this document that regularly feeds within the benthic community. In an EIS conducted for the Chukchi Sea 209, 212, 217, and 221 Lease Sale, MMS noted that changes in species composition, abundance, and/or biomass of benthic biota resulting from effluent discharge were detectable at distances of 50 to 500 meters from well sites in various study areas around the globe (MMS 2008). Most of these impacts recovered after 1 year; however, some impacts were still detected at a distance of 50 meters 2 years after the exploratory drilling ceased (MMS 2008). It is assumed that these findings would also be applicable to the Beaufort Sea. Impacts to whale and pinniped food sources from the discharge of drilling fluid and cuttings would likely be limited to a localized area and would not be substantial at a landscape level. This is because of the limited number of wells that are expected to be drilled under this permit (it is assumed that the permit would limit the number of wells to no more than 28), the requirements in place that govern and regulate the amounts and type of discharges permitted, the limited extent of these impacts related to the large areas used by whales and pinnipeds within the Action Area, the availability of benthic and pelagic food sources outside of the impacted area, and the short-term nature of these impacts (with impacts potentially detectable out to 50 meters for up to 2 years).

6.1.1.2 Other Discharges

General operations on the drill rigs will result in authorized discharges to the environment (as described in Section 2.2; also see Table 1). The primary element of concern regarding these authorized discharges would be oil and grease resulting from deck drainage; however, oil and grease would be gravity-separated from the runoff in a sump prior to discharge. The oil and grease would then be sent to an off-site facility for treatment. Sanitary waste would be treated with a marine sanitary devise prior to discharge, in order to meet Coast Guard requirements. Biocides could be added to drilling fluids, ballast water, fire control water and/or non-contact cooling water to control the growth of algae. These compounds are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act. These discharges would likely occur at lower volumes than the drilling fluids described above, and are expected to dissipate within the extent of the mixing zone (i.e., a 100-meter radius around the discharge; EPA 2011). These discharges may have some short-term adverse effects to the pelagic and benthic invertebrates/plankton communities found within the 100-meter mixing zone, but are not expected to have wide-spread or long-lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the environment (EPA 2011). Also, due to the limited extent of the mixing zone related to the large areas used by whales and pinnipeds within the Action Area, and the short time that any individual whale would be exposed to the mixing zone, impacts to whales due to direct exposure to these discharges would likely be low.

6.1.1.3 Oil Spills

The release of oils into the environment (as a result of accidental spills) could have impacts to local wildlife. Oil spills can be defined as either small or large spills, with small spills consist of less than 1,000 bbl, while large spills consist of 1,000 bbl or more. BOEMRE further defines Very Large Oil Spills (VLOS) as any spill greater than or equal to 150,000 bbl.

Small Spills

MMS conducted a review of crude oil spills that have resulted from exploratory drilling in the Pacific, Atlantic, Alaskan, and Gulf of Mexico OCS leases from 1971-2007. Of the approximately 14,000 wells drilled in these areas between 1971 and 2007, 4 resulted in spills of crude oil or condensate reaching the environment with spill sizes ranging from 0.8 bbl to 200 bbl (MMS 2008). During drilling of 35 exploratory wells in the Beaufort and Chukchi OCS region specifically, a total of 35 small spills occurred, with spill volumes totaling 26.7 bbl (MMS 2008). The volume of spills ranged from 0.01 gallons to 800 gallons, with a median spill size of 1 gallon. The majority of the small spills occurred into containment structures and did not reach the environment, while some occurred onto platforms and facilities, which were easily cleaned up (MMS 2008, 2009). Of the 26.7 bbl spilled, approximately 24 bbl (or 90 percent) were recovered or cleaned-up (MMS 2008). BOEMRE anticipates a similar pattern of low numbers of small spills of diesel, refined fuel, or crude oil will occur as a result of future exploratory drilling activities.

If whales were exposed to oil spills, they would likely experience harmful effects. For example, surface contact with petroleum hydrocarbons, particularly the low-molecular-weight fractions, can cause

temporary or permanent damage of mucous membranes and eyes (Davis et al. 1960) or epidermis (Hansbrough et al. 1985; St. Aubin 1988; Walsh et al. 1974). Ingestion of petroleum hydrocarbons can lead to subtle and progressive organ damage, or to rapid death in some cases. Inhalation of volatile hydrocarbon fractions of fresh crude oil can damage the respiratory system (Hansen 1985; Neff 1990a), cause neurological disorders or liver damage (Geraci and St. Aubin 1982), have anesthetic effects (Neff 1990a), and can cause sudden death if accompanied by excessive adrenalin release (Geraci 1988). The likelihood of impacts to seal species from accidental oil spills would likely be greater than for whales, as they are less likely to avoid exploration activities than whales (see Sections 6.1.3 and 6.1.4); thereby increasing the potential that they would be exposed to these compounds. Potential effects of contact with or ingestion of crude or refined oil on seals includes temporary soiling of the pelage (i.e., fur covering), eye irritation, kidney lesions, possible liver damage, or death (Geraci and Smith 1976). Impacts to walruses would be similar to those discussed for whales and seals; however, as discussed earlier, there is a very low likelihood that walruses would be in the area during exploratory drilling. The likelihood of these small spills reaching the environment is low, as the recovery rate of any accidental spills of crude or refined oil is expected to be high (MMS 2009).

Consumption of food sources that are tainted by oil, or toxic contaminants derived from drilling fluid, could have adverse impacts to whales and pinnipeds. A study by Duesterloh et al. (2002) demonstrated that copepods can passively accumulate toxins from the water-column due to their high lipid content. As a result, copepods can serve as a vector for bioaccumulation of toxins in higher trophic levels. Exploration activities are unlikely to adversely affect copepods or other zooplankton levels at a landscape level (as discussed above); however, as the discharge of effluent materials as well as small oil spills can result in the bioaccumulation of toxins from zooplankton into higher trophic levels, whales that feed on these food sources may have incremental long-term increases in their toxin levels. Populations of fish (which are preyed upon by whales and pinniped) are unlikely to be directly affected by exploration activities; however, they are also subjected to the same bioaccumulation impact discussed above, as they are also a link in the food-chain that depends on zooplankton. Therefore, whales and pinnipeds that do not directly feed upon zooplankton may also experience some level of toxic bioaccumulation due to the consumption of fish.

Small spills of oil into the environment are unlikely to affect humpback or bowheads whales because: 1) these whales are likely to avoid areas around exploration activities (see Sections 6.1.3 and 6.1.4); 2) the recovery rate of any accidental spills of crude or refined oil is expected to be high (MMS 2008, 2009); and 3) the area that would be affected by small spills would be minor compared to the extent of the Action Area. Potential impacts to pinnipeds are similar to whales, except that they are less likely to avoid exploration activities, and as such, as at a slightly higher risk of exposure.

Large Spills

BOEMRE has conducted a hypothetical scenario for analyzing VLOS (i.e., a spill greater than or equal to 150,000 barrels of oil) as part of their Revised Draft Supplemental Environmental Impact Statement on the Chukchi Sea Planning Area (BOEMRE 2011). The VLOS analysis is based on the estimated size of an unlikely but possible oil spill resulting from a blowout scenario (BOEMRE 2011). The comprehensive

VLOS analysis results indicate that a large oil spill and gas blowout would present sustained degradation of water quality from hydrocarbon contamination in exceedance of State and Federal water and sediment quality criteria. Additional effects on water quality would occur from response and cleanup vessels; in-situ burning of oil; use of dispersants; discharges and seafloor disturbance from relief well drilling; and on-shore activities associated with clean-up, booming, beach cleaning, and monitoring. If a large spill were to occur, short- and long-term major impacts to marine mammals, marine birds, EFH species, and their habitat/prey would be expected. However, the potential for a VLOS is considered low (MMS 2008).

6.1.2 Permanent Habitat Loss

Permanent habitat loss would be limited to the extent of the capped wells (consisting of up to 34 wells). This permanent loss of sea floor habitat would not have a substantial direct impact to whale or pinniped species due to the limited extent of this area compared to the extent of the Action Area, the large ranges of these species, and the fact that only the Pacific walrus regularly utilize the sea floor; however, loss of this habitat could have a localized impact on these species' food supply (see Section 6.1.1). As discussed in Section 6.1.1, the settling of drill mud would result in the burial of benthic habitats adjacent to drilling operations. The depth of this settled mud would vary depending on water currents and disposition rate (see EPA 2011 for predictive models of mud depth); however, as discussed earlier, changes in species composition, abundance, and/or biomass of benthic biota resulting from effluent discharge and mud settling have been detectable at distances of 50 to 500 meters from well sites after exploratory drilling (MMS 2008). Most of these impacts recovered after 1 year; however, some impacts were still detected at a distance of 50 meters 2 years after the exploratory drilling ceased (MMS 2008).

6.1.3 Disturbance from Ships, Helicopters, and General Noise

Vessel traffic within the Action Area would include drill-vessels, as well as support ships used to transport supplies and personnel between the drill-vessels and the shore. In addition, helicopters may be used for transportation between vessels and the shore. The presence of these crafts within the Action Area could affect wildlife species.

The whale and pinniped species that use the Beaufort Sea have shown a highly variable response level to the presence of ships (NMFS 2008). Bowhead whales seem to react to the approach of vessels at greater distances than they do to most other industrial activities (NMFS 2008). Observations by Richardson and Malme (1993) indicated that bowhead whales may be more sensitive when vessels approach them directly instead of at a tangential vector; this avoidance may be related to the fact that bowheads have been commercially hunted within the life of some individual whales and they continue to be hunted for subsistence throughout many parts of their range (NMFS 2008). Bowhead whales typically respond when a rapidly approaching vessel is within 1 to 4 km, with some whales reacting at distances up to 5 to 7 km (NMFS 2008). Bowhead whales are often more tolerant of vessels that are moving slowly or in directions other than directly toward a whale. A fleeing response by bowhead whales is generally ceased within minutes after the vessel passed, but scattering may persist for a longer period (NMFS 2008). Responses to vessels are similar for humpback whales. Richardson et al. (1995a) observed that humpbacks attempted to avoid vessels and displayed such behavioral responses as aggressiveness, increased surfacing, or changes in dive patterns when approached by vessels. They found that humpback whales move away from large

cruise-ships when approached within only few kilometers (Richardson et al. 1995a). Similar to bowhead whales, humpback whales seem less likely to react to vessel noise when actively feeding than when they are resting or engaged in other activities (Richardson et al. 1995a). In one study, ringed seals were observed escaping from the ice into water in response to a vessel which came within 250 to 500 meters of the seals (Brueggeman et al. 1992); reactions of bearded seals would likely be similar. Walruses are considered to be extremely sensitive to anthropogenic noises (Lowry 1984; Kastelein et al. 2002). For example, they have been known to "stampede" into the water when disturbed by an approaching vessel at a range of hundreds of meters (Fay et al. 1984).

Response distances of whales and pinniped to ice-breaking noise would vary (i.e., noise created by ice-breakers, which may be required to clear ice during summer months). Miles et al. (1987) predicted that bowhead whales would likely respond to the sound of ice-breakers at distances of 2 to 25 km. This study predicted that roughly half of the bowhead whales exposed to ice-breaker noises would show avoidance response in open water at a range of 2 to 12 km when the sound-to-noise ratio is 30 dB (Miles et al. 1987). The study also predicted that roughly half of the bowhead whales would show avoidance response to an icebreaker pushing ice at a range of 4.6 to 20 km when the sound-to-noise ratio is 30 dB (Miles et al. 1987). Richardson et al. (1995a) predicted a somewhat larger range of response (10 to 30 km) in which bowhead whales would respond to the sound of ice-breakers. Data is not currently available regarding the response of humpback whales, or the pinniped species to ice-breaking noises.

Noise generated by helicopters used to transport supplies and personnel may have an effect on whale and pinniped species; however, data on the sensitivity of these species to helicopters is limited. Observations of bowhead whales exposed to helicopter overflights indicate that most bowheads exhibited no obvious response when the craft is above 150 meters. Bowheads may dive in response to the aircraft noise when the craft is at altitudes below 150 meters (Richardson and Malme 1993). Helicopter noise is generally audible for only a brief time (tens of seconds) if the aircraft remains on a direct course, (as is expected during transport of supplies and personnel), and the whales should resume their normal activities once the craft has passed. As a result, noise disturbances to whales and seals from helicopters will likely result in only short-term alterations in behavior; however, mortality of walruses may occur if overflights occur in areas occupied by this species. For example, a mass stampede on Wrangell Island was caused by an aircraft flying at an elevation of 800 meters; this stampede resulted in the death of 102 walruses (Ovsyanikov et al. 1994); however, as stated earlier, walruses are unlikely to occur within the Action Area. BOEMRE requires flights to operate at an altitude of greater than 140 meters above ground/sea level where possible, which would significantly reduce disturbance to marine mammals.

The magnitude of impact that would result from noise and vessel presence on whales and pinnipeds would depend on when and where this disturbance occurred. Whales disturbed during migration would likely make minor alterations to their path (i.e., swim in a somewhat different vector in order to avoid the ship or noise); however, whales have shown "tolerance" to these types of disturbances if it is necessary in order to continue their migration (Richardson et al. 1995b). If the disturbance occurred in areas used by whales for resting or feeding, then this disturbance could have a more substantial biological impact (i.e., disrupting feeding or resting behaviors). Seals have shown a high tolerance for drilling and vessel activities, and as such, adults populations will not likely experience adverse effects; however, very young

seal pups (i.e., those that have not established a sufficient blubber layer) that are disturbed by noise or vessel presences and subsequently flee a lair into the water may not survive the resultant heat loss (Taugbol 1982). Any very young pups that do flee into the water and survive would have to expend substantial amount of energy reserves in order to maintain their core body temperatures while drying (Taugbol 1982). However, disturbance of young pups is unlikely, as pups are typically weaned and able to swim by summer (Reeves et al. 2002) when project related activities are expected to occur. While walruses are believed to be sensitive to noise and may stampede into the water when disturbed, which can result in mass mortalities of individuals (Ovsyanikov et al. 1994), walruses are unlikely to occur near exploration activities.

The impacts to whales and pinnipeds would be limited due to the limited number of vessels and active drilling operations expected to occur within the Action Area. As discussed earlier, bowhead whales and bearded seal are likely to occur in areas affected by these disturbances, while the remaining species occurrences within the Action Area during exploratory activities is unknown, and would depend on site specific conditions at the time of the activities. The overall impacts to whales and pinnipeds from noise and vessel disturbances are expected to be temporary, resulting in a short-term alteration of behavior.

6.1.4 Disturbance from Drilling Noise

Point sources of offshore noise (e.g., drilling operations) appear to be less disruptive to whale species than the moving source of noise such as those generated by vessel traffic and ice-breaking discussed in the previous sub-section (NMFS 2008). Current information regarding the effects of drilling on whale and seal behavior is mixed. For example, Koski and Johnson (1987) found that migrating whales avoided an area within 10 km of drill-ships during their study. However, in another study, Ward and Pessah (1988) reported observations of bowhead whales within 0.2 to 5 km of operating drill-ships, and Richardson et al. (1985) observed three bowheads within 4 km of operating drill-ships. The whales observed during Richardson et al. (1985) study were socializing, even though they were exposed to strong drill-ship noise levels. Eleven additional whales on three other occasions were observed at distances of 10 to 20 km from operating drill-ships; on two of the occasions, drillship noise was not detectable by researchers at distances from 10 to 12 km or 18 to 19 km respectively (Richardson et al. 1985). Davies (1997) analyzed the distribution of bowhead whales in related to an active drilling operation in Camden Bay, AK; this study found that bowhead whales avoided the region surrounding a drill site at a range of approximately 20 km. Data are limited regarding the possible reaction of humpback whales to drill-ships noises; however, Malme (cited in Richardson et al. 1995 and NMFS 2008) observed reactions among humpback whales exposed to drillship, semi-submersible, drilling platform, and production platform noises and found no clear responses at broadband received levels up to 116 dB. It is assumed for this analysis that the reaction of humpback whales would be similar to bowhead whales. A study by Moulton et al. (2003) was unable to find a clear indication that sound and vibration from an industrial drilling operation (Northstar) in the Beaufort Sea reduced the density of ringed seals in the area. In fact, seal densities were higher near (within 1 km) of the drilling operation than they were farther away from the operation (Moulton et al. 2003).

6.1.5 Direct Mortality (Collisions)

As discussed earlier, bowhead whales and bearded seal are likely to occur in areas affected by exploratory activities; therefore, they may be at risk of collisions. The remaining species occurrences within the Action Area during exploratory activities is unknown, and would depend on site specific conditions at the time of the activities. Due to the likelihood that whales would avoid vessels while in transit, the requirements that any vessels traveling through the Action Area would need to adhere to distance and speed requirements applicable to the MMPA and ESA/Biological Specific Measures (see Appendix B), and that marine mammal monitors would be required on all vessels during exploration activities, the risk that vessels would collide with marine mammals during transit is low.

6.1.6 Impacts to Prey Species

As discussed in Section 6.1.1, effluent discharges and oil spills could have an adverse effect on food supplies for whale and pinniped species. This would include reductions to the extent and composition of benthic and pelagic species due to effluent discharges, as well as a potential for bioaccumulation of toxins resulting from small oil spills.

In an EIS conducted for the Chukchi Sea 209, 212, 217, and 221 Lease Sale, MMS noted that changes in species composition, abundance, and/or biomass of benthic biota resulting from effluent discharge resulting from drilling fluid and cuttings were detectable at distances of 50 to 500 meters from well sites (MMS 2008). Most of these impacts recovered after 1 year; however, some impacts were still detected at a distance of 50 meters 2 years after the exploratory drilling ceased (MMS 2008). It is assumed that these findings would also be applicable to the Beaufort Sea; however, note that the Pacific walrus is the only ESA species addressed in this document that regularly feeds in the benthic community.

General operations on the drill rigs will result in authorized discharges to the environment (as described in Section 2.2; also see Table 1). The primary element of concern regarding these authorized discharges would be oil and grease resulting from deck drainage; however, oil and grease would be gravity-separated from the runoff in a sump prior to discharge. The oil and grease would then be sent to an off-site facility for treatment. Sanitary waste would be treated with a marine sanitary devise prior to discharge, in order to meet Coast Guard requirements. The concentration of chemical additives (e.g., treatment chemicals, biocides, corrosion inhibiters, etc.) in any authorized discharge (i.e., Discharges 001–013) must not exceed the most stringent of the following two limitations: (1) the maximum concentrations and any other conditions specified in the EPA product registration labeling if the chemical is an EPA registered product; or (2) the maximum manufacturer's recommended concentration. Furthermore, these discharges are expected to dissipate within the extent of the mixing zone (i.e., a 100-meter radius around the discharge; EPA 2011). These discharges may have some short-term adverse effects to the invertebrates/plankton communities found within the 100-meter mixing zone, but are not expected to have wide-spread or long-lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the environment (EPA 2011).

Impacts to whale and pinniped food sources from effluent discharges and oil spills would likely be limited to a localized area and would not be substantial at a landscape level. This is because of the limited number of wells that are expected to be drilled under this permit (it is assumed that the permit would limit

the number of wells to no more than 34), the requirements in place that govern and regulate the amounts and type of discharges permitted, the limited extent of these impacts related to the large areas used by whales and pinnipeds within the Action Area, the availability of benthic and pelagic food sources outside of the impacted area, and the short-term nature of these impacts (with impacts potentially detectable out to 50 meters for up to 2 years). However, there could be some long-term impacts to these species toxicity levels due to the potential for bioaccumulation in the food-web (see the previous sub-sections for more details).

6.2 Impacts to Polar Bears

In general, any polar bears present within the Action Area during summer months could be displaced and/or disturbed due to exploration activities. However, exposure pathways for polar bears to the direct effects of the drilling activities are likely low because polar bear are unlikely to be presence in the open water areas in the Action Area during summer due to the reduced extent of sea-ice during summer months.

6.2.1 Effluent Discharge and Other Contaminants

As discussed in Sections 2.2 and 6.1.1, as well as the Draft Ocean Discharge Criteria Evaluation conducted for the Beaufort Sea NPDES permit (EPA 2011), exploration activities conducted with the Action Area would result in the discharge of chemicals to open waters. These discharges are detailed in Table 1, and include drilling fluid and cuttings, various forms of waste, on-deck accidents/cleaning products, or crude oil (the release of crude oil would be limited to accidental spills).

6.2.1.1 Drill Cuttings and Fluids

Exploration activities would result in the release of drill cuttings and fluids, which contain toxic or hazardous substances (EPA 2011). As discussed in the whale/pinniped impact section, impacts to biotic communities would likely be detectable at distances of 50 to 500 meters from well sites, with impacts potentially affected for up to 2 years within areas 50 meters from the original discharge (based on previous research and cited from MMS 2008).

Polar bears have large home ranges and a low density in the Beaufort Sea, and they are unlikely to spend much of their time in the open water directly adjacent to drilling discharge. Thus, they are unlikely to be exposed to the localized effects of this discharge. Furthermore, effects from drill cuttings and fluids to polar bears would be limited due to the low number of wells that are expected to be drilled under this permit (up to 34 wells) and the requirements in place that govern and regulate the volume and type of discharges permitted (EPA 2011).

6.2.1.2 Other Discharges

As discussed in the whale/pinniped impact section, general operations on the drill rigs will result in other authorized discharges to the environment; however, these discharges would be limited to the mixing zone (i.e. a 100-meter radius around the discharge) and are not expected to have wide-spread or long-lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the

environment (EPA 2011). Therefore, they are not expected to have direct or indirect impacts to polar bears.

6.2.1.3 Oil Spills

As discussed in the whale/pinniped impact section, there is a very low risk of large crude oil spills as a result of exploratory activities; however, small spills of refined oil products are likely to occur during these activities. Any polar bears that come into contact with large quantities of crude or refined oil would likely die (Neff 1990b; St. Aubin 1990). Other possible non-fatal impacts could include loss of hair, anemia, anorexia, and stress (St. Aubin 1990; Derocher and Stirling 1991). However, as the recovery rate of any accidental spills of crude or refined oil is expected to be high (MMS 2009), and the density of polar bears in open water habitats within the Beaufort Sea during summer is low, the likelihood of polar bears coming into contact with spilled oil is also low.

6.2.2 Permanent Habitat Loss

No permanent impact to polar bear habitat is expected as no structures would be constructed on land, and wells would be capped below the water's surface, leaving only a scare on the sea-floor (and polar bears do not use the sea floor as habitat).

6.2.3 Disturbance from Ships, Helicopters, and General Noise

Drill-ships and vessels could act as a physical obstruction, thereby altering polar bear movements or behaviors. Furthermore, ice-breakers, if required (see Section 2.2), would alter the polar bear's habitat by breaking up summer pack-ice near drill-rigs. Polar bears in the Beaufort Sea have shown variable responses to the presence of ships (USFWS 2009a). Four polar bears were observed by marine mammal observes during a ship based seismic survey conducted in 2006 within the Chukchi Sea (along a 26,029 km transect); three of these bears were observed moving away from the ship, presumable in response to the ships' presence (Ireland et al. 2009). In addition, four polar bears were observed during another ship based survey conducted in the Beaufort Sea during that same year (unknown transect length); one bear did not alter its behavior (feeding), two entered the water in response to the ships presence, and one bear was already swimming at the time and as such, no behavioral change was observed (Funk et al. 2006). As exploration activities would be conducted in open water during summer months, when the likelihood of pack-ice being present in the Action Area is the lowest, the probability of coming into close contact with polar bears is low. The use of ice management methods that involve redirecting, rather than breaking, ice floes while the floes are well away from the drill sites can reduce potential effects to polar bears. Also, vessels traveling outside of the polynya zone can try, whenever possible, to avoid the need for ice-breaking. Any adverse effects to polar bears that result from the presence of ships within the Action Area are likely to be limited to temporary behavioral disturbances to a small number of bears.

Noises generated by ships as well as day-to-day activities onboard ships and drill-rigs could result in alterations to polar bear behaviors. Noises could deter polar bears from entering an area, or could potentially attract bears (USFWS 2009a). For example, 25 polar bears were observed during a walrus monitoring program conducted in 1990 near an offshore drilling operation. These bears had varying responses to drilling and ice-breaking activities; with two bears approaching drilling and ice-breaking

activities, nine watching the activities, seven slowly moving away, five ignoring the activities, and two that did not have their behaviors evaluated (USFWS 2009a). Therefore, noises generated by drilling, ship motors, and general day-to-day activities will likely result in some temporary behavioral alterations to polar bears, if they are present in the Action Area. However, based on 1) the observations that polar bears are closely associated with sea-ice, and are believed to follow the sea-ice northward during summer melts (Garner et al. 1990), and 2) the summer extent of sea-ice in the Arctic has substantially decreased since 1990 (USFWS 2009a), there is a low likelihood of polar bears being present in the area of the drilling activity during the open water period and it is likely that the number of polar bears encountered during future drilling operations will be less than those reported in 1990.

Polar bears could be disturbed by the use of helicopters, as they fly from the coastline to offshore vessels (in order to transport supplies and personnel). Behavioral reactions of non-denning polar bears would likely be limited to short-term changes in behavior and have no long-term impact on individuals. As exploration activities would not occur during polar bear denning (which occurs between December and early spring; Reeves et al. 2009) no impacts to denning bears are expected. In addition, BOEMRE requires these types of flights to operate at an altitude of greater than 140 meters where possible, which would substantially reduce disturbance to polar bears present on land or nearshore areas.

6.2.4 Disturbance from Drilling Noise

The impact of drilling noise on polar bears was discussed above, in conjunction with noises generated by ship motors, on-board activities, and ice breakers (as data regarding their response to noise has generally been collected for these activities as a whole without distinguishing between noise sources).

6.2.5 Direct Mortality (Human-Bear Interactions)

As discussed above, exploration activities could result in either the attraction or exclusion of polar bears from areas. If activities result in the attraction of polar bears to work sites (i.e., near drill-rigs that are frozen in sea-ice) this could result in bear-human interactions. These types of interactions are dangerous for both the humans and the polar bears involved. Polar bears, being a large bodied carnivore, will kill and eat humans if presented with the opportunity. In order to prevent injuring or killing of polar bears in defense of human life, hazing would be used to deter bears from work areas (i.e., active drill sites). The hazing method used would need to be defined within the Exploration Plan (EP) or Development and Production Plan (DPP) (see Appendix B) and approved by the USFWS prior to its implementation. Hazing of polar bears would alter their short-term behaviors, but would not be expected to affect an individuals' long-term health.

6.2.6 Impacts to Prey Species

Ringed seals are the primary prey source for polar bears. Exploration activities could result in impacts to ringed seals, including displacement of seals from areas or toxic impacts from discharges (see discussion in Section 6.1). However, the analysis of effects from drilling activities shows these effects will be low to seals (see section 6.1) Also, population level impacts to seals from existing oil development activities in the Beaufort Sea have not been documented to date (Moulton et al. 2003). Therefore, it is not likely that

exploration activities would impact seal populations in such a way as to substantially affect the abundance of polar bear food sources.

Even though the abundance of polar bear food is not expected to be substantially impacted by exploratory activities, impacts to food quality could occur. There are two possible scenarios by which polar bears could be negatively affected by the consumption of their main prey source (i.e., ringed seals). First, polar bears are likely to eat any ringed seals carcasses they find even if it died due to oil contamination. Consumption of oil contaminated food by a polar bear (i.e., seals that were killed by oil) would likely result in that bear's mortality (St. Aubin 1990). Second, any increased toxicity levels found in live seals (as a result of bioaccumulation that has not reached a fatal level; see Section 6.1.6) could be transferred to the polar bear during consumption, resulting in a long-term increase in toxic bioaccumulation for polar bears (as discussed for whale species in Section 6.1.1).

6.3 Impacts to ESA Avian Species

The three bird species addressed within this BE (i.e., the spectacled eider, Steller's eider, and yellow-billed loon) are likely to occur outside of the Action Area (within on-shore lake habitats) during the summer exploration activities, but would be uncommon in the Action Area (i.e., within the marine environment). The ADNR's *Beaufort Sea Areawide Final Best Interest Finding* contains figures that display the distribution of these bird species in relation to the Beaufort Sea area (Map 4.2; ADNR 2009).

The spectacled eider is uncommon in the Beaufort Sea area in general, although they have been found in the Colville River area, and along the coast plain near Prudhoe Bay (Johnson and Herter 1989). The Steller's eider is more common in the Beaufort Sea area than the spectacled eider, and the area around Barrow is considered to be particularly important for Steller's eider breeding (Johnson and Herter 1989). If present in the Action Area (i.e., within the marine environment) during exploration activities, the spectacled eider and the Steller's eider would likely be found either flying over the area on their way to the Chukchi Sea, or resting in small numbers within nearshore portions of the Beaufort Sea for a short period (11 to 30 days). Therefore, there is a low likelihood that these species would be exposed to impact pathways.

The Colville River area supports some of the highest densities of breeding yellow-billed loons found in Alaska (Smith et al. 1993). They would arrive in this area in late May, and leave in late August or early September (i.e., they would be present during exploration activities; Johnson and Herter 1989). However, their distribution would be mostly restricted to on-shore lake habitats, and they would only rarely be found foraging in the nearshore portions of the Action Area. Therefore, there is a low likelihood that this species would be exposed to impact pathways.

6.3.1 Effluent Discharge and Other Contaminants

Exploration activities conducted within the Action Area would result in the authorized and unauthorized discharge of chemicals to open waters (as discussed in Sections 2.2 and 6.1.1, as well as the Draft Ocean Discharge Criteria Evaluation conducted for the Beaufort Sea NPDES permit; EPA 2011). These discharges are listed in Table 1, and could include drilling fluid, various forms of waste, on-deck spills/cleaning products, or crude oil (the release of crude oil would be limited to accidental spills).

6.3.1.1 Drill Cuttings and Fluids

Exploration activities would result in the release of sea floor cuttings and drill fluid, which can contain toxic or hazardous substances (EPA 2011). As discussed in the whale/pinniped impact section, impacts to benthic communities would likely be detectable at distances of 50 to 500 meters from well sites, with impacts potentially affected for up to 2 years within areas 50 meters from the original discharge (MMS 2008). However, impacts to seabirds from these discharges are expected to be low as these three bird species are unlikely to be in the Action Area, and if they are present in the Action Area they would most likely be found flying over the area on their way to the Chukchi Sea (i.e., not in the water). Birds that may be foraging in marine waters adjacent to these discharges (i.e., the yellow-billed loon) could be effect due to a reduced quantity of prey sources in the affected zone.

6.3.1.2 Other Discharges

In addition to drilling fluid and oil spills, general operations on the drill rigs will result in authorized discharges to the environment (as described in Section 2.2; also see Table 1). These discharges would likely occur at lower volumes than the drilling fluids described above, and are expected to dissipate within the extent of the mixing zone (i.e., a 100-meter radius around the discharge; EPA 2011). These discharges may have some short-term adverse effects to the invertebrates/plankton communities found within the 100-meter mixing zone, but are not expected to have wide-spread or long-lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the environment (EPA 2011). Therefore, they are not expected to have direct or indirect impacts to seabirds.

6.3.1.3 Oil Spills

As discussed in the whale/pinniped impact section, there is a very low risk of large crude oil spills as a result of exploratory activities; however, small spills of refined oil products are likely to occur during these activities. Any seabirds that come into contact with crude or refined oil, as a result of a spill, are likely to be killed. Oil-based mortality can result in a variety of ways. Birds that come into direct contact with even small amounts of crude or refined oil typically lose the water-proofing qualities of their feathers. This results in their skin becoming wet, as well as hypothermia and potential drowning (Jenssen 1994). Mortality of eggs incubated by oil covered parents has been documented (Parnell et al. 1984; Hoffman 1990; Szaro et al. 1980). Birds that ingest foods that are tainted with crude or refined oils can develop multiple symptoms including gastrointestinal irritation, pneumonia, dehydration, red blood cell damage, impaired osmoregulation, immune system suppression, hormonal imbalance, inhibited reproduction, retarded growth, and abnormal parental behavior (Albers 2003; Briggs et al. 1997; Epply 1992; Fowler et al. 1995; Hartung and Hunt 1966; Peakall et al. 1982).

Two factors reduce likelihood of exposure of these ESA bird species to an oil spill in this Action Area. First, the recovery rate of any accidental spills of crude or refined oil is expected to be high (MMS 2009), and second, these seabirds are unlikely to occur within the Action Area's water reducing the likelihood of contact with spilled oil. However, as seabirds could forage in the Action Area at some-point in the year, biotic uptake of oil contamination could enter their prey base and become a route of exposure to toxins (see Section 6.1.1).

6.3.2 Permanent Habitat Loss

Permanent impact to habitat would be limited to the extent of capped wells (located on the sea floor). This would reduce the area inhabited by benthic species (which these diving seabirds use as a food source); however, this permanent impact would be small in comparison to the total Action Area (i.e., limited to the extent of the capped well), and is not expected to substantially reduce the amount of foraging habitat for seabirds.

6.3.3 Disturbance from Ships, Helicopters, and General Noise

Some temporary disturbances to seabird habitats could occur during exploration activities. If present within the Action Area during exploration activities, seabirds may become displaced from habitats due to the presence of drill-rigs and vessels within the Action Area, as well as noises generated by helicopters and support vessels traveling between the shore and drill-rigs/ships. This would result in a temporary reduction in habitat quality. The displacement of birds from habitats may result in some energetic cost to the birds, in the form of distress flights away from activities, as well as the abandonment of any activities the birds might have been performing prior to the distress flight (e.g., temporary abandonment of hunting activity in the general area, or alteration of flight path during migration). In order to limit the potential impact of disturbance on seabirds, no vessels or drilling activities will be allowed within spring lead systems between April 15 and June 10 (Appendix B). Also, there is a low likelihood that seabirds would be present in the Action Area's water during summer months (i.e., they are more likely to occur inland along lakes, or flying over the Action Area). Therefore, although some seabirds may be disturbed during exploration activities if they are present in the Action Area (e.g., resting prior to migration, or foraging), the timing restrictions on when activities could be conducted in sensitive areas (e.g., the spring lead systems) would limit the effect of this impact.

6.3.4 Disturbance from Drilling Noise

Impacts from drilling noise are unlikely to disturb these seabirds, as there is a low likelihood that they would be present in the Action Area's water during summer months. If seabirds are located in areas where noise disturbances related to drilling occurs, then impacts would be similar to those discussed in Section 6.3.3.

6.3.5 Direct Mortality (Collisions)

There is a risk of seabirds colliding with structures such as drill-rigs and vessels. The potential for these collisions is affected by multiple factors such as the flight behaviors of the birds in question, weather conditions, if the structures are lighted or not, and if these structures are present in areas that contain seabirds.

The flight behaviors of the listed and candidate bird species within the Action Area place these species at a high risk for collisions. Eider species may be particularly susceptible to collisions with offshore structures as they fly low and at relatively high speed (~ 45 mph) over water (Day et al. 2005), and at relatively low altitudes (between 5 and 10 meters; Johnson and Richardson 1982). Yellow-billed loons typically fly at low altitudes and they have been clocked at speeds of 64 km/h, thereby increasing their risk of colliding with structures (North 1994).

Weather and lighting conditions can further affect a birds' ability to avoid obstacles. In a study of avian interactions with offshore oil platforms in the Gulf of Mexico, Russell (2005) found collision events were more common during poor weather conditions. Artificial lighting can attract birds towards structures, which when combined with poor weather conditions, can substantially increase their risk of colliding with structures (Russell 2005; Gauthreaux and Belser 2002; FCC 2004). In order to limit this risk, restrictions will be places on the types of lighting that can be used, when structures can be lighted, and specific areas (listed blocks and federal waters) where lighting will be minimized (see Appendix B). However, even with these restrictions, it is likely that birds will still collide with structures related to the exploratory activities while migrating from their breeding grounds in the Beaufort Sea inland areas to the Chukchi Sea, or while foraging in the Action Area, resulting in mortalities of ESA listed and candidate bird species (USFWS 2009a).

6.3.6 Impacts to Prey Species

Exploration activities would result in the release of sea floor cuttings and drill fluid, which can contain toxic or hazardous substances (EPA 2011). As discussed in the whale/pinniped impact section, impacts to benthic communities would likely be detectable at distances of 50 to 500 meters from well sites, with impacts potentially affected for up to 2 years within areas 50 meters from the original discharge (MMS 2008). As a portion of the food supply for seabirds consists of benthic species (as discussed in section 4.3), this impact could reduce the quality and quantity of food for ESA listed and candidate seabirds in the Action Area. Furthermore, seabirds could be exposed to increased toxicity levels as toxins bioaccumulate in the local food-web (as discussed in Section 6.1.1). However, as the area of impact would be small compared to the total Action Area, other pelagic and benthic food sources outside of the impacted area would still be available, and impacts would be short-term (with impacts potentially detectable out to 50 meters for up to 2 years), the total quantity of seabird food sources would not likely be substantially impacted.

6.4 Analyses of Effects to Designated Critical Habitat

6.4.1 Polar Bear Designated Critical Habitat

Polar bear designated critical habitat consists of offshore sea-ice, terrestrial denning areas, as well as on-shore barrier islands. The primary constituent elements of the polar bear designated critical habitat are: 1) space for individual population growth and for normal behavior, 2) food, water, air, light, minerals, and other nutritional or physiological requirements, 3) cover or shelter, 4) sites for breeding, reproduction, or rearing (or development) of offspring, and 5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species (USFWS 2009b).

Impacts to terrestrial denning areas or on-shore barrier islands would be limited to temporary disturbances related to helicopter overflights. As discussed in Section 6.2, helicopters travelling to and from offshore facilities are likely to use the same routes, which would presumably allow female polar bears to avoid heavily traveled areas for den sites or to become habituated to this type of disturbance. In addition, BOEMRE requires these types of flights to operate at an altitude of greater than 457 feet above

ground/sea level where possible, which would substantially reduce disturbance to polar bears present on land or nearshore areas.

As summer months are considered to be the open-water season in the Beaufort Sea, impacts to offshore sea-ice would likely be low. However, sea-ice can be present within the Action Area during summer, and as ice-breakers may be used during summer in order to clear ice around vessels and drill-rigs, some designated offshore sea-ice may be impacted (resulting in an impact to point 5 of the primary constituent elements). It should be noted that although sea-ice can be present during summer, the extent of sea-ice in the Beaufort Sea during summer has been decreasing in recent years, possibly due to climate change (MMS 2009). Given the extent and timing of potential impacts to polar bear critical habitat, substantial adverse effects to the primary constituent elements are not anticipated, and they should not appreciably reduce the conservation value of this area for polar bears.

7.0 EFFECTS DETERMINATIONS

Table 3 lists the effects determinations for ESA listed species as well as conditional effects determination for ESA proposed species (in case these proposed species become listed after the filing of this BE). Effects determinations have not been developed for species on the ESA candidate list (i.e., yellow billed loon and Pacific walrus). The discussion that follows this table is broken down by species under the jurisdiction of NMFS (i.e., bowhead and humpback whales, as well as bearded and ringed seals) and those under the jurisdiction of USFWS (i.e., polar bears, and spectacled and Steller's eiders).

Table 3. Effects determinations for ESA listed and proposed species potentially present within the Action Area

Common name	Scientific name	ESA status	Jurisdiction	Effects determination
Bowhead Whale	*Balaena mysticetus*	Endangered	NMFS	May affect, not likely to adversely affect
Humpback Whale	*Megaptera novaeangliae*	Endangered	NMFS	May affect, not likely to adversely affect
Bearded Seal	*Erignathus barbatus nauticus*	Proposed	NMFS	May affect, not likely to adversely affect
Ringed Seal	*Phoca hispida hispida*	Proposed	NMFS	May affect, not likely to adversely affect
Polar Bear	*Ursus maritimus*	Threatened	USFWS	May affect, not likely to adversely affect
Spectacled Eider	*Somateria fischeri*	Threatened	USFWS	May affect, not likely to adversely affect
Steller's Eider	*Polsticta stelleri*	Threatened	USFWS	May affect, not likely to adversely affect

7.1 Species under NMFS Jurisdiction

7.1.1 Bowhead Whale (Endangered)

The effect determination for the bowhead whale as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for disturbance to migration routes as well as feeding or resting whales as a result of vessel traffic, drilling noise, and ice-breaking activities;
- The potential for direct exposure to small oil spills, as well as effluent discharges;
- The potential for bioaccumulation of toxins within available food sources; and
- The potential for vessel collisions with marine mammals.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The limited scope (both in regards to timing and extent) of potential impacts;

- The measures taken to reduce impacts from disturbances as well as the risk of collisions with marine mammals (i.e., preventing vessels from approaching marine mammals, restricting maximum speeds of vessels, and requiring marine mammal observers on all vessels);
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed; and
- The low risk of large oil spills and the high recovery rate of small accidental spills.

7.1.2 Humpback Whale (Endangered)

The effect determination for the humpback whale as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for disturbance to migration routes as well as feeding or resting whales as a result of vessel traffic, drilling noise, and ice-breaking activities;
- The potential for direct exposure to small oil spills, as well as effluent discharges;
- The potential for bioaccumulation of toxins within available food sources; and
- The potential for vessel collisions with marine mammals.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The low likelihood that this species would be present within the Action Area during exploration activities;
- The limited scope (both in regards to timing and extent) of potential impacts;
- The measures taken to reduce impacts from disturbances as well as the risk of collisions with marine mammals (i.e., preventing vessels from approaching marine mammals, restricting maximum speeds of vessels, and requiring marine mammal observers on all vessels);
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed; and
- The low risk of large oil spills and the high recovery rate of small accidental spills.

7.1.3 Bearded Seal (Proposed)

The effect determination for the bearded seal as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for ice-breaking activities to alter sea-ice habitat;
- The potential for disturbance to seals as a result of vessel traffic, drilling noise, and ice-breaking activities;
- The potential for direct exposure to small oil spills, as well as effluent discharges;

- The potential for bioaccumulation of toxins within available food sources; and
- The potential for vessel collisions with marine mammals.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The limited scope (both in regards to timing and extent) of potential impacts;
- The measures taken to reduce impacts from disturbances as well as the risk of collisions with marine mammals (i.e., preventing vessels from approaching marine mammals, restricting maximum speeds of vessels, and requiring marine mammal observers on all vessels);
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed; and
- The low risk of large oil spills and the high recovery rate of small accidental spills.

7.1.4 Ringed Seal (Proposed)

The effect determination for the ringed seal as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for ice-breaker activity to alter sea-ice habitat;
- The potential for disturbance to seals as a result of vessel traffic, drilling noise, and ice-breaking activities;
- The potential for direct exposure to small oil spills, as well as effluent discharges;
- The potential for bioaccumulation of toxins within available food sources; and
- The potential for vessel collisions with marine mammals.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The limited scope (both in regards to timing and extent) of potential impacts;
- The measures taken to reduce impacts from disturbances as well as the risk of collisions with marine mammals (i.e., preventing vessels from approaching marine mammals, restricting maximum speeds of vessels, and requiring marine mammal observers on all vessels);
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed; and
- The low risk of large oil spills and the high recovery rate of small accidental spills.

7.2 Species under USFWS Jurisdiction

7.2.1 Polar Bear (Threatened)

The effect determination for the polar bear as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for ice-breaker activity to alter sea-ice habitat;
- The potential for noise and human presences to alter polar bear behavior (either by attracting or excluding bears from areas);
- The potential for deadly bear-human interactions;
- The potential for direct exposure to small oil spills, as well as effluent discharges; and
- The potential for bears to die as a result of consuming oil tainted ringed seal carcasses.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The low likelihood that this species would be present within the open-water portion of the Action Area during exploration activities;
- The limited scope (both in regards to timing and extent) of potential impacts;
- The measures taken to prevent deadly bear-human interaction (i.e., hazing bears away from vessels and drill-rigs);
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed;
- The low risk of large oil spills and the high recovery rate of small accidental spills; and
- The low likelihood for impacts to their prey-base (i.e., ringed seals).

7.2.2 Spectacled Eider (Threatened)

The effect determination for the spectacled eider as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

- The potential for disturbance to seabirds as a result of vessel traffic, drilling noise, and ice-breaking activities (including potential impacts to Ledyard Bay);
- The potential for direct exposure to small oil spills, as well as effluent discharges;
- The potential for bioaccumulation of toxins within available food sources; and
- The high potential for avian collisions with structures.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The limited scope (both in regards to timing and extent) of potential impacts (including those to Ledyard Bay);
- The measures taken to reduce (but not eliminate) the risk of collisions with structures;
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed;
- The low risk of large oil spills and the high recovery rate of small accidental spills; and

- The low likelihood that this species would be present in marine waters during exploration activities (more likely to occur inland along lakes or flying over the Action Area on their way to the Chukchi Sea).

7.2.3 Steller's Eider (Threatened)

The effect determination for the Steller's eider as a result of exploration activities within the Action Area is "may affect, not likely to adversely affect."

A "may affect" determination is warranted based on the following reasons:

- The potential for disturbance to seabirds as a result of vessel traffic, drilling noise, and ice-breaking activities (including potential impacts to Ledyard Bay);
- The potential for direct exposure to small oil spills, as well as effluent discharges;
- The potential for bioaccumulation of toxins within available food sources; and
- The high potential for avian collisions with structures.

A "not likely to adversely affect" determination is warranted based on the following reasons:

- The limited scope (both in regards to timing and extent) of potential impacts (including those to Ledyard Bay);
- The measures taken to reduce (but not eliminate) the risk of collisions with structures;
- The EPA enforced restrictions on the types, quantities, and extent of effluent discharges that are allowed;
- The low risk of large oil spills and the high recovery rate of small accidental spills; and
- The low likelihood that this species would be present in marine waters during exploration activities (more likely to occur inland along lakes or flying over the Action Area on their way to the Chukchi Sea)

7.3 Designated Critical Habitat

7.3.1 Polar Bear Designated Critical Habitat

Although some impacts to polar bear offshore sea-ice designated critical habitat would occur, exploration activities "will not adversely modify" this critical habitat. This effect determination is warranted based on the following reasons:

- Activities would occur in the summer, which is considered as the open-water season in the Beaufort Sea; therefore, impacts to sea-ice would be limited.

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APPENDIX A: ESSENTIAL FISH HABITAT ASSESSMENT FOR THE CHUKCHI SEA AND BEAUFORT SEA PROGRAM AREAS

1.0 INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (Act), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), establish the procedures designated to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal Fisheries Management Plan (FMP). The Act defines EFH as habitat necessary to the fishery species for spawning, breeding, feeding, or growth to maturity (i.e. all life stages). These habitats include aquatic areas and their associated physical, chemical, and biological properties that are used by fish; sediment, hard bottom, and structures underlying the waters; and associated biological communities.

Section 305(b)(2) of the Act requires federal action agencies to consult with the National Oceanic and Atmospheric Administration (NOAA) on all proposed actions that are authorized, funded, or undertaken by the agency that may adversely affect EFH. As part of the EFH consultation process, EFH guideline 50 CFR 600.05 – 600.930 requires that federal action agencies prepare a written EFH assessment describing the effects of the proposed action on EFH. An EFH assessment must include: 1) a description of the proposed action, 2) the EFH present in the area affected by the proposed action, 3) an analysis of the effects of the proposed action on EFH, and 4) mitigation, if necessary. This EFH assessment is for the Environmental Protection Agency's (EPA) proposed re-issuance of a general NPDES permit for oil and gas exploration activities in the Chukchi and Beaufort Seas Planning area, and includes all of these required elements.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

The action proposed by the EPA is to re-issue the National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges associated with oil and gas exploration activities in the Chukchi and Beaufort Sea Program Area as two separate general permits. The Chukchi and Beaufort Sea Program Areas consist of the federal and state waters of the U.S. in the Chukchi and Beaufort Seas (see Figures 1 and 2). The oil and gas exploration activities that would be conducted under the Chukchi and Beaufort NPDES general permits consist of drilling exploration and delineation wells in order to determine the location and extent of oil and gas deposits within the Chukchi and Beaufort Program Areas. Drilling would be conducted from floating barges, drill ships, jack-up rigs, or semi-submersible rigs. Drilling operations are expected to range between 30 and 90 days at different well sites, and a maximum of 42 and 34 exploration or delineation wells are expected to be drilled under this permit in the Chukchi and Beaufort Seas, respectively. These exploration activities could result in the discharge of chemicals to open waters. These discharges could include drilling fluid, various forms of waste, deck drainage, and non-contact cooling water (the levels and composition of approved effluent discharges would need to conform to the stipulations and requirements established by the EPA). Discharges could also occur as a result of spills, which would be outside the authorization of the permit. A detailed description of the exploration activities, as well as the types and levels of effluent discharges that could occur from these activities

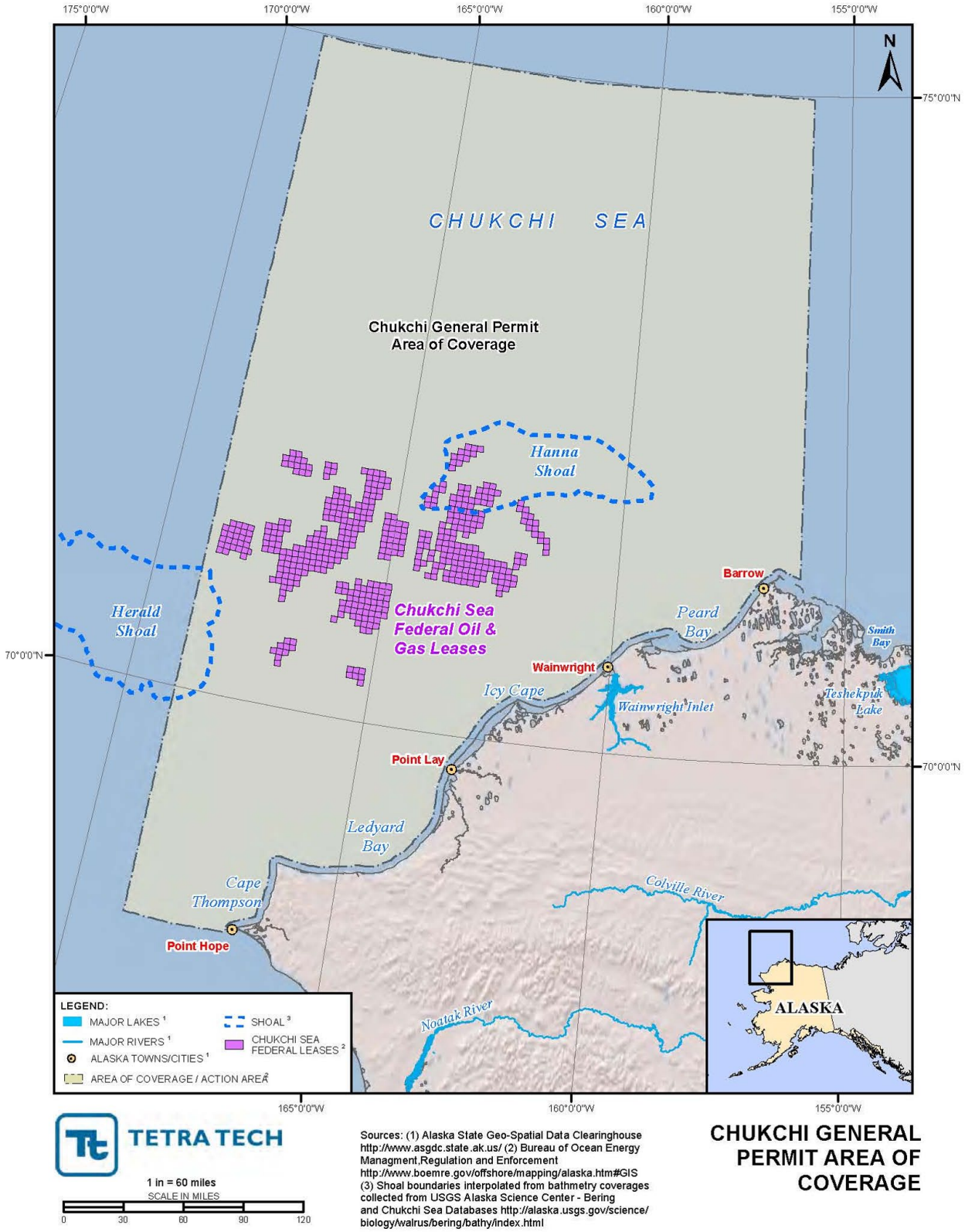

Figure 1. Chukchi General Permit Area of Coverage.

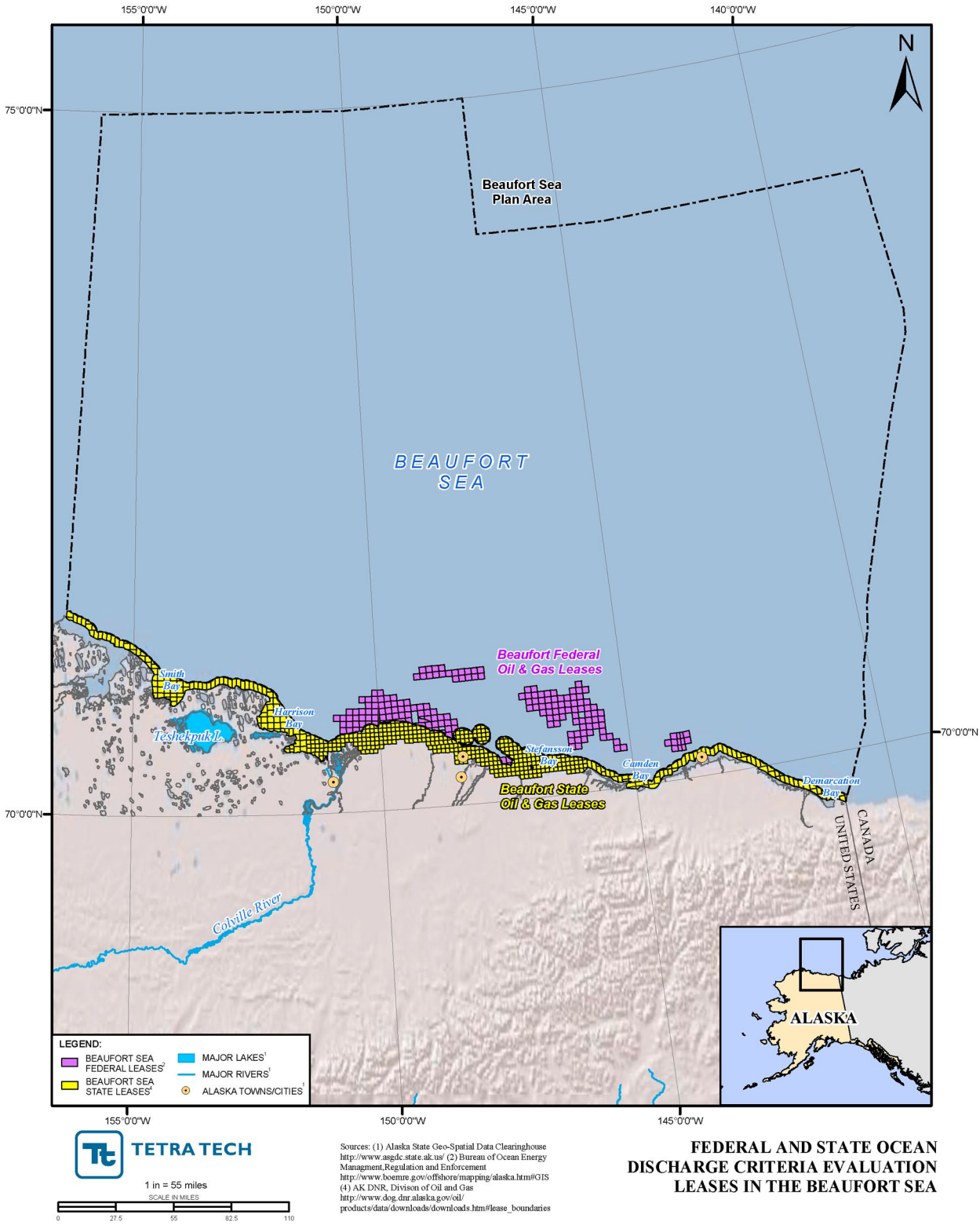

Figure 2. Beaufort General Permit Area of Coverage.

can be found in Section 2.0 of the associated Biological Assessment (BA), as well as within the EPA's Ocean Discharge Criteria Evaluations (ODCEs) for oil and gas exploration in the Chukchi and Beaufort Seas (EPA 2012a and b).

3.0 ESSENTIAL FISH HABITATS PRESENT IN THE ACTION AREA

Based on communications with the National Marine Fisheries Service (Eagleton 2011) and the North Pacific Fisheries Management Council (Evens 2011), as well as review of the Fishery Management Plan for Fish Resources of the Arctic Management Area (NPFMC 2009) the proposed action in the Chukchi Sea Program Area would overlap with the EFH of Pacific salmon, Arctic cod, saffron cod, and opilio snow crab. The proposed action in the Beaufort Sea Program area would overlap with the EFH of Pacific salmon and Arctic cod. Although no EFH has been designated for the opilio snow crab in the Beaufort Sea, this species does occur in the Beaufort Sea Program Area (NPFMC 2009). Below is a description of the EFH designations within the Program Areas.

3.1 Pacific Salmon EFH - Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*), sockeye (*O. nerka*), and chum (*O. keta*)

The life-histories of Pacific salmon are summarized here; however, detailed life-histories for each of the five Pacific salmon species present within the Program Areas can be found in the EPA's ODCEs (EPA 2012a and b). Pacific salmon typically leave the rivers and enter the nearshore waters during spring ice-break-up in June. As the ice cover melts and recedes, these fish will migrate along the coast; smaller fish tend to stay near the mouths of rivers while larger fish may migrate distances of 130 kilometers or more in search of feeding habitat (ADNR 1999). The date of their return migration back to rivers varies by species, but most return to freshwater to spawn and overwinter by mid-September (ADNR 1999).

Pacific salmon are present in the Chukchi and Beaufort Sea Program Areas; however, they are uncommon in these areas. For example, there is little evidence of viable, self-sustaining salmon populations in the Beaufort and the northern Chukchi Sea (north of 70 degrees latitude). In fact, the Beaufort and northern Chukchi Sea can be considered as a population sink for salmon, as they draw excess salmon from other areas instead of production a surplus of salmon (BLM 1998). It is likely that salmon have a difficult time establishing and persisting in the Arctic because of the marginal habitats (Craig 1989, Fechhelm and Griffiths 2001). Conclusions based on a survey of available information describing salmon stocks in the Beaufort Sea indicate that only a few isolated spawning stocks of chum and pink salmon might occur in the region, primarily the Sagavanirktok and Colville rivers (Fechhelm and Griffiths 2001). Small runs of pink and chum salmon have been noted in the Colville River (Bendock 1979, McElderry and Craig 1981) and in recent years these species have been found in the Itkillik river as part of the fall subsistence fishery (BLM 1998); however, catches in scientific sampling and in the subsistence fishery are extremely low (Moulton 1994, 1995, 1996, 1997). Of the salmon species present, it is likely that pink salmon are the most abundant in the Program areas; although their abundance is greatly reduced compared to waters farther south (Craig and Halderson 1986, MMS 2008). Chinook are found in limited quantities in the Program Areas, while major populations of Chinook salmon exist in the Bering Sea including in the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine Rivers (Schultz 2003). These population centers may contribute to the individuals that have been observed in the Chukchi Sea. In

Alaska, the most northern coho salmon population is found in the Kukpuk River near Point Hope on the Chukchi Sea (Groot and Margolis 1991). Coho have also been found in the Singoolik, Kivalina, Wulik, Noatak, Buckland, and Inmachuk rivers, all of which enter Kotzebue Sound, Alaska. Information on coho salmon from Point Hope to Cape Prince of Wales is sparse because they occur there in relatively small numbers and arrive in the rivers too late to be captured by native fishermen (Groot and Margolis 1991).

EFH for salmon has been designated for marine-nearshore and freshwater habitats in Alaska (NMFS 2005). Marine and nearshore salmon EFH is described as all marine waters from the mean higher tide line to the limits of the Exclusive Economic Zone (EEZ). Freshwater salmon EFH is described as those areas above the mean higher tide to the upper limits of those freshwater systems supporting salmon; these areas may include contiguous wetland areas.

Both Program Areas contain adult salmon EFH (this is limited to marine EFH, as no freshwater habitats would be directly impacted by the exploration activities conducted in offshore areas). The Chukchi Sea Program Area contains some juvenile rearing habitats; however, these are missing from the Beaufort Sea Program Area (Eagleton 2011). Adult salmon may be present in both Program Areas, but in low numbers.

3.2 Arctic Cod EFH - *Boreogadus saida*

The arctic cod has a circumpolar distribution. It can be found throughout the Arctic Ocean, except for a region just north of Scandinavia. The Arctic cod is typically associated with the underside of ice-packs, and its presence is often correlated with the presence of ice and a low salinity. During spawning (from October to March) they move from offshore areas into areas closer to the coastline; in fact, they have been observed moving into freshwater habitats during spawning (Svetovidov 1984). Their eggs are pelagic, and will float on the water's surface. Developing eggs are often found in accumulations under the ice, and hatching typically occurs when the ice begins melting. Arctic cod feed mostly on plankton; however, they will also eat fish eggs as well as small fish (Morrow 1980).

There is insufficient information currently available to define Arctic cod EFH for egg and early juvenile life stages. Late juvenile and adult Arctic cod EFH is described as the general distribution area for these two life stages that corresponds to the pelagic and epipelagic waters, from the nearshore and offshore areas along the entire shelf and upper slope in Arctic waters. These areas are often associated with ice-flows. Furthermore, Arctic cod has been identified as a keystone species that needs to remain close to current carrying capacity in order for the marine ecosystem to retain its present structure. No other keystone species have been identified for these Program Areas (NPFMC 2009).

Arctic cod juvenile and adult EFH occurs within both the Chukchi and Beaufort Program Areas, and Arctic cod occur in large numbers in both areas.

3.3 Saffron Cod EFH - *Eleginus gracilis*

The saffron cod is found in the north Pacific Ocean, as well as the Bering and Chukchi Seas. They can be found in "warmer" waters along their ranges, and are replaced by Arctic cod in the colder regions (Svetovidov 1948). Saffron cod inhabit deep offshore waters during spring and summer, and move closer to shore in winter in order to spawn. Some reports have indicated that their eggs are adhesive, and will

adhere to substrates instead of flowing loose in the pelagic environment (Svetovidov 1948). Although saffron cod will sometimes head into freshwater habitats during spawning (similar to the Arctic cod), they typically remain within tidally influenced areas. Saffron cod feed on small crustaceans as well as worms and small fish (Morrow 1980).

There is insufficient information currently available to define saffron cod EFA for egg and early juvenile life stages. Late juvenile and adult saffron cod EFH is described as the general distribution area for these two life stages that corresponds to the pelagic and epipelagic waters along the coastline, within nearshore bays, and under ice along the inner shelf throughout arctic waters, and wherever there are substrates consisting of sand and gravel (NPFMC 2009).

Saffron cod juvenile and adult EFH occurs within the Chukchi Program Area. Saffron cod are present in the Chukchi Program area, but they are not as common as Arctic cod. For example, the NPFMC estimates that a target fishery for saffron cod would likely take over two tons of Arctic cod for every ton of saffron cod caught (NPFMC 2009)

3.4 Opilio Snow Crab EFH - Chionoecetes opilio

Opilio snow crabs in Alaskan waters are found from the Arctic Ocean to the Bearing Sea. Adult crabs typically inhabit benthic areas that contain mud bottoms and have year-round temperatures of 0 to 5°C (Elner 1982). Matting occurs from January through June. Females carry clutches of approximately 36,000 eggs and nurture the embryos for approximately one year after fertilization. Larvae of the snow crab are found in early summer and remain planktonic for about 4 months (Elner 1988). Snow crab larvae mainly feed on diatoms, algae and zooplankton. Adult snow crab feed on polychaetes, brittle stars, mollusks, crustaceans, hydroids, algae and diatoms.

There is insufficient information currently available to define opilio snow crab EFH for larvae and early juvenile life stages. Opilio snow crab EFH for the egg life stage is inferred from the general distribution of egg-bearing female crabs. Late juvenile and adult EFH is described as the general distribution of these two life stages, located in bottom habitats along the inner and middle shelf in Arctic waters south of Cape Lisburne, wherever there are substrates consisting mainly of mud (NPFMC 2009).

Opilio snow crab egg, late juvenile and adult EFH occurs in the southern most portion of the Chukchi Sea Program Area.

4.0 EFFECTS OF THE PROPOSED ACTION

In general, Arctic ecosystems are expected to have less biological productivity than lower latitude ecosystems due to seasonal darkness and cold; however, there is considerable variability between Arctic systems. The physical characteristics of the Chukchi and Beaufort Seas lead to the distinctive ecological characteristics of each system. For example, the combination of increased open water and far higher nutrient inputs into the Chukchi Sea relative to the Beaufort Sea generates much higher biological productivity in the Chukchi (NPFMC 2009). The existing conditions within the Program Area, including the available food sources for EFH species in the benthic and pelagic zones, are discussed in detail within Section 5 of the associated BA(s).

As discussed in the associated BA(s), exploration activities would result in some temporary loss of benthic habitat due to the drilling and capping of exploratory and delineation wells, as well as temporary impacts to benthic and pelagic zones due to the effects of effluent discharge. Each well's blowout preventer would be placed at the bottom of a hole 37 feet in diameter and 37 feet across. The 1-meter diameter well would start at the bottom of the blowout preventer. Once the blowout preventer was removed and the well plugged upon closure of the well, the hole would begin to naturally re-fill and benthic habitat would start being reestablished. This loss of habitat would be low in magnitude however, due to the limited number of wells that are expected to be drilled within each Program Area (42 wells in the Chukchi Sea and 34 wells in the Beaufort Sea) compared to the extensive area encompassed by each sea's Program Area. Temporary loss of habitat would also result from the discharge of effluents (e.g., drilling fluid and cuttings). It is anticipated that most solids from the drill fluids/cuttings would settle within 1,000 meters, with some smaller sediments settling as far as 1,400 meters (EPA 2012). Deposition of these sediments could result in the burial of benthic organism (resulting in direct mortality). Increased turbidity could reduce light levels in areas directly adjacent to the drill, resulting in lowered productivity. Pollutants in the drill-fluid (e.g., barite, metals, etc…) could inhibit growth of, or result in the death of benthic or pelagic species that are exposed to these chemicals for long periods of time. In an Environmental Impact Statement (EIS) conducted for the 209, 212, 217, and 221 Lease Sale, MMS noted that changes in species composition, abundance, and/or biomass of benthic biota resulting from effluent discharge were detectable at distances of 50 to 500 meters from well sites (MMS 2008). Most of these impacts recovered after 1 year; however, some impacts were still detected at a distance of 50 meters 2 years after the exploratory drilling ceased (MMS 2008). However, the magnitude of temporary impacts resulting from effluent discharges are expected to be low due to the limited extent of the area affected (compared to the total extent within the Program Areas), as well as the EPA requirements that regulate and govern the amount and types of discharges that can be released to the environment.

As discussed in the associated BA(s), the risk of large oil spills (i.e., spills greater than 1,000 barrels) due to exploration activities is low; however, small spills (i.e., spills less than 1,000 barrels) are likely to occur. Most of these small spills are unlikely to reach the environment due to the high recovery rate of these spills (MMS 2009). For example, during drilling of 35 exploratory wells previously completed in the Beaufort and Chukchi Outer Continental Shelf, a total of 35 small spills occurred, with a total spill volume of 26.7 barrels. Of these 26.7 barrels, approximately 24 barrels (or 90 percent) was recovered or cleaned-up (MMS 2008). Any small spills that do reach the environment would likely result in adverse impacts to any marine life that are expose (i.e., sickness or death); however, due to the nature of oil-water interactions, these impacts are unlikely to have a long-term measureable impact to benthic communities.

Noise caused by drilling, boat traffic, and other associated structure activities may cause fish behavior response such as avoidance of the area. It is expected this response would be localized and intermittent, and would not result in adverse impacts to EFH.

5.0 IMPACT AVOIDANCE AND MINIMIZATION MEASURES

The EPA has established measures to limit the impact of exploration activities on biological resources or habitats within the Chukchi and Beaufort Sea Program Areas. These measures include restrictions on the types and quantities of effluent discharges that can be released to the open environment. The list of measures required by the EPA can be found in Section 2.4 of the associated BA(s). Applicable measures that are included in Section 2.4 of the accompanying BA(s) include, but are not limited too:

- Requirements to develop a Best Management Practices (BMP) Plan which contains measures to control the levels and types of pollutants discharged;
- Requirements to develop a Drilling Fluid Plan that is in compliance with all EPA regulations;
- Development of an Orientation Program that shall inform on-site personnel about environmental, biological, social, and cultural concerns that relate to oil and gas activities on the Project Area and adjacent areas;
- The need to conduct biological surveys to determine extent and composition of biological populations or habitats in the Action Area if determined necessary by the Regional Supervisor;
- The restriction of surface vessels (e.g., boats, barges) associated with exploration and delineation drilling operations from operating within or traversing the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10; and
- The requirement that all operations be conducted in adherence to the conditions of the most recent Biological Opinions issued by the USFWS and the NMFS.

6.0 CONCLUSIONS

EFH for Pacific salmon, Arctic cod, saffron cod, and opilio snow crab occurs within the Chukchi Sea Program Area, while EFH for Pacific salmon and Arctic cod occurs within the Beaufort Sea Program Area. Other than the effects of potential oil spills (of which the probability of occurring or reaching EFH is low), overall adverse effects on EFH in the Chukchi and Beaufort Sea Program Areas from exploration activities is expected to be short-term and low. Adverse effects from effluent discharges, temporary loss of habitat from developing the wells, and general disturbance to habitats (e.g., from noise) would be negligible, due to extensive area within each Program Area, the limited extent and magnitude of potential impacts, and the EPA regulations in place to govern and regulate effluent discharges. Although the probability of large oil spills occurring or small spills coming into contact with the open environment (i.e., the sea) is low, spills could have moderate adverse effects on EFH if they occur and reach the open environment (i.e., killing pelagic prey resources, benthic species in very shallow waters, or target EFH species within the area encompassed by the spill).

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APPENDIX B: IMPACT AVOIDANCE AND MINIMIZATION MEASURES

B.1. GENERAL MEASURES

1. The permittee shall, during the term of this permit, operate the facility in accordance with its current Best Management Practices (BMP) Plan or in accordance with subsequent amendments to the Plan. The permittee shall notify the Director of the EPA (Director) and Alaska Department of Environmental Conservation (ADEC) that the BMP Plan is complete and on-site at least 7 days prior to discharge. The permittee shall ensure that the BMP Plan incorporates practices to achieve the objectives and specific requirements listed below.

2. Through implementation of the BMP Plan, the permittee shall:

a. Prevent or minimize the generation and the potential for the release of pollutants from the facility to the waters of the United States through normal operations and ancillary activities; and

b. Ensure that methods of pollution prevention, control, and treatment will be applied to all wastes and other substances discharged.

3. The permittee shall develop and amend the BMP Plan consistent with the following objectives for the control of pollutants.

a. The number and quantity of pollutants and the toxicity of effluent generated, discharged or potentially discharged at the facility shall be minimized by the permittee to the extent feasible by managing each waste stream in the most appropriate manner.

b. Under the BMP Plan, and any Standard Operating Procedures (SOPs) included in the Plan, the permittee shall ensure proper operation and maintenance of the facility.

c. The permittee shall establish specific objectives for the control of pollutants by conducting the following evaluations.

(1) Each facility component or system shall be examined for its waste minimization opportunities and its potential for causing a release of significant amounts of pollutants to waters of the United States due to equipment failure, improper operation, and natural phenomena such as rain or snowfall, etc. The examination shall include all normal operations and ancillary activities including loading or unloading operations or spillage or leaks.

(2) Where experience indicates a reasonable potential for equipment failure, natural condition (e.g., precipitation), or other circumstances to result in significant amounts of pollutants reaching surface waters, the program should include a prediction of the direction, rate of flow and total quantity of pollutants which could be discharged from the facility as a result of each condition or circumstance.

4. The BMP Plan shall be consistent with the objectives listed above and the general guidance contained in the publication entitled Guidance Manual for Developing BMPs or any subsequent revisions to the guidance document. The BMP Plan shall:

a. Be documented in narrative form, shall include any necessary plot plans, drawings or maps, and shall be developed in accordance with good engineering practices. The BMP Plan shall be organized and written with the following structure:

(1) Name and location of the facility.

(2) Statement of BMP policy.

(3) Structure, functions, and procedures of the BMP Committee.

(4) Specific management practices and standard operating procedures to achieve the above objectives, including, but not limited to, the following:

(a) modification of equipment, facilities, technology, processes, and procedures,

(b) reformulation or redesign of products,

(c) substitution of materials, and

(d) improvement in management, inventory control, materials handling or general operational phases of the facility.

(5) Risk identification and assessment.

(6) Reporting of BMP incidents.

(7) Materials compatibility.

(8) Good housekeeping.

(9) Preventative maintenance.

(10) On-ice disposal methods

(11) Inspections and records.

(12) Security.

(13) Employee training.

b. Include the following provisions concerning BMP Plan review:

(1) Be reviewed by facility engineering staff and the facility manager.

(2) Be reviewed and endorsed by the permittee's BMP Committee.

(3) Include a statement that the above reviews have been completed and that the BMP Plan fulfills the requirements set forth in this permit. The statement shall be certified by the dated signature of each BMP Committee member.

c. Establish specific best management practices to meet the objectives identified above, addressing each component or system capable of generating or causing a release of significant

amounts of pollutants, and identifying specific preventative or remedial measures to be implemented.

d. Establish specific best management practices or other measures which ensure that the following specific requirements are met:

(1) Ensure proper management of solid and hazardous waste in accordance with the regulations promulgated under the Resource Conservation and Recovery Act (RCRA). Management practices required under RCRA regulations shall be referenced in the BMP Plan.

(2) Reflect requirements for Spill Prevention, Control, and Countermeasure (SPCC) plans under Section 311 of the Act and 40 CFR Part 112 and may incorporate any part of such plans into the BMP Plan by reference.

(3) Reflect requirements for storm water control under Section 402(p) of the Act and the regulations at 40 CFR 122.26 and 122.44, and otherwise eliminate to the extent practicable, contamination of storm water runoff.

(4) Reflect requirements for air emissions under 18 AAC 50.

(5) Address on-ice disposal methods, including on-ice spacing of discharge piles and height of accumulated drilling fluids and cuttings piles.

e. Include the following specific BMPs:

(1) Ensure that solids, sludges, or other pollutants removed in the course of treatment or control of water and wastewaters are disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

(2) Separate used motor oil from deck drainage collection systems.

(3) Minimize wastewater treatment system upsets by the controlled usage of deck washdown detergents.

(4) Reduce oil spillage and oil leaks from pump bearings and seals through the use of good prevention techniques such as drip pans and other handling and collection methods.

(5) If oil is used as a spotting fluid, careful attention to the operation of the drilling fluid system could result in the segregation from the main drilling fluid system of the spotting fluid and contaminated drilling fluid. Once segregated, the contaminated drilling fluid can be disposed of in an environmentally acceptable manner.

(6) When possible, substitute standard drill pipe threading compound (pipe dope) with “toxic metals free” pipe dope.

(7) Careful application of standard drill pipe dope to minimize contamination of receiving water and drilling fluids.

(8) Substitute diesel oil with less toxic mineral oil or synthetic based material in drilling fluid applications.

(9) When possible, substitute standard drilling fluid additives with less toxic additives.

(10) Careful handling of drilling fluid materials and treatment chemicals to prevent spills.

(11) Use of local containment devices such as liners, dikes and drip pans where chemicals are being unpackaged and where wastes are being stored and transferred.

(12) Install treatment devices for deck drainage to reduce or remove pollutants in the discharges (e.g., skim tanks, oil/water separators, sediment tanks/basins, or detention ponds).

B.2. DRILL FLUID PLAN REQUIREMENTS

1. The permittee shall develop and have on-site at all times a written procedural plan for the formulation and control of drilling fluid/additive systems for each well. The mud plan must specify the drilling fluid/additive systems to be used. The plan shall be implemented during drilling operations.

2. The drilling fluid plan shall be available to the EPA (Agency) upon request. Seven (7) days prior to commencement of discharges from a given well, the permittee shall notify the Director, in writing, that the drilling fluid plan for the well is complete and provide the well and drilling fluid information required by the NOI information sheet.

3. At a minimum, the drilling fluid plan shall provide the following information:

a. Types of drilling fluids proposed for discharge, the well name, well number, NPDES permit number, and drilling fluid types as basic plan identification for each well drilled.

b. Specific for use at each well and drilling fluid type, a list including commercial product names, descriptions of the products, and the maximum proposed discharge concentrations for each product. Concentrations shall be commonly stated in appropriate terms (e.g., lb/bbl, gal/bbl, % (wt), or % v/v (% volume oil per volume drilling fluid). Each drilling fluid or additive system shall be clearly labeled with respect to drilling fluid type (e.g., KCl/polymer drilling fluid, freshwater lignosulfonate drilling fluid). Components of the basic drilling fluid shall be listed separately from specialty or contingency additives which may be used.

c. A record of the operator's determination of how discharge is expected to comply with the 30,000 ppm SPP toxicity limitation. Operator's determination must be based upon, but not limited to, the following criteria:

(1) Estimate of worst-case cumulative discharge toxicity based on additive toxicity estimations or commercially calculated discharge toxicity estimations;

(2) Estimations of discharge toxicity based on the use of mineral oil pills and subsequent discharge of residual mineral oil concentrations must be estimated separately from the proposed drilling fluid or additive system; and

(3) Description of how overall toxicity is minimized, where possible.

d. A clearly stated procedure for determining whether or not an additive not originally planned for or included in toxicity estimations may be used and discharged.

e. An outline of the drilling fluid planning process which shall be consistent with other permit requirements. Names and titles of personnel responsible for the drilling fluid planning process shall be included in the drilling fluid plan.

B.3. ESA/BIOLOGICAL SPECIFIC MEASURES

1. If previously unidentified biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats (see stipulations under Section II.B.3.c in OCS EIS/EA MMS 2007-026 MAY 2007). Additional stipulations may apply based on a Draft Supplemental EIS (OCS EIS/EA BOEMRE 2010-034) once the Final SEIS is issued.

The RS/FO shall give written notification to the lessee of the RS/FO‘s decision to require such surveys. Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

a. Relocate the site of operations;

b. Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;

c. Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or

d. Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such finding to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection. The lessee shall submit all data drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

2. A lessee proposing to conduct exploration operations during the periods and within the subsistence use areas related to whale, ice seals, walrus, and polar bears and their migrations and subsistence hunting as

specified below, will be required to conduct a site-specific monitoring program approved by the Regional Supervisor, Field Operations (RS/FO); unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with appropriate agencies and co-management organizations, determines that a monitoring program is not necessary. Organizations currently recognized by the NMFS and the USFWS for the co-management of the marine mammals resources are the North Slope Borough, the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, the Alaska Eskimo Walrus Commission, the Ice Seal Commission, and the Nanuk Commission. The RS/FO will provide the appropriate agencies and co-management organizations a minimum of 30 but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced. The monitoring program will be designed to assess when whales, ice seals, walrus, and polar bears are present in the vicinity of lease operations and the extent of behavioral effects on these marine mammals due to these operations. In designing the program, the lessee must consider the potential scope and extent of effects that the type of operation could have on these marine mammals. The program must also provide for the following:

a. Recording and reporting information on sighting of the marine mammals of concern and the extent of behavioral effects due to operations;

b. Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP) and other mandated aerial monitoring programs;

c. Invite a local representative to be determined by consensus of the appropriate co-management organizations to participate as an observer in the monitoring program;

d. Submitting daily monitoring results to the RS/FO;

e. Submitting a draft report on the results of the monitoring program to the RS/FO within 60 days following the completion of the operation. The RS/FO will distribute this draft report to the appropriate agencies and co-management organizations; and

f. Submitting a final report on the results of the monitoring program to the RS/FO. The final report will include a discussion of the results of the peer review of the draft report. The RS/FO will distribute this report to the appropriate agencies and co-management organizations. The lessee will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for bowhead whales. The lessee may be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program for other co-managed marine mammal resources. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the appropriate agencies and co-management resource organizations. The results of these peer reviews will be provided to the RS/FO for consideration in final

approval of the monitoring program and the final report, with copies to the appropriate agencies and co-management organizations.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from NMFS and/or FWS, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. The lessee must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NMFS and/or FWS and will advise the lessee if the LOA or IHA will meet these requirements. The BOEMRE, NMFS, and FWS will establish procedures to coordinate results from site-specific surveys required by this stipulation and the LOAs or IHAs to determine if further modification to lease operations are necessary. This stipulation applies to the areas and periods listed below. This stipulation will remain in effect until termination or modification by the Department of the interior after consultation with appropriate agencies.

3. The lessee shall include with any Exploration Plan (EP) or Development and Production Plan (DPP) submitted under 30 CFR 250.212 and 250.242, respectively, an overview of a proposed orientation training program for all personnel (including personnel of the lessee‘s agents, contractors, and subcontractors) involved in on-site exploration, development, production, and support activities.

The orientation program shall inform on-site personnel about environmental, biological, social, and cultural concerns that relate to oil and gas activities on the OCS and adjacent areas. The program shall address the importance of not disturbing biological resources and habitats and include an explanation of “take” definitions under the ESA and MMPA. The program shall include guidance about restrictions on approaching marine mammals and how to avoid disturbance of marine mammals. The program shall be designed to increase the awareness and understanding of industry personnel to local community values, customs, and lifestyles, including an overview of the Iñupiaq culture and the importance of subsistence hunting and sharing practices. The orientation program shall include information concerning avoidance of conflicts with subsistence activities. The program shall address the importance of not disturbing archaeological, cultural, and historic resources and provide guidance on how to avoid disturbance of these resources.

All personnel involved in on-site exploration or development and production activities (including personnel of the lessee‘s agents, contractors, and subcontractors) and all supervisory and managerial personnel overseeing such activities must complete the orientation training program before beginning onsite work and annually thereafter. Evidence of completion of the orientation program by individuals employed by the lessee is subject to BOEMRE onsite inspection. Upon request from the RS/FO, orientation material shall be made available for MMS review. The RS/FO may require materials to be modified if BOEMRE review determines the materials do not adequately cover the environmental, biological, social, and cultural concerns of the area.

4. An EP must include a plan for recording and reporting bird strikes resulting from all exploration activities. All bird collisions (with vessels, aircraft, or drilling structures) shall be documented and reported within 3 days to BOEMRE. Minimum information will include species, date/time, location,

weather, identification of the vessel, and aircraft or drilling structure involved and its operational status when the strike occurred. Bird photographs are not required, but would be helpful in verifying species. Lessees are advised that the FWS does not recommend recovery or transport of dead or injured birds due to avian influenza concerns.

5. Surface vessels (e.g., boats, barges) associated with exploration and delineation drilling operations should avoid operating within or traversing the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, to the maximum extent practicable. If surface vessels must traverse this area during this period, the surface vessel operator will have ready access to wildlife hazing equipment (including at least three *Breco* buoys or similar devices) and personnel trained in its use; hazing equipment may located onboard the vessel or on a nearby oil spill response vessel, or in Point Lay or Wainwright. Lessees are required to provide information regarding their operations within the area upon request of BOEMRE. The BOEMRE may request information regarding number of vessels and their dates of operation within the area.

a. Except for emergencies or human/navigation safety, surface vessels associated with exploration and delineation drilling operations will avoid travel within the Ledyard Bay Critical Habitat Area between July 1 and November 15. Vessel travel within the Ledyard Bay Critical Habitat Area for emergencies or human/navigation safety shall be reported within 24 hours to BOEMRE.

b. Aircraft supporting drilling operations will avoid operating below 1,500 feet above sea level over the listed blocks or Federal waters between the listed blocks and the coastline between April 15 and June 10, or the Ledyard Bay Critical Habitat Area between July 1 and November 15, to the maximum extent practicable. If weather prevents attaining this altitude, aircraft will use pre-designated flight routes. Pre-designated flight routes will be established by the lessee and BOEMRE, in collaboration with the FWS, during review of the EP. Route or altitude deviations for emergencies or human safety shall be reported within 24 hours to BOEMRE.

6. For activities conducted between April 15 and November 15, the following lighting requirements would apply:

a. Drilling Structures: Lessees must adhere to lighting requirements for all exploration or delineation drilling structures so as to minimize the likelihood that migrating marine and coastal birds will strike these structures. Lessees are required to implement lighting requirements aimed at minimizing the radiation of light outward from exploration or delineation drilling structures to minimize the likelihood that birds will strike those structures. These requirements establish a coordinated process for a performance-based objective rather than pre-determined prescriptive requirements. The performance-based objective is to minimize the radiation of light outward from exploration/delineation structures while operating on a lease or if staged within nearshore Federal waters pending lease deployment. Measures to be considered include but need not be limited to the following:

(1) Shading and/or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;

(2) Types of lights;

(3) Adjustment of the number and intensity of lights as needed during specific activities;

(4) Dark paint colors for selected surfaces;

(5) Low-reflecting finishes or coverings for selected surfaces; and

(6) Facility or equipment configuration.

Lessees are encouraged to consider other technical, operational, and management approaches that could be applied to their specific facilities and operations to reduce outward light radiation. Lessees must provide BOEMRE with a written statement of measures that will be or have been taken to meet the lighting objective, and must submit this information with an EP when it is submitted for regulatory review and approval pursuant to 30 CFR 250.203.

b. Support Vessels: Surface support vessels will minimize the use of high-intensity work lights, especially when traversing the listed blocks and federal waters between the listed blocks and the coastline. Exterior lights will be used only as necessary to illuminate active, on-deck work areas during periods of darkness or inclement weather (such as rain or fog); otherwise they will be turned off. Interior lights and lights used during navigation could remain on for safety. For the purpose of this stipulation, the listed blocks are as follows:

NR02-06, Chukchi Sea: 6624, 6625, 6674, 6675, 6723-6725, 6773-6775, 6822, 6823, 6872

NR03-02, Posey: 6872, 6873, 6918-6923, 6967-6973, 7016-7023, 7063-7073, 7112-7123

NR03-03, Colbert: 6674, 6723, 6724, 6771-6774, 6820-6824, 6869-6874, 6918-6924, 6966-6974, 7015-7024, 7064-7074, 7113-7124

NR03-04, Solivik Island: 6011-6023, 6060-6073, 6109-6122, 6157-6171, 6206-6219, 6255-6268, 6305-6317, 6354-6365, 6403-6414, 6453-6462, 6502-6511, 6552-6560, 6601-6609, 6651-6658, 6701-6707, 6751-6756, 6801-6805, 6851-6854, 6901-6903, 6951, 6952, 7001

NR03-05, Point Lay West: 6014-6024, 6062-6073, 6111-6122, 6160-6171, 6209-6221, 6258-6269, 6307-6317, 6356-6365, 6406-6414, 6455-6462, 6503-6510, 6552-6558, 6602-6606, 6652-6655, 6702, 6703

NR04-01, Hanna Shoal: 6223, 6267-6273, 6315-6323, 6363-6373, 6411-6423, 6459-6473, 6507-6523, 6556-6573, 6605-6623, 6654-6671, 6703-6721, 6752-6771, 6801- 6819, 6851-6868, 6901-6916, 6951-6964, 7001-7010, 7051-7059, 7101-7107

NR04-02, Barrow: 6003-6022, 6052-6068, 6102-6118, 6151-6164, 6201-6214, 6251-6262, 6301-6312, 6351-6359, 6401-6409, 6451-6456, 6501-6506, 6551, 6552, 6601, 6602

NR04-03, Wainwright: 6002-6006, 6052, 6053

NS04-08, (Unnamed): 6816-6822, 6861-6872, 6910-6922, 6958-6972, 7007-7022, 7055-7072, 7104-7122

Nothing in this stipulation is intended to reduce personnel safety or prevent compliance with other regulatory requirements (e.g., U.S. Coast Guard or Occupational Safety and Health Administration) for marking or lighting of equipment and work areas.

7. Vessels will not approach within 100 yards of ESA-listed whales or other sensitive marine mammals to the maximum extent practical. These species are protected under ESA and the MMPA and permittee shall work with NMFS and USFWS to establish specific approach measures that will be used where avoidance is not practical.

8. Operations conducted in support of exploration and development activities are required to adhere to the conditions of the most recent Biological Opinions issued by the USFWS and the NMFS.