# Biological Assessment

**of the**

# Bowhead Whale (*Balaena mysticetus*), Ringed Seal (*Phoca hispida*), and Bearded Seal (*Erignathus barbatus*)

Prepared for

**ExxonMobil**

**Point Thomson Project**

**North Slope, Alaska**

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**November 2011**

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Appendix A Oil Spill Preparedness

## LIST OF ACRONYMS

| | |
|---|---|
| AAC | Alaska Administrative Code |
| ACS | Alaska Clean Seas |
| ADEC | Alaska Department of Environmental Conservation |
| AEWC | Alaska Eskimo Whaling Commission |
| BA | Biological Assessment |
| BCB | Bering-Chukchi-Beaufort Sea |
| BOEMRE | Bureau of Ocean Energy Management, Regulation, and Enforcement |
| CAA | Conflict Avoidance Agreement |
| CFR | Code of Federal Regulations |
| Corps | U.S. Army Corps of Engineers |
| CPF | Central Processing Facility |
| dB | decibels |
| ESA | Endangered Species Act |
| ExxonMobil | Exxon Mobil Corporation |
| FEED | Front End Engineering Design |
| ft | feet |
| Hz | Hertz |
| KHz | kilohertz |
| km | kilometers |
| $km^2$ | square kilometers |
| m | meters |
| mi | miles |
| MMO | marine mammal observer |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| NMFS | National Marine Fisheries Service |
| NSB | North Slope Borough |
| ODPCP | Oil Discharge Prevention and Contingency Plan |
| Project | Point Thomson Project |
| PTU | Point Thomson Unit |
| rms | root mean square |
| Shell | Shell Exploration and Production Company |
| USDI | U.S. Department of the Interior |

# 1.0 EXECUTIVE SUMMARY

This Biological Assessment (BA) considers the potential effects of the Point Thomson Project (Project) on species managed by the National Marine Fisheries Service (NMFS); the bowhead whale (*Balaena mysticetus*), ringed seal (*Phoco hispida*), and bearded seal (*Erignathus barbatus*) and their habitats. The bowhead whale is listed as endangered under the Endangered Species Act (ESA), and the ringed and bearded seal were proposed by the NMFS for listing as threatened species on December 3, 2010. A final decision to list these two species could occur in late 2011 or early 2012, just prior to beginning the planned construction at Point Thomson.

The Project is located along the coast of the Beaufort Sea, on the eastern North Slope of Alaska, approximately 80 kilometers (km) (50 miles [mi]) east of the Prudhoe Bay Development. The proposed development will be located on the coast and serviced by ice roads, barges, and aircraft. Ice roads will be constructed on land and sea ice, with the latter generally occurring within a water depth (less than 3 meters [m] [less than 10 feet (ft)]) not accessible to seals during winter. Aircraft will operate from an airstrip located approximately 5 km (3 mi) inland, and generally fly an inland route. Coastal barges will operate inside the barrier islands to provide routine resupply during the open-water season (generally July 15 to August 25, but may extend longer). Seven to 10 large marine sealift barges carrying modules will travel routes outside of the barrier islands using established marine shipping routes until reaching the vicinity of Point Thomson. Marine sealift barges carrying modules will travel to Point Thomson potentially during any of the three open-water construction seasons (2013-2015). Offloading the sealift barges will require temporarily grounding three barges, end-to-end, from shore, at the marine bulkhead creating a barge-bridge, and subsequently removing them before freeze-up. Sealift barges would be rotated through this barge-bridge system over a period of two to four weeks. Preconstruction activities are planned to commence during the summer and fall of 2012, with major construction activities occurring in each winter season through 2015. Module installation/commissioning, facility startup, first production, and construction demobilization are scheduled for 2015-2016.

This BA assesses the potential direct and indirect effects of the Project on the bowhead whale, ringed seal, and bearded seal and their habitats during the following three phases of the Project:

Drilling, construction, and operation. Activities considered to potentially affect these three species during each of the three phases of the Project include operations generating underwater and airborne noise, barge traffic, placement of grounded barges for offloading materials at the site, pier construction and associated dolphin placement, dredging and screeding, oil spills, and ice roads. These activities would have no more than a negligible effect on bowhead whales, ringed seals, and bearded seals or their habitats, because:

- The airstrip will be located 5 km (3 mi) inland and aircraft will generally follow an inland flight corridor;
- Noise generated by barges or grounding of barges will be muted by background levels and site conditions, unlikely to expose more than a few bowhead whales, ringed seals, or bearded seals;
- Underwater noise (primarily from tugboats pulling barges) will be below levels the NMFS considers to be a Level B take for bowhead whales, ringed seals, and bearded seals;
- Pier construction and associated dolphin installation, and dredging and screeding will be primarily during winter through the ice and in waters less than the 3 m (10 ft) depth which is generally unavailable for use by seals, and noise and disturbance for any summer dredging and screeding would be transitory with insignificant effects to a few ringed seals;
- Oil spills will likely be small and confined to the project site; and
- Ice roads will be built on sea ice in water depths generally less than 3 m (10 ft) which is rarely inhabited by seals.

Consequently, all direct and indirect effects from the Project considered in the BA were determined to be insignificant to bowhead whale, ringed seal, and bearded seal individuals and their populations.

The primary activity bowhead whales, ringed seals, and bearded seals could potentially be exposed to during the Project would be barge traffic. Barge traffic would occur during each phase of the Project with the highest level of traffic occurring during the construction phase. Bowhead whales, ringed seals, and bearded seals could be exposed to barge traffic in three ways: Underwater vessel noise disturbing them, vessels colliding with them, or approaching vessels causing them to change course to avoid a collision. It is unlikely any of these activities would have more than a negligible effect on a small number of bowhead whales, ringed seals, or bearded seals, since most barging would occur primarily within or near the barrier islands, where bowheads rarely occur and seals occur in small numbers.

Bowheads typically occur considerably north of the barrier islands. The offshore distance from mainland of fall migrating bowheads averages 31.2 km (19 mi) (Treacy et al. 2006), where they are widely distributed over the outer continental shelf. Ringed and bearded seals occur in offshore pack ice during summer, which are areas avoided by barges. If a bowhead whale, ringed seal, or bearded seal were encountered by a barge, any effect would be insignificant, since underwater noise levels would be below levels the NMFS considers to be a take for bowheads and ringed and bearded seals). Transmission of vessel noise would also be reduced by the noise-absorbing effects of the shallow water combined with the high underwater ambient noise levels caused by persistent winds, typical of the Arctic Ocean. Sea ice, if present, adds considerably to ambient noise levels. There is currently a substantial amount of barge and vessel traffic in the region during the open-water season that has occurred for many years without any documented effect on the health or growth of the bowhead whale, ringed seal, or bearded seal populations.

Collisions or the effects of behavioral disturbance on bowhead whales, ringed seals, and bearded seals from an approaching barge would also be negligible, since captains would be required to take actions to alter course to avoid these marine mammals, whenever possible. The slow movement and continuous noise of a traveling barge does not normally disturb marine mammals, provided actions are taken to avoid directly approaching them. Also, marine mammal observers (MMOs) will be stationed on each lead vessel of a tug barge group to observe and alert captains of sightings to avoid and minimize disturbance of marine mammals. Because barge traffic, as well as other activities associated with each phase of the Project, would have no significant effect on bowhead whales, ringed seals, and bearded seals, the Project is *not likely to adversely affect* these animals or their populations.

**Table 1.1 Effects determinations for listed species and critical habitat in the Point Thomson Action Area.**

| Species/Critical Habitat | Status | Determination |
|---|---|---|
| Bowhead Whale | Endangered | Not likely to adversely affect |
| Ringed Seal | Proposed for Listing | Not likely to adversely effect |
| Bearded Seal | Proposed for Listing | Not likely to adversely affect |

Based on these effects determinations, the U.S. Army Corps of Engineers (Corps) requests that NMFS concur with this determination and complete an informal consultation process without the preparation of a Biological Opinion for the Project.

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# 2.0 PROJECT DESCRIPTION

Exxon Mobil Corporation (ExxonMobil) is proposing to initiate development and commercial hydrocarbon production from the Thomson Sand reservoir on the Arctic Coastal Plain of Alaska, with surface development located approximately 80 km (50 mi) east of Prudhoe Bay and 3 to 16 km (2 to 10 mi) west of the Staines River, which is the western boundary of the Arctic National Wildlife Refuge. The proposed Project location is along the central coast of the Beaufort Sea. The Beaufort Sea is used seasonally by bowhead whales (*Balaena mysticetus*) during their spring and fall migration, and by ringed (*Phoca hispida*) and bearded seals (*Erignathus barbatus*). Bowhead whales are listed as endangered, and ringed and bearded seals have been proposed for listing as threatened under the ESA of 1973, as amended (PL 93-205; 16 USC §§1531–1544). Section 7 of the ESA requires federal agencies to consult with the NMFS prior to development to ensure that any federally authorized action is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of their critical habitat (50 Code of Federal Regulations [CFR] §402). The federal action triggering the Section 7 consultation is the requirement for a permit from the Corps under Section 404 of the Clean Water Act of 1972, as amended, and Section 10 of the Rivers and Harbors Act for construction of project facilities in wetlands and waters of the United States. This BA is prepared to comply with the Section 7 consultation requirements for these listed species. The specific purpose of this BA is to provide sufficient data on the distribution, abundance, and habitat use of these three species in the Project area to support the Section 7 consultation process with the NMFS. Also included in this BA are mitigation measures proposed to minimize the impacts of the proposed action on these species. Following review of the BA, the NMFS will assess whether the proposed action is likely to jeopardize the populations of each species. No critical habitat has been designated for these species. The history for this consultation includes the following milestones to-date.

**February 19, 2010 –** District Engineer, Alaska District, Corps requests information (species list) on threatened and endangered species from the NMFS.

**March 2, 2010 –** NMFS responds to Corps Alaska District stating that the Project is within the range of the bowhead whale.

**March 19, 2010 –** Project Manager, Corps Alaska District designates ExxonMobil as the non-federal representative to prepare the BA.

**May 19, 2010 –** A coordination meeting occurs between representatives of the Corps, NMFS, and ExxonMobil to discuss ESA Section 7 consultation process and the content of the BA.

**December 10, 2010 –** NMFS proposes to list both the ringed and bearded seal as threatened.

**__________________ –** ESA Section 7 consultation is initiated with the submittal of the BA to NMFS.

## 2.1 Location/Action Area

The Project will be located along the Beaufort Sea coast, on the eastern North Slope of Alaska in an area generally between the Staines River on the east and the Sagavanirktok River on the west, as shown in Figure 2.1. The main Project facilities will be located approximately 9.7 km (6 mi) west of the Staines River, and approximately 35 km (22 mi) east of the Badami Development, as shown in Figure 2.2. An export pipeline will extend 35 km (22 mi) west from the Central Pad to the Badami Development occupying a narrow corridor 1.6 to 4.8 km (1 to 3 mi) inland. Sea ice roads, when constructed, will occur on or very near the sea ice near the coastline between Point Thomson and the Endicott Development road with occasional short inland spurs to water source lakes, or to avoid suspected polar bear dens by a 1-mi buffer.

The Action Area will also include nearshore marine transportation corridors used by coastal resupply barges between the Project site and Prudhoe Bay, generally inside the barrier islands, and offshore marine corridors used as sealift routes between off-site docks and the Project site (as shown in Figure 2.1). The marine sealift routes will use established marine shipping routes from the manufacturing sites away from the North Slope, then traverse around Point Barrow to Prudhoe Bay. These routes will then approach Point Thomson at the Challenge or Mary Sachs Entrances.

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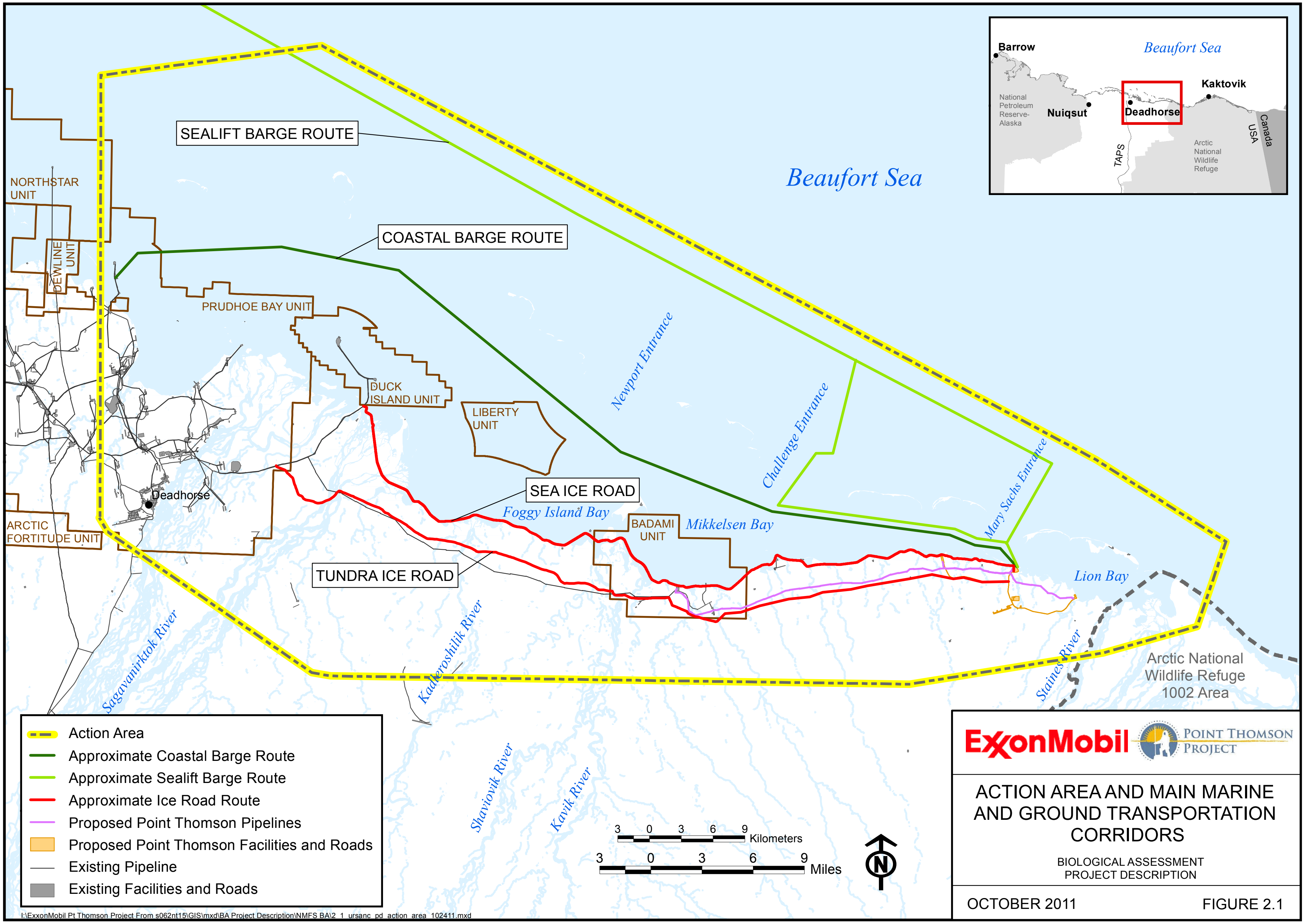


ACTION AREA AND MAIN MARINE AND GROUND TRANSPORTATION CORRIDORS

BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION

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FIGURE 2.1

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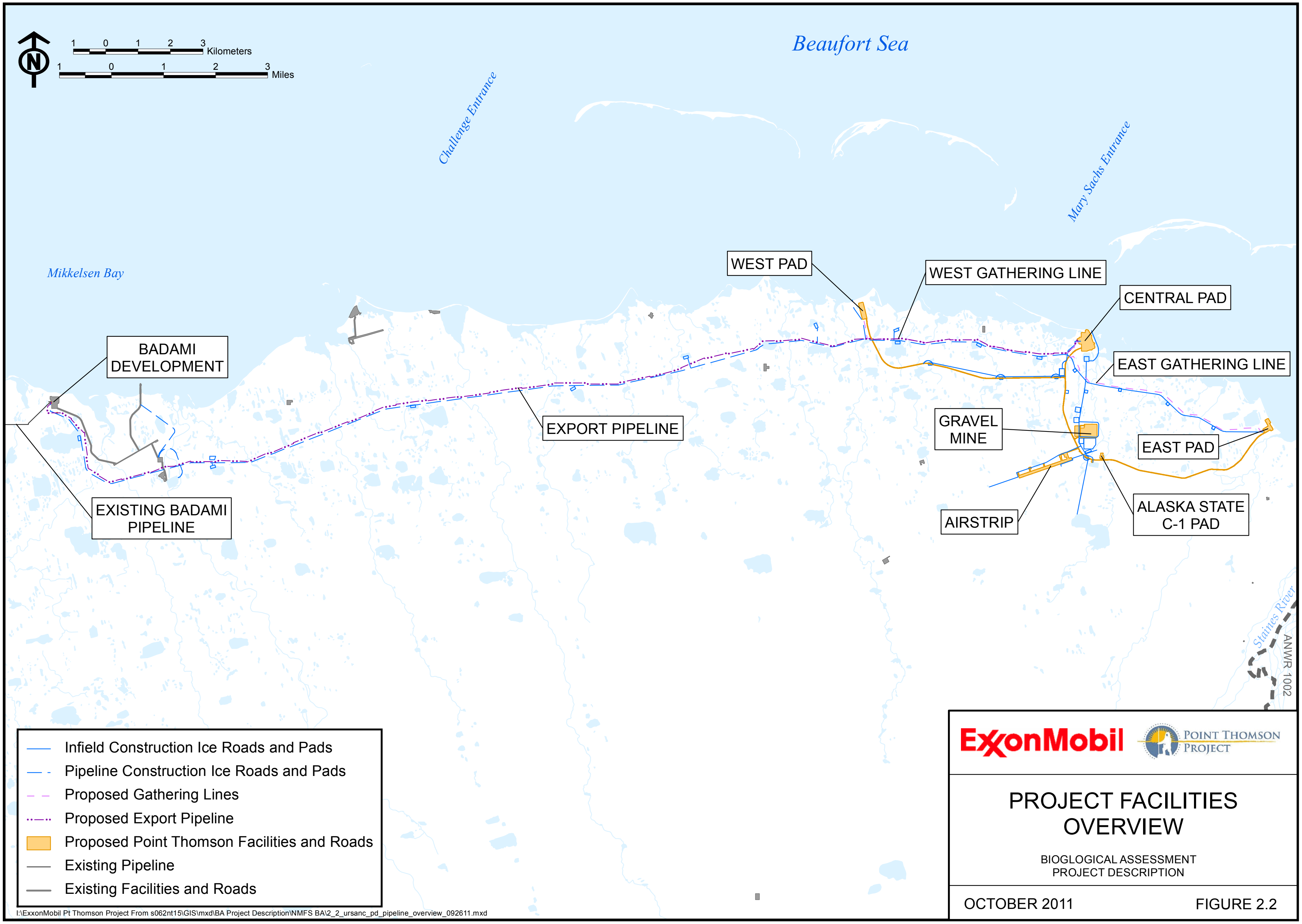


ExxonMobil
POINT THOMSON PROJECT

PROJECT FACILITIES OVERVIEW

BIOGLOGICAL ASSESSMENT
PROJECT DESCRIPTION

OCTOBER 2011

FIGURE 2.2

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## 2.2 Project Overview

The proposed Project will initiate development and commercial hydrocarbon production from the Thomson Sand reservoir. The Thomson Sand reservoir is a high-pressure gas condensate reservoir that underlies state lands onshore and state waters offshore. ExxonMobil is proposing to produce gas from the Thomson Sand reservoir, recover liquid hydrocarbons, and re-inject the residual gas back into the Thomson Sand reservoir, with the injected gas saved (or *"available"*) for future production. The Project will also delineate and test other hydrocarbon resources encountered, and obtain information about reservoir connectivity and the effectiveness of production of gas condensate.

The Project is comprised of development wells, infield gathering lines, processing facilities, and support infrastructure; and the Point Thomson Export Pipeline and ancillary facilities, which is a common carrier pipeline used to transport hydrocarbon liquids from Point Thomson to Badami. The Export Pipeline will be constructed and operated under terms of a Right-of-Way lease.

The Project also includes the necessary infrastructure to drill and produce five development wells from three pads (Central, East, and West Pads). The first two wells at the Central Pad (PTU-15 and PTU-16) were drilled, cased, flow-tested, and suspended in 2009 and 2010. The proposed configuration of the three pads is necessary (and strategically located) to delineate the Thomson Sand reservoir and effectively access its offshore portions from onshore locations using long-reach directional drilling. The Central Pad is located to access the core of the reservoir and the East and West pads are located to access the eastern and western extent of the reservoir, respectively. Gathering lines are planned to transport three-phase production from the East and West pads to the Central Processing Facility (CPF) on the Central Pad. The proposed three-pad configuration, combined with long-reach directional drilling technology, will allow the hydrocarbon resource to be evaluated and developed with minimal expansion required to meet reasonably foreseeable future field development scenarios (e.g., expanded gas cycling and/or gas sales). The locations of the Central and East pads were also chosen to allow utilizing existing exploration well pads, which reduces new gravel footprints.

The CPF is being designed with capacity to process 200 million standard cubic feet per day of natural gas for recovery of approximately 10,000 barrels per day of condensate. Condensate is the hydrocarbon liquid that condenses from the produced natural gas as pressure and temperature fall below original reservoir conditions during production and surface handling at processing facilities.

At the CPF, the three-phase stream (gas, water, and hydrocarbon liquids) produced from the wells will be separated and hydrocarbon liquids will be recovered and stabilized to meet pipeline tariff specifications from Export Pipeline to the Trans-Alaska Pipeline System Pump Station 1. After separation, produced water will be injected into a Class 1 disposal well. Produced gas will be conserved by being compressed and re-injected into the Thomson Sand reservoir through the gas injection well. Produced natural gas will be used as the primary fuel source for the Project facilities. A connection to the gas injection well also allows use of natural gas as fuel when the production operation is shutdown, with diesel fuel used for an additional backup in case of an emergency.

In addition to the CPF, the Central Pad will also include the infrastructure to support remote drilling and production operations, such as camps, offices, warehouses, and maintenance shops; electric power-generating and distribution facilities; diesel fuel, water, and chemical storage; treatment systems for drinking water and wastewater; waste management facilities; and communications facilities.

Other infrastructure essential for Project site and infield access will include:

- A gravel airstrip for all-season transportation and emergency response;
- An onshore Sealift Bulkhead and offshore mooring dolphins for offloading facility modules from sealift barges;
- A Service Pier and mooring dolphins for offloading smaller coastal re-supply barges;
- A boat launch to support access by emergency response vessels;

- An in-field gravel road network to provide a reliable and safe year-round means to transport personnel, equipment and drilling rigs between the Central Pad and field locations in support of operations, drilling, and emergency response activities. No gravel road between Point Thomson and other North Slope infrastructure is planned;

- Use of a former gravel mine (Alaska State C-1 pit) as a freshwater source;

- A new gravel mine to support construction, with the mined pit reclaimed as a freshwater habitat and backup water source; and

- Single-season winter ice roads and pads used for construction, operations, and other activities, as needed.

From the CPF facilities, stabilized hydrocarbon liquids will be transported through the approximately 35-km-long (22-mi) Export Pipeline to existing common carrier pipelines for delivery to the Trans-Alaska Pipeline System. The Export Pipeline will be supported on approximately 2,200 Vertical Support Members. Other infrastructure associated with the Export Pipeline include two small gravel pads at Badami, an Auxiliary Pad to provide space to install a leak detection metering skid, and a pipeline crossing pad to provide a platform for rigs to safely pass over the pipeline to facilitate continued production development at Badami.

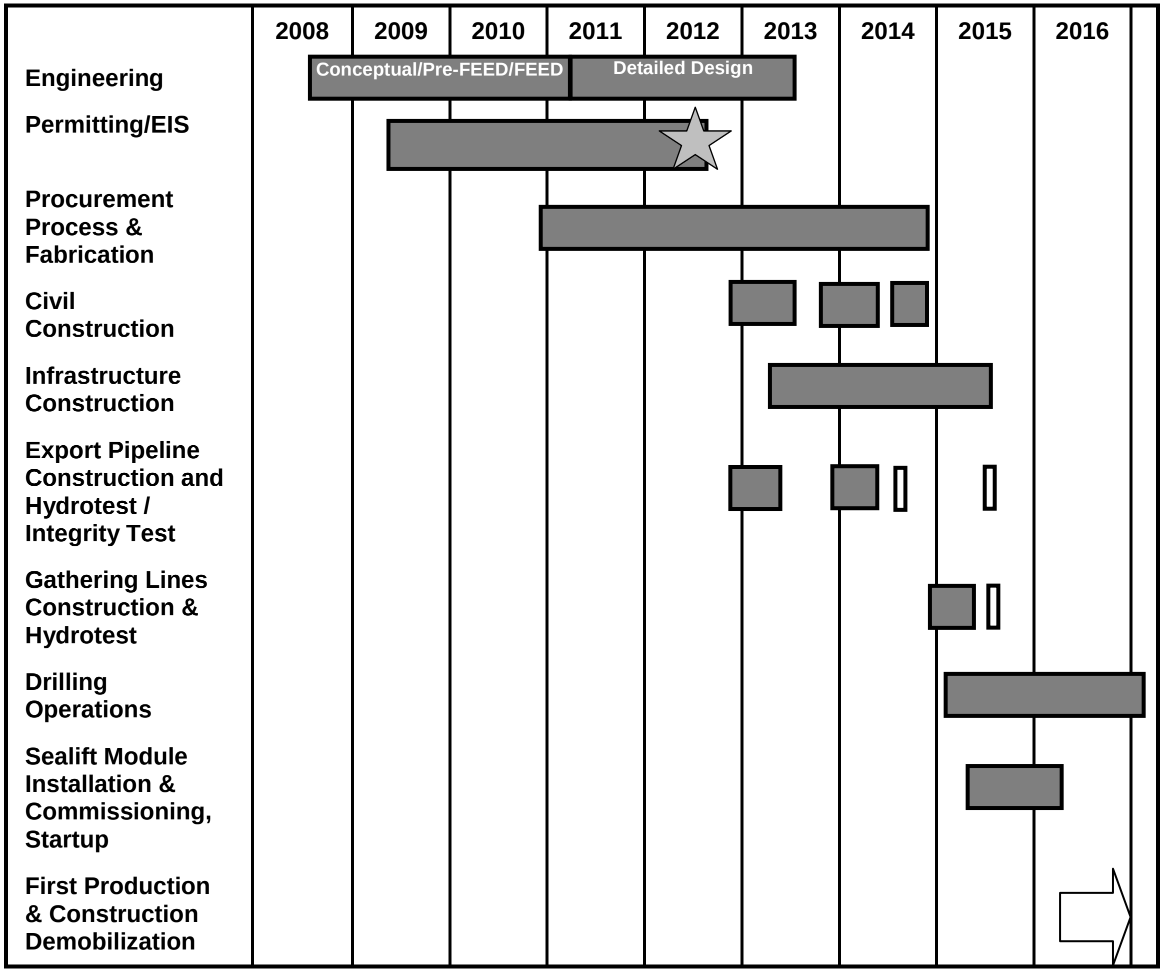
The design life of Project facilities is predicted to be approximately 30 years. Detailed facility abandonment procedures will be developed prior to terminating the operations.

## 2.3 Schedule

Estimated timeframes for major elements of the Project are shown in Table 2.1. This schedule is dependent upon timely receipt of permits. The actual timing of some Project components may vary to accommodate execution plan contingencies.

This BA will analyze Project elements beginning with gravel construction in the winter of 2012/2013.

**Table 2.1 Point Thomson Project Schedule**



| Project Element | Estimated Time Frame | Description |
|---|---|---|
| Engineering | 2008 – 3rd Q 2013 | Conceptual design, FEED, and detailed design of Project facilities and the Export Pipeline. |
| Permitting/EIS | 2009 – 3rd Q 2012 | All applicable federal, state, and local permits and approvals secured to construct and operate Project facilities and the Export Pipeline. |
| Procurement Process and Fabrication | 4th Q 2010 – 4th Q 2014 | Procurement and off-site fabrication of modular processing equipment, utilities, and other equipment. |
| Civil Construction | 4th Q 2012 – 4th Q 2014 (See Notes 1 and 2) | Gravel construction is expected to commence late in 2012 utilizing equipment mobilized and staged on the Central Pad during Summer 2012. |
| Support Infrastructure Construction | 2nd Q 2013 – 2nd Q 2015 | Construction of infrastructure such as airstrip facilities, power generation, storage tanks, communications facilities, and temporary/permanent camps. |
| Export Pipeline Construction and Hydrotest / Integrity Test | 4th Q 2012 – 2nd Q 2015 | Export Pipeline construction is expected to be performed during the winter months from 2012-2015, with the pipeline hydrotesting or integrity assessment occurring during the summers of 2014 and 2015. |
| Gathering Lines Construction and Hydrotest | 4th Q 2014 – 2nd Q 2015 | In-field gathering line construction is expected to be performed during the winter months of 2014/2015, with pipeline hydrotesting occurring during the summer of 2015. |
| Module Sealift | 3rd Q 2015 (See Note 3) | The sealift of IPS facilities to Point Thomson. |
| Drilling Operations | 1st Q 2015 – 2017 (See Note 4) | Drill rig mobilization and drilling. |
| Module Installation, Commissioning, and Startup | 3rd Q 2015 – 1st Q 2016 | Place and install the modules at Point Thomson, conduct testing for commissioning, and complete facilities commissioning and startup. |
| First Production and Construction Demobilization | 2nd Q 2016 – onward | First production in 2016, ongoing operations follow. |

**Key:**

FEED – Front End Engineering Design
Q – Quarter

**Notes:**

1. Depending on timing and certainty of expected permit acquisition, some items may be mobilized in advance of permit issue to allow maximum work to be accomplished during the limited winter construction seasons. Such mobilization would utilize existing gravel pads or seasonal ice roads and ice pads, which will require Alaska Department of Natural Resources and North Slope Borough approvals.
2. In the first winter season (2012-2013), the gravel access road from the mine site to the airstrip and Central Pad will be fully installed. A gravel base approximately 2 feet thick (or deep) will be applied over the entire airstrip and Central Pad area. During the following spring/summer (2013), additional gravel will be placed and compacted on the gravel base footprint at the airstrip and a portion of the Central Pad. In the second winter season (2013-14), gravel will be placed for East and West pad roads, East and West pads, Alaska State C-1 Pad, and the remaining Central Pad. In the second summer (2014), the winter-placed gravel will be seasoned and compacted.
3. Sealift barge transport may be utilized for any one or more of three summer construction seasons.
4. Drilling will resume in 2015, after placement of the Central Pad gravel

## 2.4 Project Facilities

The Project includes the installation of civil works such as gravel roads and pads, wells, process and utility facilities, camps, pipelines, an airstrip, and a gravel mine. Figure 2.3 provides a map showing the location of the well pads, and the related pipelines and infrastructure. Gravel structures will be constructed primarily in the winter using standard North Slope equipment and methods. Some additional gravel layering of the airstrip and Central Pad will occur during the summer, as well as compaction of previously placed gravel. The schedule for construction will follow the schedule as outlined above.

Of relevance in this BA are facilities and activities associated with marine transportation, and ice roads associated with ground transportation. These include the facilities located at the Central Pad used to support marine barging and offloading (Service Pier and Sealift Bulkhead), the emergency response boat launch, and both tundra and sea ice roads used for the transportation of equipment, supplies, and personnel from the road system located at Prudhoe Bay. The barge facilities are depicted on Figure 2.4. The tundra and sea ice roads and barging (coastal and sealift) routes are shown in Figure 2.1. The construction of these facilities and their supported activities are discussed below.

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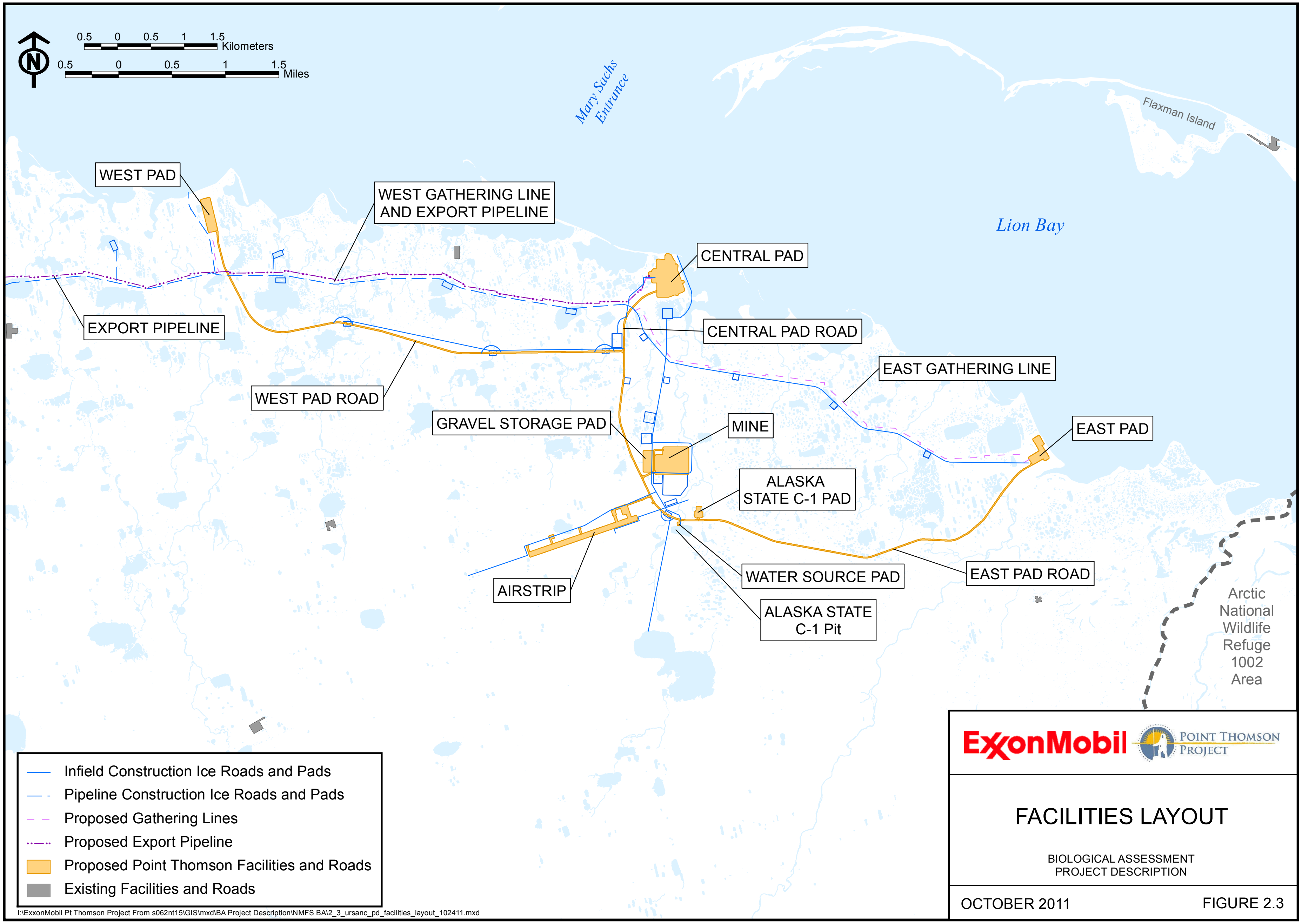

0.5 0 0.5 1 1.5 Kilometers
0.5 0 0.5 1 1.5 Miles
N
Mary Sachs Entrance
Flaxman Island
Lion Bay
WEST PAD
WEST GATHERING LINE AND EXPORT PIPELINE
CENTRAL PAD
EXPORT PIPELINE
CENTRAL PAD ROAD
EAST GATHERING LINE
WEST PAD ROAD
GRAVEL STORAGE PAD
MINE
EAST PAD
ALASKA STATE C-1 PAD
WATER SOURCE PAD
EAST PAD ROAD
AIRSTRIP
ALASKA STATE C-1 Pit
Arctic National Wildlife Refuge 1002 Area
Infield Construction Ice Roads and Pads
Pipeline Construction Ice Roads and Pads
Proposed Gathering Lines
Proposed Export Pipeline
Proposed Point Thomson Facilities and Roads
Existing Facilities and Roads
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\2_3_ursanc_pd_facilities_layout_102411.mxd
ExxonMobil
POINT THOMSON PROJECT
FACILITIES LAYOUT
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
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FIGURE 2.3

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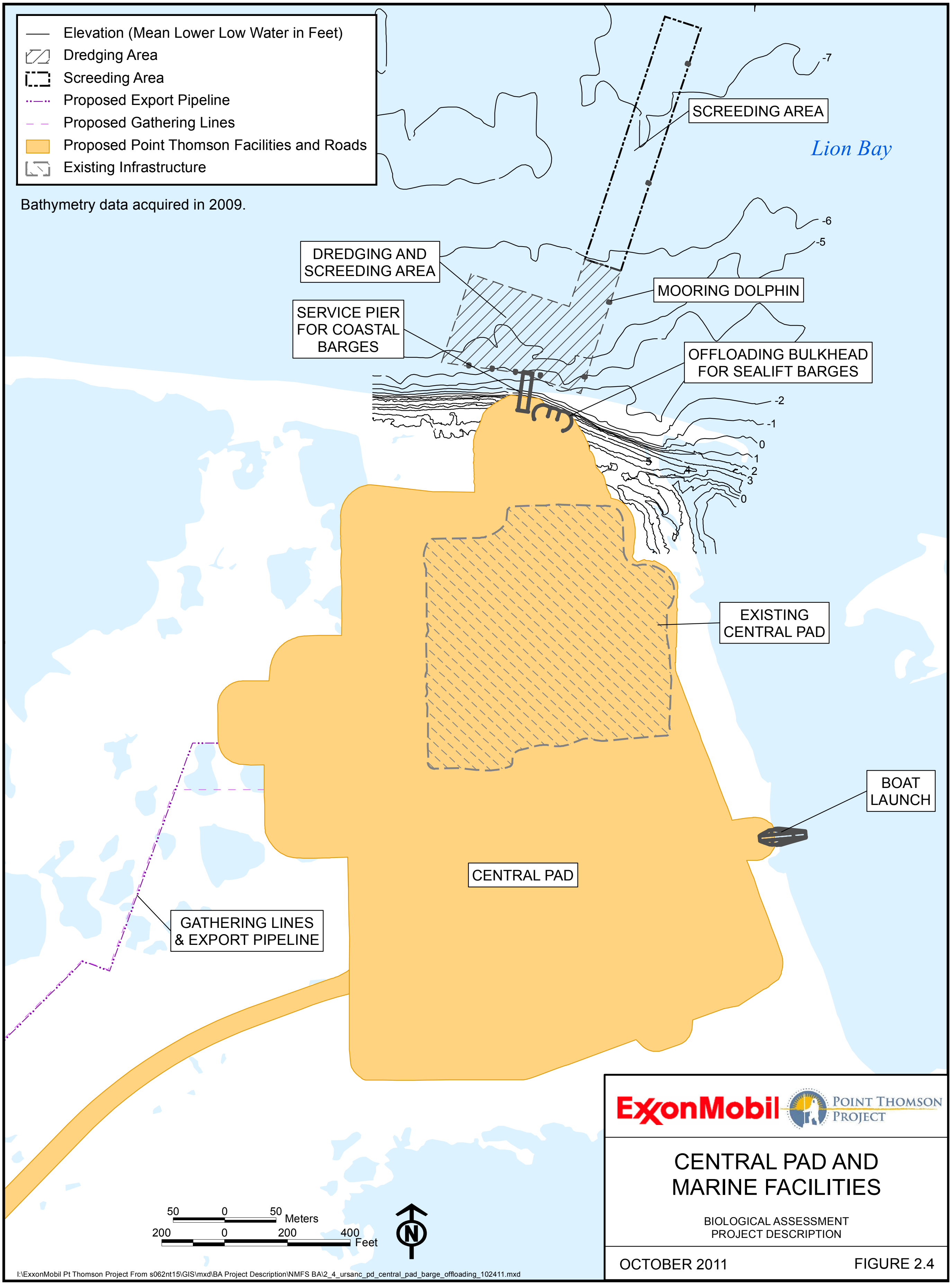


CENTRAL PAD AND MARINE FACILITIES

BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION

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FIGURE 2.4

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### 2.4.1 Boat Launch

A boat launch will be located on the east side of the Central Pad. The gravel/concrete panel ramp will be 7.3± m wide (24± ft) and extend approximately 50.3 m (165 ft) from the Central Pad and then into the bay to approximately 1.1 m below (3.5 ft) the Mean Lower Low Water level. The boat launch will consist of a 32.9 m long (108-ft) gravel ramp with concrete planks (7.3-m-wide [24 ft], 17.3-m-long [57 ft]) extending into the water as a running surface. During construction, ice over the footprint will be removed, gravel fill will be placed in the excavation, the concrete planks will be put in place, and side slope armoring will be installed. This facility will be adequate for launching the smaller emergency response vessels that will be stationed at Point Thomson. This location is in a protected lagoon, which affords an ideal access to launch these vessels.

### 2.4.2 Sealift Barge Bulkhead and Operations

The Project will require the use of oceangoing barges supported by tugboats for sealift of large, pre-fabricated facility (production and camp) modules. Sealift barges will transport these large modules from locations outside of Alaska generally using established marine shipping routes from those locations. In the Beaufort Sea these routes will occur generally offshore of the barrier islands and then pass through either Challenge or Mary Sachs Entrance before reaching Point Thomson (Figure 2.1). These oceangoing barges are considerably larger than coastal barges, with deeper hulls, and can carry heavy loads with a relatively shallow draft during transport and delivery to the site. Oceangoing barge dimensions are approximately 7.6 m deep (25 ft), 32 m wide (105 ft), and 121.9 m long (400 ft). The oceangoing barges transporting modules to Point Thomson do not carry ballast from the port of origin, however, severe weather during transit may make it necessary to take on ballast. In such a case, this ballast will either be pumped out in international waters (before entering coastal waters and before entering the Beaufort Sea) at a distance of 321.9 km (200 mi) or more from the nearest shore, or to an authorized disposal facility in accordance with federal ballast water discharge regulations.

Loaded oceangoing barges require several feet of draft and cannot directly access the beach. For landing and securing oceangoing barges, an onshore (above mean high water) Sealift Bulkhead and four offshore mooring dolphins will be constructed. The Sealift Bulkhead will be made of sheet pile in an OPEN CELL® design, with a gravel backfill transition to the Central Pad surface. Shore protection will consist of a combination of sheet piles on the seaward face of the abutment and gravel bags on the east and west faces of the Sealift Bulkhead.

Modules will be offloaded via a barge bridge system, which is a configuration of up to three barges linked end-to-end and temporarily connected to this bulkhead by a ramp. The three barges making up the barge bridge system will be ballasted with local Point Thomson seawater and temporarily grounded in place during the offloading operations. This temporary grounded-barge offloading barge bridge system would be used during July or August, as soon as open water allows access of sealift barges to the Point Thomson site. It is expected that the large oceangoing barges will be in place at the Point Thomson site for approximately two to four weeks, providing adequate time to dock and offload cargo. A total of ten sealift barges will use this method of access over the three construction seasons (2013-2015).

Dolphins for mooring/breasting the barges are needed to ensure an accurate alignment of the barges for offloading operations and will be left in place for future use. Dolphins will be installed in water depths of approximately 1.2 m (4 ft) closest to shore and in water depths of approximately 2.3 m (7.5 ft) furthest from shore using typical North Slope methods (i.e., driving piles or drill and slurry, through the ice in winter). If additional structural support between the sealift abutment and the first grounded barge is deemed necessary to support the loading ramp, then up to six temporary piles parallel to the shore at a distance of 12.2 m (40 ft) from the sealift abutment may be installed during the construction phase using typical North Slope methods. These will be cut off at 1.5 m (5 ft) below the mudline or removed during the construction phase after all facility modules are transported to the Central Pad.

### 2.4.3 Dredging and Screeding

Barges transporting modules, equipment, materials or supplies to Point Thomson require a specified draft for offloading. Minor or shallow dredging, if needed, will be used to provide the required seabed depth profile. The actual dredging requirements can be expected to vary due to the changing coastal processes (sediment transport and storms) in the Beaufort Sea and will be determined on an annual basis.

Sealift barges transporting modules to the Sealift Bulkhead will be grounded and require 1.8 m (6 ft) of water depth for the barge closest to shore. The sealift barges require a level seabed to safeguard the structural integrity of the barges. Coastal re-supply barges transporting equipment, materials or supplies to the Service Pier require a minimum 1.2 m (4 ft) water depth to access the Pier. The coastal barges typically will not be grounded, however there may be a need to ground or ballast down the coastal barges delivering certain modules such as the camp and tank modules that may exceed 800 tons. In such cases the barges will use local water if ballasting and de-ballasting is required.

Dredging and screeding will be conducted during the first winter construction season (through the ice) and could occur during the following second and third winter construction seasons in front of the Sealift Bulkhead and, possibly, in front of the Service Pier. The area where screeding and/or shallow dredging could occur is approximately 14,307 square meters (154,000 square feet) and starts at a location approximately 12 to 18 m (40 to 60 ft) from the Sealift Bulkhead seaward (north) to about 152 m (500 ft), and in front of the Service Pier seaward (north) to about 91 m (300 ft).

Not all of the ice in the designated dredge area can be removed at the same time. Therefore, dredging and screeding will be conducted sequentially in different areas. As a result, in order to achieve the needed seabed profile, some of the dredged material may need to be temporarily placed in an onshore dredge spoils placement area (described below). As another area of the seabed is exposed after ice removal, some of these dredge materials may need to be placed back in the dredge area to fill low spots if insufficient dredge material at the work site is available. Thus there may be some double handling of dredge materials. The maximum dredged volume requiring disposal after dredging is completed to establish the needed seabed profile is conservatively estimated not to exceed 1,147 cubic meters (1,500 cubic yards) during any construction season.

Following completion of construction, and throughout the operations phase, periodic screeding and, possibly, some dredging may be needed in the area in front of the Service Pier. If dredging is needed, it would likely be done in summer and the maximum dredged volume is conservatively estimated to be about half of that estimated for construction, or 611.6 cubic meters (800 cubic yards).

The seabed material remaining after dredging will be placed along nearby shoreline above mean high water in an area that is far enough away from the barge offloading facilities that the dredged area would not be refilled from the deposited material. The disposal location may vary based on dredging season and volume, but approval will be sought from the appropriate regulatory agencies prior to placement of spoils onshore.

### 2.4.4 Coastal Barge Service Pier and Operations

A Service Pier for offloading smaller coastal barges will be constructed adjacent to the Sealift Bulkhead**.** The Service Pier will support offloading of barges used for transporting material, equipment, and supplies, and for the removal of wastes and excess equipment. North Slope-based coastal barges supported by tugboats will be the primary vessels deployed for this purpose. Previous drilling activity at Point Thomson was supported by over-the-beach barge access during the open-water season. This type of direct beach access limits the loads that can be delivered. The Service Pier will allow more fully loaded coastal barges (up to 800 tons) to access the site, substantially decreasing the number of seasonal coastal resupply barge trips, and can accommodate loads up to 1,100 tons as may be needed during construction. Over-the-beach barge access will occur until the Service Pier is constructed.

The docking facility will consist of a 36.6 m long (120 ft) by 9.1 m wide (30 ft) pier, extending approximately 21 m (70 ft) offshore of the Central Pad shoreline. The Service Pier will have a concrete deck and be supported by nine vertical piles (six offshore and three onshore) which will be driven or drilled in the winter from grounded ice. Four mooring dolphins will be installed to extend docking options to assist in securing barges. The mooring dolphins will be driven or drilled into the seafloor through the ice in the winter in a line perpendicular to the dock. The deepest dolphin will be in a water-depth of approximately 1.2 m (4 ft).

Two to four coastal barges could operate during the nominal July 15 to August 25 barging season, but may continue beyond this date as required by operational requirements. Barges will traverse a route inside the barrier islands between Prudhoe Bay and Point Thomson.

The total anticipated number of round-trip coastal barge trips during construction and construction demobilization (2013-2016) is 170. This number will drop to between 20 and 100 annually for drilling, and 15 per year during operations (2016 and beyond).

### 2.4.5 Ice Roads

Ice roads will be constructed during the winter seasons as needed to connect Project locations to the existing gravel road system at Endicott, approximately 75 km (47 mi) to the west (Figure 2.1). The ice road between Point Thomson and Endicott could either be on the sea ice or tundra, depending upon weather, operational requirements, and other factors. Spur ice roads, off of these ice roads, will be constructed to connect to onshore freshwater sources or to avoid polar bear dens by a 1-mi buffer. Tundra ice roads and ice pads will also be needed during construction to support infrastructure and pipelines, for mobilizing and demobilizing the drilling rig, and on an as-needed basis during operations to support operations and maintenance activities.

Ice road size and location will vary depending on seasonal ice conditions and bear-den locations, as well as the size and weight of the loads that need to be transported. Pull-out or passing areas may be constructed at various locations for safety or operational requirements. Ice road activities will be coordinated with the Alaska Department of Natural Resources, Alaska Department of Fish and Game, and U.S. Fish and Wildlife Service. Ice road activity can begin as early as November, depending on weather conditions and permitting status.

Seawater for sea ice roads will be withdrawn from locations along the road alignment by drilling through the sea ice and pumping the seawater across the surface of the ice. If needed, ice chips will be milled from the surface of the sea ice or the surface of frozen freshwater lakes to provide a solid aggregate in place of liquid water. The ice roads will be capped with freshwater. This technique is used for increasing ice thickness in order to provide the required load-bearing capacity for vehicular travel.

Sea ice roads may be up to approximately 23 m wide (75 ft) for large equipment access and safety, and will be constructed in shallow waters as close to the adjacent shoreline as practicable, and generally in less than approximately 3 m (10 ft) of water. Water depths greater than 3 m may be encountered in some areas, particularly off river mouths. Any part of a road over seawater will either be grounded to the sea floor or of sufficient thickness to support the expected weights of vehicles traversing the route.

Ice roads and pads require maintenance throughout the winter season. At the end of the season, ice structures will be cleared of equipment and debris and any residual contamination will be cleaned up. Ice roads may be breached or slotted at stream crossings and other locations to facilitate water flow during breakup.

## 2.5 Environmental Protection and Mitigation

Environmental protection for the Project includes practices for reducing pollution and contamination (spill prevention and response, fuel storage and handling, and waste management), design, construction, and operational measures and practices, and measures specifically designed to protect listed species.

### 2.5.1 Spill Prevention and Response

Prevention of oil spills is core to Point Thomson environmental performance. The Project and associated drilling activities include numerous prevention, design, detection, reporting, response, and training measures which are described in the Alaska Department of Environmental Conservation (ADEC)-required Oil Discharge Prevention and Contingency Plan (ODPCP) and Environmental Protection Agency-required Spill Prevention Control and Countermeasure Plans, and Facility Response Plans for various project activities. Although the ODPCP has only been approved for the initial drilling phase to-date, it will be revised to cover the construction, operations, and future drilling phases. The protection measures described in the current ODPCP are representative of those that can be expected in the revised documents.

Additional information on project-wide, and pipeline- and drilling-specific oil spill prevention and preparedness is summarized in Appendix A.

The ODPCP is the major spill prevention and response document and will contain the following.

- Response Action Plan: Describes all actions required by responders to effectively respond to a spill and includes an emergency action checklist and notification procedures, communications plan, deployment strategies, and response scenarios based on Response Planning Standards.

- Prevention Plan: Describes regular pollution prevention measures and programs to prevent spills (e.g., drilling well control systems, tank and pipeline leak prevention systems, and discharge detection and alarm systems). This plan also covers personnel training, site inspection schedules, and maintenance protocols.

- Best Available Technology: Presents analyses of various technologies used and/or available for use at the site for well source control, pipeline source control and leak detection, tank source control and leak detection, tank liquid level determination and overfill protection, and corrosion control and surveys.

- Supplemental Information: Describes the facility and the environment in the immediate vicinity of the facility. This section also includes information on response logistical support and equipment (mechanical and non-mechanical), realistic maximum response operating limitations, and the command system.

In addition to plans and procedures in the ODPCP, ExxonMobil identifies risks in its operations and prepares plans and programs addressing these; examples are specific Barging and Ice Road spill prevention programs such as the current Drips and Drops Program to find, cleanup, and learn from small drips and drops so that these do not grow into larger spills.

Alaska Clean Seas (ACS) will serve as the Project's primary Oil Spill Response Organization and primary Response Action Contractor, as approved by the U.S. Coast Guard and the ADEC, respectively. As they do for other North Slope oil production operations, ACS technicians will help assemble, store, maintain, and operate the Project's spill response equipment.

Oil spill response equipment will be stored at the Central Pad. The equipment is expected to include containment and absorbent boom, skimmers, portable tanks, pumps, hoses, generators, and wildlife protection equipment. Snowmachines and other vehicles for off-road access will be stored on the Central Pad. Equipment will not routinely be staged at the East or West Pad, although such items may be placed there during certain operations such as drilling, to assist with immediate spill responses.

To respond to spills into streams and the nearshore marine environment, spill response vessels, such as shallow-draft boats capable of traversing the near-shore waters common in the area, will be maintained at Point Thomson during the summer open-water season. Small barges for storing and hauling oil recovered from marine oil spills will be staged, as appropriate. Other equipment used in day-to-day operations and not dedicated to oil spill response, such as loaders, earth moving equipment, and vacuum trucks, will supplement the dedicated spill response equipment as required. A boat launch has been incorporated into the design of the Central Pad to facilitate marine access for oil spill response by ACS.

In addition to the ODPCP, ExxonMobil has prepared a Well Control Blowout Contingency Plan. This Plan addresses primary well control, which includes well control planning, well control training, and well control during drilling. It also addresses secondary well control means including blowout preventers, means of actuating them, and ancillary equipment that would be used in a well control situation. The primary and secondary well means of well control are intended to ensure that control of the well is maintained at all times to prevent blowouts. Additionally, this Plan prescribes the equipment that would be required and actions that would be taken in the unlikely event of a blowout.

To ensure proper reporting of spills and to improve spill prevention and response performance, ExxonMobil monitors and addresses all spills or potential incidents as follows.

1. Reportable spills based on external guidelines and regulatory requirements of the ADEC, Alaska Department of Natural Resources, Alaska Oil and Gas Conservation Commission, the North Slope Borough (NSB), and National Response Center (NRC).

2. Spills that are not agency-reportable but are internally reportable based on ExxonMobil guidelines.

3. Near misses based upon ExxonMobil guidelines where no spill occurred but an unintended or uncontrolled loss of containment could have led to a spill.

In all of these cases, ExxonMobil conducts a root cause analysis and implements appropriate corrective actions based on the results.

### 2.5.2 Fuel Transfers and Storage

Fuel transportation, storage, and use will be in accordance with applicable federal, state, and NSB requirements. Additionally, all fuel transfers will be in accordance with ExxonMobil's fuel transfer guidelines contained in the Point Thomson ODPCP. The Best Management Practice for spill prevention during fuel transfers established by ExxonMobil drew upon the guidelines and operating procedures applicable to North Slope operations developed by other operators. Proper use of surface liners and drip pans is also described in the ODPCP, which is consistent with North Slope Unified Operating Procedures (UOP) for surface liners and drip pans. The Unified Operating Procedures mandates the use of liners for vacuum trucks, fuel trucks, sewage trucks, and fluid transfers, all heavy- and light-duty parked vehicles, and support equipment (heaters, generators, etc.) within facilities.

Visual monitoring is the primary method to determine fluid levels in tanks during loading and to detect leaks or spills during fuel transfers. All fuel transfers will be continuously staffed and visually monitored. Typically, diesel tanks will be filled via transfer of fuel from trucks using a fuel hose. Personnel involved in fluid transfers at Point Thomson will be specifically trained in accordance with fluid transfer guidelines. Personnel involved in the transfer will have radios and will be able to communicate quickly if a transfer needs to be stopped.

The diesel storage tanks may be filled in the summer open-water season by transfer from a barge. Such transfers will comply with the requirements of 18 Alaska Administrative Code (AAC) 75.025, and will be covered by a U.S. Coast Guard-approved Facility Operations Manual and Facility Response Plan (Title 33 CFR, Part 154, Sub-part D).

As described in the Point Thomson ODPCP, oil storage tanks will be located within secondary containment areas. These secondary containment areas will be constructed of bermed/diked retaining walls and will be lined with impermeable materials resistant to damage and weather conditions. These areas will be kept free of debris, including excess accumulated rainwater and snow accumulation during the winter season. They will be visually inspected by facility personnel as required by 18 AAC 75.075. Fuel storage tanks will not be placed within 100 ft of waterbodies unless otherwise approved by the appropriate regulatory agencies.

Tanks with capacities of 10,000 gallons or more will conform to state regulations and requirements provided in 18 AAC 75.066. Inspections will be conducted in accordance with 18 AAC 75.075.

### 2.5.3 Waste Management

ExxonMobil is developing and implementing a comprehensive waste management plan prior to the generation of wastes. Integral parts of the overall waste management plan are effective mitigation measures, including: Avoiding waste generation (where possible), waste minimization, product substitution, beneficial reuse, recycling, and proper disposal. The waste management plan will address storage, transportation, and disposal of wastes generated during construction, drilling, and operations. Wastes will be handled in accordance with the North Slope industry standard, "Alaska Waste Disposal and Reuse Guide" (Red Book), in full compliance with federal, state, and NSB regulatory requirements. Elements of the waste management plan will include the following.

- Drilling mud recycling/reuse to the maximum extent possible, and spent drilling muds and cuttings will be injected into an on-site or off-site disposal well. Tanks or lined storage pits for drilling muds and cuttings.

- Segregated storage of wastes using appropriate containers, including dumpsters, hoppers, bins, etc., for food waste, burnable (non-food) waste, construction debris, oily waste, and scrap metal.

- Segregated and secured storage of hazardous waste in a hazardous waste Central Accumulation Area. Satellite Accumulation Areas will be provided, as needed.

- Incinerator for camp waste (including food waste).

- Identification of recyclable materials and associated proper handling and storage methods. Recyclable Accumulation Areas will be provided, as needed.

- Storage hoppers and bins for contaminated snow.
- Domestic wastewater treatment system(s).
- Class I non-hazardous disposal well for approved liquid waste disposal.
- Methods for proper waste management.

Most waste fluids from drilling, production, operations and maintenance, and domestic sources will be injected into a Class I disposal well (already permitted), when available. When the disposal well is unavailable (e.g., during construction) treated wastewater from construction camps will be discharged under the provisions of an Alaska Pollutant Discharge Elimination System permit and/or a National Pollution Discharge Elimination System permit. Discharges to the tundra and surface waters (freshwater and marine water) will be controlled by permit requirements which are designed to prevent or minimize adverse effects.

Some wastes and recyclable materials will be transported to other North Slope locations, or transferred to other facilities in Alaska or the Lower 48 for treatment, disposal, or recycling. All hazardous waste must be sent to authorized off-site disposal facilities. These wastes will be consolidated and stored on site in designated accumulation areas prior to transport. Hauling waste offsite is seasonally limited. During the open-water season, waste hauling from the Project area is available by barges/vessels. During the winter, waste hauling may occur via an ice road or tundra travel. Waste may also be removed by air.

Of particular concern is the handling of food wastes and food-related garbage to prevent attracting wildlife to Project facilities. Food wastes and garbage that could attract wildlife will be incinerated on a daily basis. Such wastes will temporarily be stored in enclosed bear-proof containers until incinerated.

Likewise, sewage and wastewater odors could attract wildlife. The Central Pad camp will have a wastewater treatment plant. Sewage sludge will be incinerated on site regularly, or stored in enclosed tanks prior to shipment to the NSB treatment plant in Deadhorse.

## 2.5.4 Mitigation

The following mitigation procedures designed to minimize potential adverse impacts of the Project on federally listed species were from applicable subject areas of the Project Environmental Mitigation Report.

Proposed Project development concerns associated with marine mammals are habitat impact, changes in behavior due to disturbance and activities, and direct impacts such as vessel or vehicle collision or exposure to toxic materials.

Because Project activities are primarily onshore, the potential to impact bowhead whales, ringed seals, and bearded seals is limited. The activity with the greatest potential for impact is marine vessel traffic. Vessel noise and activity could disturb or deflect whales and seals. Vessel collisions are unlikely, but possible. There is also a potential for noise from pile driving to impact seals.

### *2.5.4.1 Summary*

Key mitigation measures related to bowhead whales, ringed seals, and bearded seals will include:

- Minimizing offshore infrastructure;
- Installing mooring dolphins and the Service Pier in winter and in less than 2.4 m (8 ft) of water;
- Using MMOs on barges, vessels, and convoys, as was done in 2008, 2009, and 2010. ExxonMobil conducted coastal barging operations in the open-water seasons of 2008 (20 trips), 2009 (120 trips), and 2010 (48 trips). Local Iñupiat MMOs were onboard conducting observations throughout all these transits;
- Sealift barging planned to be completed prior to the main fall bowhead whale migration and subsistence whaling;
- Routing coastal barging inside barrier islands;
- Constructing the Service Pier to reduce the number of coastal barging trips;

- Implementing protective measures of the Conflict Avoidance Agreement (CAA) with the Alaska Eskimo Whaling Commission (AEWC). In addition, ExxonMobil has committed to avoid barging during the subsistence whaling season to the greatest extent practicable, and to directly consult with the whaling community to avoid impacts should such barging be required;

- Constructing ice roads onshore or on the sea ice over shallow waters (grounded ice), avoiding seal habitat; and

- Dredging the barge landing area through the ice during the winters preceding open-water sealift that will minimize disturbance to marine mammals. Maintenance dredging and screeding, if needed in the summer, is expected to be minor.

#### *2.5.4.2 Background Context*

The Project is an onshore field development with minimal offshore infrastructure. The primary marine vessel traffic will employ smaller coastal barges traveling between Prudhoe Bay and Point Thomson following a route inside the barrier islands. Larger sealift barges carrying modules will travel outside the barrier islands; these may be used for up to three construction seasons.

ESA-listed (or proposed for listing) marine mammal species under management of the NMFS that occur in or near the Project include the bowhead whale and ringed and bearded seals. Of these species, only the ringed seal occurs there regularly and year-round inshore of the barrier islands. The bowhead whale occurs commonly offshore of the barrier islands during spring and fall migrations. The bearded seal is seasonally uncommon in small numbers and would be unlikely to occur inshore of the barrier islands. There are also extralimital occurrences of fin and humpback whales in the region, but these species are not further analyzed in this BA (Hashhagen et al. 2009).

The barge and vessel traffic during the past three summers have given ExxonMobil considerable experience in mitigation of marine mammal impacts. During the 2008 through 2010 coastal barging seasons, MMOs sighted seals in the vicinity of the barges; no whales were observed (ExxonMobil 2010).

#### *2.5.4.3 Mitigation Measures*

Key mitigation measures incorporated to avoid or minimize impacts to bowhead whales, ringed seals, and bearded seals are discussed below by Project component.

**Barging**

The planned sealift barge route passes outside the barrier islands, after rounding Barrow, and enters Point Thomson area waters through either the Challenge or Mary Sachs Entrance, as shown on Figure 2.1. The sealift transit and offloading operation is planned to be completed prior to fall migration of the bowhead whale, which is also when ringed seals tend to occur farther offshore near the ice edge. The sealift is timed to occur during periods of historically certain open water. The more frequent coastal barging will generally follow a route inside the barrier islands between the Prudhoe Bay West Dock and Point Thomson, as shown on Figure 2.1. The Service Pier mitigates the potential effects of coastal barging by allowing more fully loaded coastal barges (up to 800 tons), thus substantially reducing the number of barge runs required by up to 50 percent.

MMOs will be present on vessels for barge operations in the Arctic and sub-arctic waters. In the event a marine mammal is encountered during a barging operation, the MMO will alert the vessel captain, who will then make any necessary speed and course alternations to avoid a collision. Such corrections will be taken when whales are within 1 mi of a barge. It should be noted that both sealift and coastal barges run at low speeds (5 to 6 knots), and there have been no known collisions in the Alaska Beaufort Sea between bowhead whales and barges operating at these speeds.

As part of the overall mitigation program, ExxonMobil will implement applicable protective measures of a CAA with the AEWC. Although the CAA primarily relates to avoiding conflicts with subsistence whaling, there are numerous provisions in the CAA that relate to minimizing impacts to marine mammals.

## Offshore Pile Installation and Dredging/Screeding

Construction of the Service Pier and mooring dolphins, particularly pile driving, and minor dredging and screeding to provide the required seabed depth profile for barging operations are sources of construction noise and disturbance. However, with the exception of some minor dredging and screeding in summer prior to the arrival of barges, construction will occur in the winter, on grounded ice, at a location that will minimize the potential for interactions with ringed seals, which are usually further offshore in floating landfast ice areas. There are eight mooring dolphins, each of which will take less than one day to install.

## Service Pier

The Service Pier mitigates the potential effects of coastal barging by substantially reducing the number of barge runs required by up to 50 percent, as described in Section 4.5.3.1 of the Point Thomson Project Environmental Mitigation Report.

## Barge Offloading Facility

Construction of the barge offloading facility will take place in winter, and a primary source of construction noise is pile driving. The timing of this activity minimizes potential effects on ringed seals. The design of the dolphins requires only one pile for each dolphin. It is expected that pile installation will take approximately 1 week.

## Ice Roads

Ice roads may be located on sea ice, tundra, or both. They are typically constructed between December and February and operate until tundra travel closure (historically late April/early May). In general, a sea ice road is routed close to the shoreline and within the 3-m (3-ft) isobath where the ice is grounded and stable. Such an alignment minimizes the potential for interactions with ringed seals, since ringed seals do not occupy waters less than 3 m deep (3 ft) during winter and spring because the water freezes to the seafloor (Link et al. 1999).

## Aircraft Overflights

Routine aircraft flights (e.g., transportation of personnel and cargo) will be required to generally fly at a 457 m (1,500 ft) altitude following a path inland from the coast to avoid disturbance to wildlife, except as required for takeoffs and landings, safety, weather, and operational needs, or as directed by air traffic control.

# 3.0 SPECIES DESCRIPTION AND HABITAT

## 3.1 Bowhead Whale

### 3.1.1 Stock Description

Bowhead whales only occur at high latitudes in the northern hemisphere and have a disjunctive circumpolar distribution (Reeves 1980). They are one of only three whale species (the other species being beluga whale and narwhal) that spend their entire lives in the Arctic. Bowhead whales occur in the western Arctic (Bering, Chukchi, and Beaufort seas), the Canadian Arctic and western Greenland (Baffin Bay, Davis Strait, and Hudson Bay), the Okhotsk Sea (eastern Russia), and the Northeast Atlantic from Spitzbergen westward to eastern Greenland. The Project-related activity will only occur within the range of the Bering-Chukchi-Beaufort Sea (BCB) stock, which is the largest of the four genetically distinct stocks (Givens et al. 2010).

### 3.1.2 Population Size and Status

The BCB stock of bowhead whales was estimated at 10,400 to 23,000 animals in 1848, before commercial whaling decreased the stock to between 1,000 and 3,000 animals by 1914 (Woodby and Botkin 1993). This stock has increased since 1921 when commercial whaling ended, and now numbers at least 10,545 whales with an estimated 3.4 to 3.5 percent (greater than 350 animals/year) annual rate of increase (Brandon and Wade 2004; George et al. 2004a and 2004b; Zeh and Punt 2005; and Allen and Angliss 2010). The actual population size is likely higher, because the most recent estimate was derived from data collected in 2001. The current population could be over 13,000 bowheads given the annual growth rate (3.4-3.5 percent) (Brueggeman et al. 2009). Shelden et al. (2001) and Gerber et al. (2007), using historic and recent population data, suggested that the BCB stock should be delisted under the ESA, because its population is within the range of its pre-commercial exploitation size and not at risk of extinction. George et al. (2004a) concluded that the recovery of the BCB bowhead whale population is likely attributable to low anthropogenic mortality, relatively high-quality habitat, and well-managed subsistence harvest.

### 3.1.3 Seasonal Distribution, Habitat, and Biology

The following section provides an overview of bowhead whale use of the seasonal ranges followed by information specific to the Project area (Figure 3.1).

The BCB stock winters in the central and western Bering Sea and largely summers in the Canadian Beaufort Sea (Quakenbush et al. 2009 and 2010; Moore and Reeves 1993; and Brueggeman 1982). Spring migration from the Bering Sea follows the eastern coast of the Chukchi Sea to Point Barrow in nearshore leads from mid-March to mid-June before continuing through the Alaska Beaufort Sea through offshore ice leads (Braham et al. 1984; and Moore and Reeves 1993). The leads occur annually a considerable distance offshore of the Project area. Some bowheads arrive in coastal areas of the eastern Canadian Beaufort Sea and Amundsen Gulf in late May and June, but most may remain among the offshore pack ice of the Beaufort Sea until mid-summer. Bowhead whales calve during spring in both the Bering Sea and during migration.

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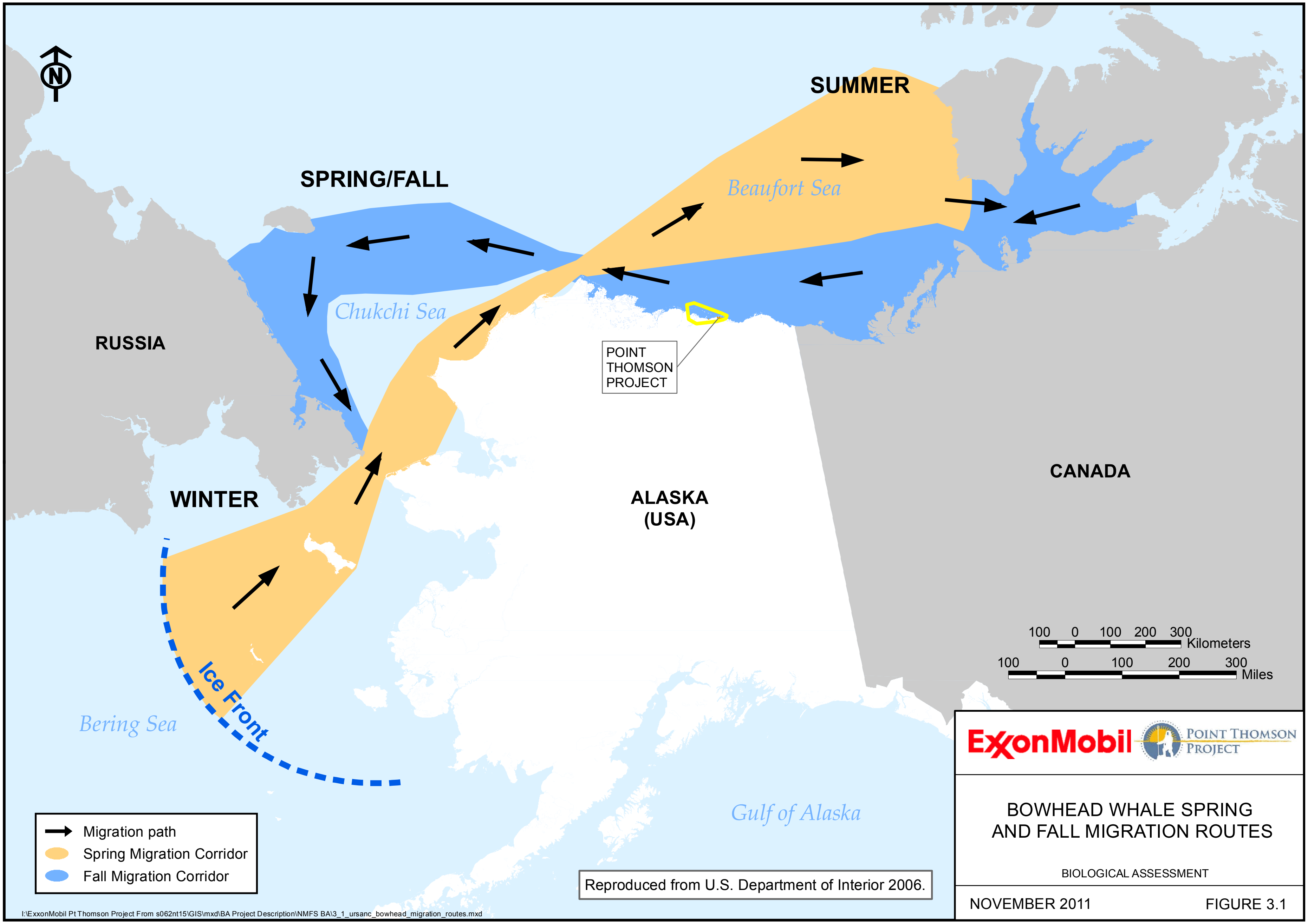


BOWHEAD WHALE SPRING AND FALL MIGRATION ROUTES

BIOLOGICAL ASSESSMENT

NOVEMBER 2011

FIGURE 3.1

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After leaving the Canadian Beaufort Sea, bowheads migrate westward through the Alaska Beaufort Sea, primarily during September and October (Quakenbush et al. 2009 and 2010). In recent years bowheads have been seen or heard offshore from Point Barrow to Kaktovik during summer and early fall (LGL and Greeneridge 1996; Greene 1997; Greene et al. 1999; Blackwell et al. 2004; Funk et al. 2009; and Goetz et al. 2009). Nuiqsut whalers have stated that a small number of the earliest arriving bowheads have apparently reached the Cross Island area earlier (late August) than in past years. Although some whales summer in the Alaska Beaufort Sea, they likely represent only a small proportion of the total population based on past research and historic accounts (Moore et al. 2010a). It is not clear if this represents a new trend or is due to increased numbers of whaling crews and researchers in the Beaufort Sea detecting more bowhead whales and other marine mammals. None are known to winter in the Beaufort Sea (Moore et al. 2010a).

The U.S. Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE), formerly Minerals Management Service (MMS), has conducted or funded late-summer/autumn aerial surveys for bowhead whales in the Alaska Beaufort Sea since 1982 (e.g., Ljungblad et al. 1986 and 1987; Moore et al. 1989; and Treacy et al. 2006), representing a comprehensive 28-year record of bowhead distribution in the Beaufort Sea (Figure 3.2). During the fall migration, most bowheads migrate west in waters ranging from 15 to 200 m deep (50 to 650 ft) (Richardson and Thomson 2002; and Treacy et al. 2006). Some individuals enter shallower water, particularly in light ice years (Moore 2000; and Treacy et al. 2006), but very few whales have been observed shoreward of the barrier islands where water depths are largely too shallow to support a bowhead whale (less than 5 m deep (16 ft) generally within 8 m [5 mi] of the shoreline) (Figure 3.1). Average offshore distance of fall migrating whales recorded between 1982 and 2000 was 31.2 km (19 mi) (95 percent Confidence Limits: 30.0-32.4 km [18-20 mi]) or more depending on ice conditions (Treacy et al. 2006). Tracks of satellite-tagged migrating whales did not occur inside the barrier islands (Quakenbush et al. 2010). Survey coverage far offshore in deep water is usually limited, and offshore movements may be underestimated (Treacy et al. 2006), however, regardless of inshore or offshore shifts, the main migration corridor is widespread over the continental shelf, north of the barrier islands including those off of Point Thomson (Figure 3.2)

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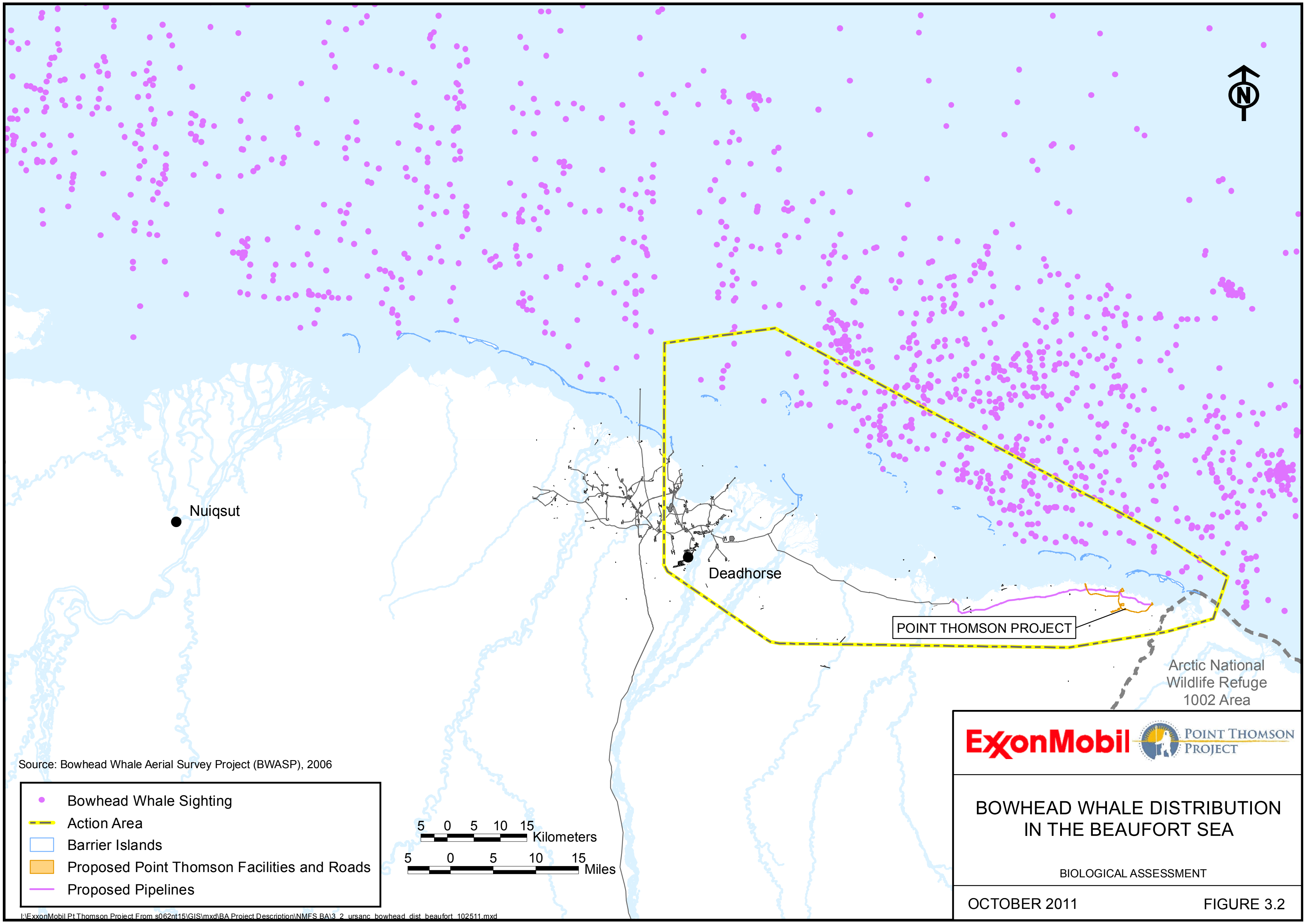


BOWHEAD WHALE DISTRIBUTION IN THE BEAUFORT SEA

BIOLOGICAL ASSESSMENT

OCTOBER 2011

FIGURE 3.2

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Bowhead whales complete their annual cycle by migrating across the Chukchi Sea (Quakenbush et al. 2010). Data for 18 satellite-tagged bowhead whales show most bowheads appear to migrate in a westerly direction past Wrangel Island and then down the western coast of the Chukchi Sea to the Bering Sea wintering grounds, although some migrate across the Chukchi Sea in a more southwesterly direction from Point Barrow (Quakenbush et al. 2009 and 2010). Most whales appear to cross the Chukchi Sea between latitudes 71º and 74º N (Quakenbush et al. 2009 and 2010). Acoustic studies conducted from 2007 to 2009 indicated calling bowheads migrated across the Chukchi Sea in both a westerly direction following the 71° N latitude and a less defined route after leaving the Point Barrow area (Hannay et al. 2009; and Martin et al. 2008). Eskimo whalers report whales travel westward and later during light ice years, and southwestward and earlier during other years (Figure 3.3, Huntington and Quakenbush 2009). These collective results suggest the location of the fall migration route may comprise a variety of paths across the Chukchi Sea.

Examination of stomach contents from whales taken in the Iñupiat subsistence harvest indicates that bowhead whales feed on a variety of invertebrates and some fishes, which vary somewhat geographically (Lowry 1993). Recent analysis of stomachs collected from harvested whales found mainly copepods in whales harvested off Kaktovik and euphausiid-like prey for those harvested off Barrow (Goetz et al. 2009). Other studies show the dominant prey eaten by bowhead off Barrow varies among years (Moore et al. 2010b). Reasons for these differences are unclear, but they are likely related to geographic differences in prey species abundance and distribution caused by changes in the physical oceanography and hydrography (i.e., currents, wind speed and direction) (Ashjian et al. 2010).

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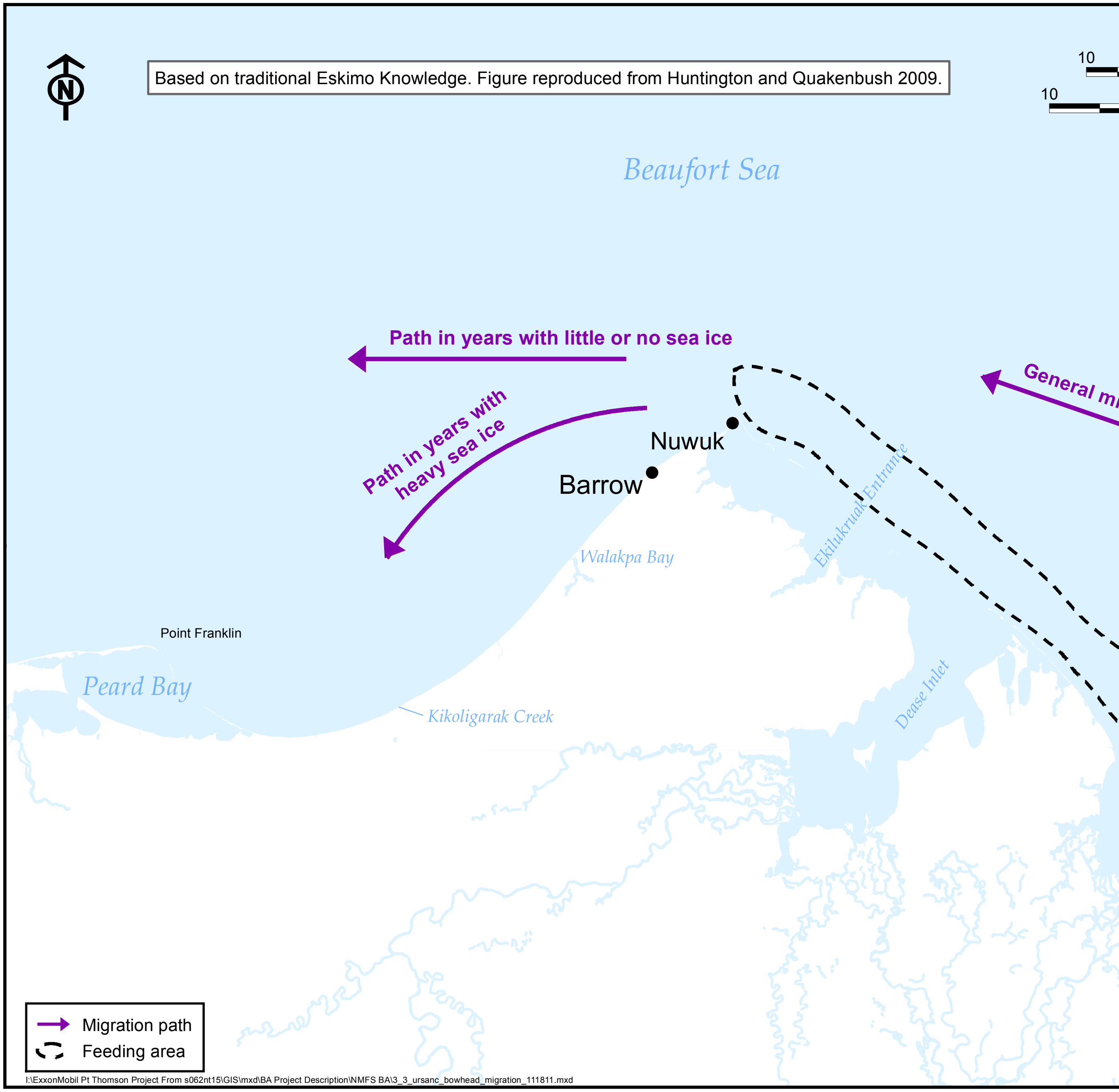


ExxonMobil — Point Thomson Project

BOWHEAD WHALE FALL MIGRATION ROUTES

BIOLOGICAL ASSESSMENT

NOVEMBER 2011

FIGURE 3.3

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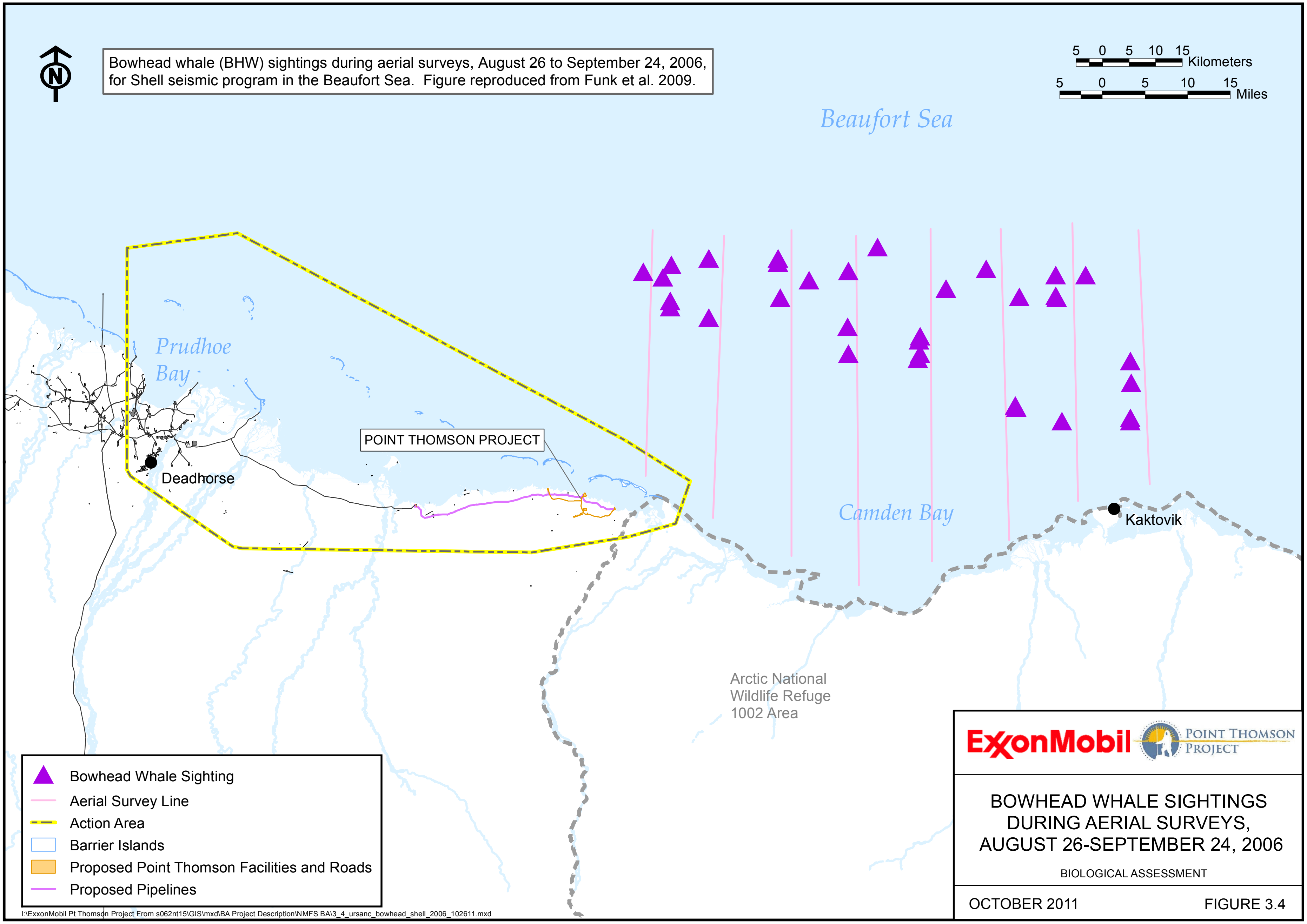
### 3.1.4 Communication and Hearing

Bowhead whales communicate by producing various sounds that transmit through the water. Most of the sounds are low-frequency, generally below 1 kilohertz (kHz). Bowheads hear sounds with dominant components in the 50 to 500 hertz (Hz) range (Richardson et al. 1995). Communication is primarily for interacting with other whales, because bowhead whales do not have sonar (echolocation) as with toothed whales, which make high frequency sounds (greater than 1 kHz). The science for understanding associations between underwater sounds and specific social or biological functions for bowheads is weak to non-existent (Richardson et al. 1995). Sounds may be used for reproduction, coordination of foraging and other activities, social interactions, and individual recognition, and establishing/maintaining bonds between mother and calf (Richardson et al. 1995). The frequency of sounds may vary by season and the transmission may be affected by natural (sea state, sea ice, etc.) and anthropogenic (seismic, vessels, etc.) events or activities (Greene et al. 1999; and Blackwell et al. 2009). The concern about anthropogenic events is that they may mask calling bowheads and interfere with communication (Richardson et al. 1995), however, such an effect has not been demonstrated to occur to bowheads even in the presence of seismic activity, which produces some of the loudest underwater sounds in the Arctic (Richardson et al. 1986; Greene et al. 1999; and Blackwell et al. 2009).

### 3.1.5 Scientific Studies in Action Area

Broad-scale aerial surveys in the Beaufort Sea conducted by Shell Exploration and Production Company (Shell) and BOEMRE overlapped the Action Area. Aerial surveys conducted by Shell Western between 2006 to 2008 show bowheads occur north of the barrier islands near the Project area from late August to early October, with most whales reported in September at locations shown in Figures 3.4 and 3.5 (Figure for 2008 not available, Funk et al. 2009). Survey effort did not extend south of the barrier islands to the shoreline but whales were observed near the barrier islands, although most were much farther north (offshore). Aerial surveys conducted annually by BOEMRE during late summer through fall from 1982 to 2010 similarly show bowheads north but not inside of the barrier islands near Point Thomson (Figure 1, Treacy et al. 2006). More bowheads would likely occur closer but still considerably north of the barrier islands during light ice years than heavy ice years as mentioned earlier. Their occurrence would be highest during

September and October, when most bowheads migrate westward across the Beaufort Sea; the spring migration is far offshore in ice leads. During both aerial survey programs bowheads were observed feeding, but neither study identified the specific locations. Satellite tagging studies of bowhead whales and acoustic studies of their vocalizations show seasonal movements occur outside of the barrier islands in the Beaufort Sea (Quakenbush et al. 2009, 2010; and Blackwell et al. 2007).




BOWHEAD WHALE SIGHTINGS DURING AERIAL SURVEYS, AUGUST 26-SEPTEMBER 24, 2006

BIOLOGICAL ASSESSMENT

OCTOBER 2011

FIGURE 3.4

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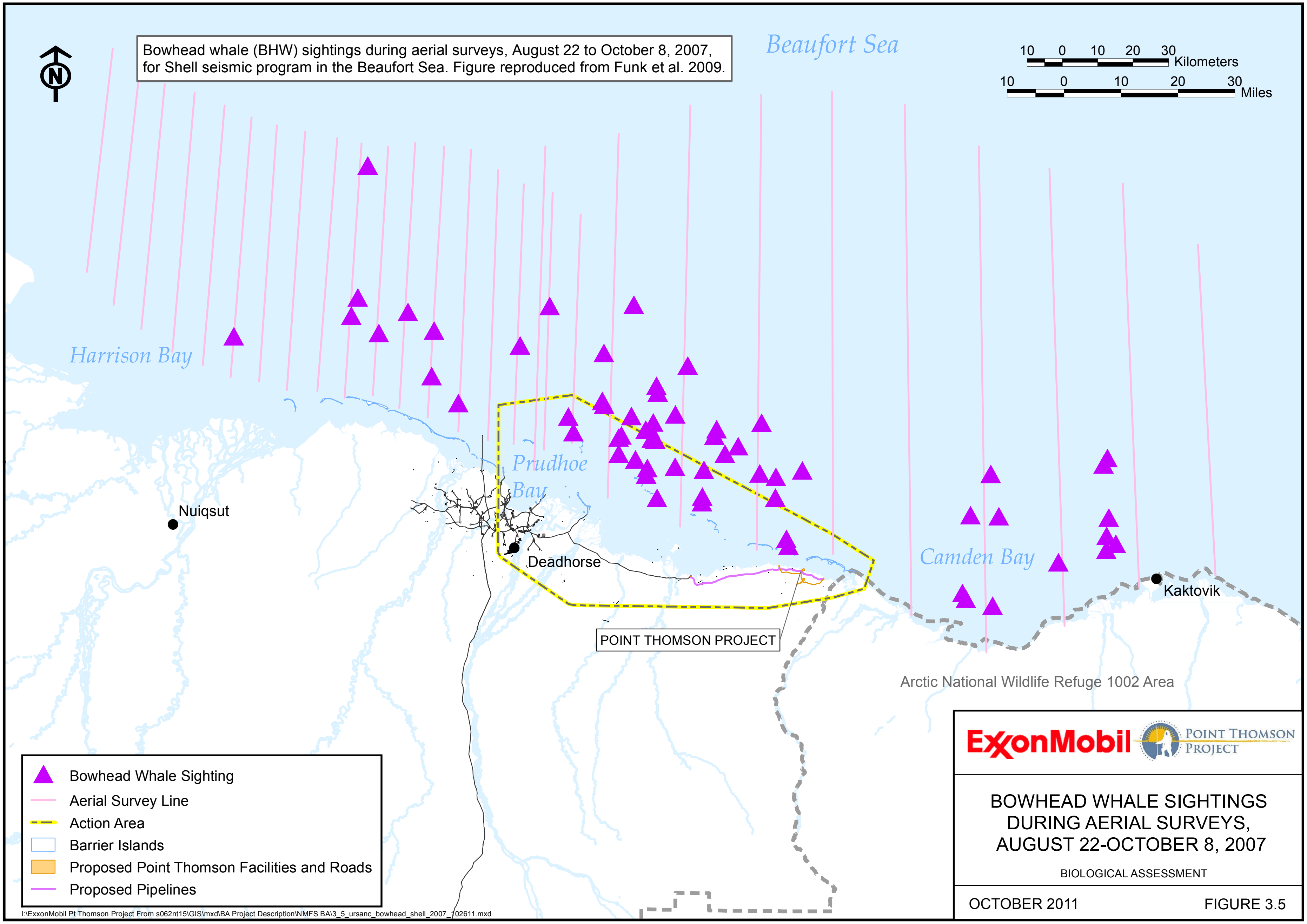


BOWHEAD WHALE SIGHTINGS DURING AERIAL SURVEYS, AUGUST 22-OCTOBER 8, 2007

BIOLOGICAL ASSESSMENT

OCTOBER 2011

FIGURE 3.5

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# 3.2 Ringed and Bearded Seals

## 3.2.1 Ringed Seals

### *3.2.1.1 Stock Description*

Ringed seals have a circumpolar distribution, which is closely associated with sea ice. Ringed seals are found throughout the BCB (Allen and Angliss 2010). They are the most abundant and widely distributed seal in the Chukchi and Beaufort Seas (King 1983).

### *3.2.1.2 Population Size and Status*

Although there are no recent population estimates for the Alaska Arctic, Bengtson et al. (2005) estimated ringed seal abundance from Barrow south to Shishmaref in the Chukchi Sea to be 252,488 (SE=47,204) for 1999 and 208,857 (SE=25,502) in 2000 for an average of 230,673 seals. Frost et al. (2002) estimated a density of 0.98/square kilometers ($km^2$) seals for 18,000 $km^2$ surveyed in the Beaufort Sea, which Allen and Angliss (2010) combined with the average estimate from Bengtson et al. (2005) for a total minimum estimate of 249,000 ringed seals in the Beaufort and Chukchi Seas. This is a minimum estimate, since Frost et al. (2002) and Bengtson et al. (2005) surveyed small parts of the total ringed seal habitat in the Beaufort and Chukchi Seas, and Frost et al. (2002) did not correct for missed seals. Considering the effect of these factors in underestimating the population size and adding at least 50,000 more seals from the eastern Beaufort Sea and Amundsen Gulf, a reasonable estimate for the total population of ringed seals in the Chukchi and Beaufort seas is 1 million seals (Kelly et al. 2010).

### *3.2.1.3 Seasonal Distribution, Habitat, and Biology*

Results from surveys by Bengtson et al. (2005) in May and June of 1999 and 2000 indicated ringed seal densities are higher in nearshore fast ice and pack ice, and lower in offshore pack ice, which is less stable and extensive. In some areas, however, where there is limited fast ice but wide expanses of pack ice, the total numbers of ringed seals on pack ice may exceed those on shorefast ice (Burns 1970; Stirling et al. 1982; and Finley et al. 1983). Frost et al. (2004) reported slightly higher ringed seal densities in the pack ice (0.92-1.33 seals/$km^2$) than in the shorefast ice (0.57-1.14 seals/$km^2$) in the central Beaufort Sea, which overlaps the Project area, during late May and early June of 1996 to 1999, when seals are most commonly hauled out on the ice. Ringed seal densities during this time period were highest in water between 5 and 25 m deep (16.4 to 82 ft) (Frost et al. 2004). Wiig et al. (1991) found highest seal densities on stable landfast ice in spring, but significant numbers of ringed seals also occur in pack ice. Moulton et al. (2002) found seals widely distributed on landfast ice in the central Beaufort Sea, but more seals occurred near the ice-edge during ice breakup. Seal numbers were highest in 10-20 m (32-65 ft) water depths (Moulton et al. 2002). During summer, high densities of ringed seals are closely associated with the offshore pack ice and ice remnants (Burns et al. 1980; Smith 1987; and Kelly et al. 2010). Funk et al. (2009) reported ringed seal densities in open water were low and varied among years, but they were higher in the fall than summer, probably due to their association with the advancing sea ice. These results suggest that ringed seal use is widespread in the sea ice, but they were somewhat higher in nearshore than offshore ice during spring, after which they use offshore pack ice and ice remnants and to a much lesser degree open water during the open-water season from approximately late June to late October.

Ringed seals are a polygamous species (Burns 1970). When sexually mature, they establish territories during the fall and maintain them during the pupping season (Burns 1970). Pups are born in late March and April in lairs that seals excavate in snowdrifts and pressure ridges on shorefast ice and pack ice where sufficient open water exists to provide underwater access to the lair (Burns 1970; Burns and Harbo 1972; and Bengtson et al. 2005). During the breeding and pupping season, adults on shorefast ice (floating fast-ice zone) usually move less than individuals in other habitats; they depend on a relatively small number of holes and cracks in the ice for breathing and foraging (Kelly et al. 2010). During nursing (four to six weeks), pups usually stay in the birth lair (Kelly et al. 2010). Alternate snow lairs provide physical and thermal protection when the pups are being pursued by their primary predators, polar bears and Arctic foxes (U.S. Department of the Interior [USDI] MMS 2003). The primary prey of ringed seals is Arctic cod, saffron cod, shrimps, amphipods, and euphausiids (Kelly 1988; and USDI MMS 2003). Ringed seals are an important resource that subsistence hunters harvest in Alaska (USDI MMS 2003).

#### *3.2.1.4 Communication and Hearing*

Ringed seal calls are presumably associated with establishment of territory and courtship (Richardson et al. 1995), however, since most relevant behaviors occur underwater or under ice, it has not been possible to link specific behaviors and call types (Richardson et al. 1995). In-air vocal behavior has not been studied (Richardson et al. 1995). Underwater audiograms for phocids suggest that they have very little hearing sensitivity below 1 kHz, though they can hear underwater sounds at frequencies up to 60 kHz and make calls between 90 Hz and 16 kHz (Richardson et al. 1995). A more recent review suggests that the auditory bandwidth for pinnipeds in water should be considered to be 75 Hz to 75 kHz (Southall et al. 2007).

## 3.2.2 Bearded Seals

### *3.2.2.1 Stock Description*

Bearded seals, the second most common seal in the Arctic, are associated with sea ice and have a circumpolar distribution (Burns 1981). During the open-water season, bearded seals occur mainly in relatively shallow areas, because they are predominantly benthic feeders (Burns 1981). They prefer waters less than 200 m deep (656 ft) (e.g., Harwood et al. 2005, Funk et al. 2009).

### *3.2.2.2 Population Size and Status*

Bearded seals occur over the continental shelves of the Bering, Chukchi, and to a lesser extent the Beaufort seas (Burns 1981). Reliable estimates of bearded seal abundance in Alaska waters are unavailable (Allen and Angliss 2010), however, Bengtson et al. (2005) estimated the average density for the eastern Chukchi Sea to be 0.07-0.14 seals/km$^2$ between Barrow and Shishmaref (west coast of Alaska) from surveys conducted in 1999 and 2000. While they did not adjust the density for animals missed in the water during the surveys to estimate abundance, they did state that actual densities could be of a magnitude of 12.5 times higher or 0.87-1.75 seals/km$^2$. Without any correction for missed seals, a crude estimate based on the area surveyed and the observed density yields an estimated 13,600 bearded seals (Cameron et al. 2010). Assuming the Russian side of the Chukchi Sea supports a similar number of bearded seals, the combined total equals 27,000 (Cameron et al. 2010). Adding in a very crude estimate for the Beaufort Sea of 3,150 bearded seals, based on earlier surveys, the total number for both the Chukchi and Beaufort seas is 30,150 seals (Cameron et al. 2010). This estimate likely grossly underestimates the actual number of bearded seals in this region (Cameron et al. 2010).

### *3.2.2.3 Seasonal Distribution, Habitat, and Biology*

Seasonal movements of bearded seals are directly related to the advance and retreat of sea ice and to water depth (Kelly 1988). During winter, most bearded seals are in the Bering Sea (Kelly

1988; and Burns 1981). In the Chukchi and Beaufort seas, favorable conditions are more limited, and consequently, bearded seals are scarce there during winter (Burns 1981). From mid-April to June, as the ice recedes, some of the bearded seals overwintering in the Bering Sea migrate northward through the Bering Strait (Burns 1981; and Frost et al. 2005). During summer they occur near the widely fragmented margin of multi-year ice covering the continental shelf of the Chukchi Sea and to a lesser degree in the Beaufort Sea (Funk et al. 2009). In the Beaufort Sea, bearded seals are most numerous in a narrow flaw zone, which is an area where drifting pack ice interacts with fast ice, creating leads and other openings (Burns and Frost 1979).

In some areas, bearded seals are associated with the ice year-round; however, they usually move shoreward into open-water areas when the pack ice retreats to areas with water depths greater than 200 m (greater than 656 ft) (Burns 1981). During summer, when the Bering Sea is ice-free, the most favorable bearded seal habitat is found in the central or northern Chukchi Sea along the margin of the pack ice (Bengston et al. 2005; and Burns 1981). Suitable habitat is more limited in the Beaufort Sea where the continental shelf is narrower and the pack ice edge frequently occurs seaward of the shelf and over water too deep for benthic feeding (Kelly 1988). Vessel surveys suggest bearded seal densities over the shelf including the area surveyed off Point Thomson during the open water season are highly variable between years and between months, indicating no predictable trends in occurrence (Funk et al. 2009).

Pupping takes place on top of the ice less than 1 m from open water from late March through May mainly in the Bering and Chukchi seas, although some takes place in the Beaufort Sea (USDI MMS 2003). These seals do not form herds but sometimes do form loose groups (Cameron et al. 2010). Bearded seals feed on a variety of primarily benthic prey, decapod crustaceans (crabs and shrimp) and mollusks (clams), and other food organisms, including Arctic and saffron cod, flounders, sculpins, and octopuses (Kelly 1988; and USDI MMS 2003).

#### *3.2.2.4 Communication and Hearing*

Bearded seal calls are a prominent element of the ambient noise in the Arctic Ocean during spring (Richardson et al. 1995). The call is thought to be a territorial or mating call by the male (Richardson et al. 1995). Underwater audiograms for phocids suggest that they have very little hearing sensitivity below 1 kHz, though they can hear underwater sounds at frequencies up to 60 kHz and make calls between 90 Hz and 16 kHz (Richardson et al. 1995). A more recent review suggests that the auditory bandwidth for pinnipeds in water should be considered to be 75 Hz to 75 kHz (Southall et al. 2007).

### 3.2.3 Scientific Studies in Action Area

Scientific studies described in Section 3.1.5 for bowhead whales incidentally recorded ringed and bearded seals. These were broad-scale aerial surveys conducted outside of the barrier islands during the open-water season near the Action Area. Ringed and bearded seals were found to be widespread and present throughout the open-water season. Ringed seals were far more common than bearded seals. The only species-specific recent studies (within 10 years) close to the Action Area have targeted ringed seals associated with BP Exploration Alaska's Northstar Project. These studies examined impacts of pile driving, drilling, and construction sounds on ringed seal density, abundance, distribution, and lair use (Blackwell et al. 2003; Moulton et al. 2003; Moulton et al. 2005; and Williams et al. 2006). All of the studies concluded that noise from the Northstar Project had no more than a slight effect on ringed seals, which when compared to natural environmental factors, was small. Acoustic studies have recorded ringed and bearded seal calls incidental to bowhead whales, but these studies occurred outside of the barrier islands, primarily from Prudhoe Bay westward into the Chukchi Sea (Moore et al. 2010a; and Blackwell et al. 2009).

# 4.0 ENVIRONMENTAL BASELINE

## 4.1 Past and Present Impacts

This chapter describes the past and present impacts of human actions on the bowhead whales, and ringed and bearded seals, as well as the current habitat conditions and trends of these species. These actions include activities other than those being proposed for this project. These actions include offshore oil and gas activities (seismic exploration and other developments in or near the Action Area), vessel, barge, and aircraft traffic, and subsistence and commercial harvests, which are discussed below. Some activities (e.g., seismic) occurring in or affecting the Action Area are not associated with the Point Thomson Project. Also predation of bowhead whales and ringed seals and bearded seals is not addressed in this section, since it is an integral component of the natural environment and ecology of these species.

### 4.1.1 Oil and Gas Activities

Oil and gas activities discussed in this section include seismic exploration, development and production, and operations of support vessels and aircraft.

#### *4.1.1.1 Seismic Exploration*

Seismic exploration has been occurring in the region of the Project for over 25 years by multiple oil and gas companies and geophysical companies. Seismic surveys have not been conducted inside of the barrier islands, except for Vibroseis, which is conducted on sea ice during winter. Airguns used in open-water seismic explorations produce underwater sounds known to travel long distances, while Vibroseis produces sounds focused on a very limited area directly below the sound source with little horizontal spreading (Richardson et al. 1995). The number of open water seismic operations varies each year from one to multiple operations, such as occurred in 2008, when seismic surveys were conducted by Shell, BP Exploration (Alaska), Inc., and Eni in the Beaufort Sea (Funk et al. 2009).

Airguns used in seismic explorations produce underwater sounds known to affect the behavior of bowhead whales (Richardson et al. 1995; George et al. 2004 a and b; Nowacek et al. 2007; and Southall et al. 2007). MacDonald et al. (2008) estimated underwater sound pressure levels from the seismic vessel *Gilavar* of 120 decibels (dB) at approximately 21 km (13 mi) from the source.

Impacts to bowhead whales have typically been associated with temporary changes in behavior including deviating around a seismic survey and changing respiration patterns (Richardson et al. 1995, Miller et al. 1999 and 2005). Such impacts have been more noticeable during the fall migration than other activities such as feeding; seismic surveys have not occurred during the spring migration (Richardson et al. 1995; Richardson 1999; and Richardson and Thomson 2002). There has been no noticeable change in the spatial or temporal distribution of bowhead whales during the fall migration or health of the population over the more than the 30-year period of oil and gas activities (Treacy et al. 2006; George et al. 2004 a and b; and Zeh and Punt 2005).

Impacts of open-water seismic exploration to ringed and bearded seals have also typically been associated with changes in behavior including moving away from the sound source. Distances moved from the sound source are generally relatively short (100 m [328 ft]), and behavioral changes are typically temporary and short-term (Richardson et al. 1995). Ringed seal sightings tended to be farther away from the seismic vessel when airguns were operating than when they were not (Moulton and Lawson 2002), however, these avoidance movements were relatively small, on the order of 100 m (328 ft) to (at most) a few hundred meters, and many seals remained within 100 to 200 m (328 to 656 ft) of the trackline as the operating airgun array passed by. Miller et al. (2005) reported higher sighting rates during non-seismic than during line-seismic operations, but there was no difference for mean sighting distances during the two conditions nor was there evidence ringed or bearded seals were displaced from the area by the operations. Similar findings have been reported in other studies, suggesting there may be some temporary localized movement away from the sound source (Funk et al. 2009; and Brueggeman et al. 2009). Any impacts to seals would be further reduced because of the low density of these species in the Action Area during the open-water season, as discussed in previous sections.

Vibroseis surveys within 150 m (492 ft) of a lair can potentially impact ringed seals by causing them to leave the lair, and in the spring abandon a newborn pup, however, population level effects would be minor, in part due to an assumption that ringed seals could readily move to other areas under the ice with conditions suitable for creating a lair (Kelly et al. 2010).

Stipulations in federal permits (incidental take permits) issued for Virbroseis operations mitigate such an impact by prohibiting Vibroseis within 150 m of known or suspected lairs.

#### *4.1.1.2 Oil and Gas Development and Production*

Offshore oil and gas developments in the Beaufort Sea include Northstar, Endicott, Oooguruk, and Nikaitchuq. Oil and gas development and production in or near the Action Area have been primarily associated with the Northstar Project. The Northstar Project, located on a manmade island about 10 km (6.2 mi) offshore, over 80 km (50 mi) west of the Project is the only development to conduct long-term acoustic and biological studies to assess impacts of industrial sounds and activities on bowhead whales and ringed seals (Richardson et al. 2008). There have been no studies of bearded seal impacts from these developments.

Underwater noise from oil and gas operation has the potential to mask bowhead whale calls and affect behavior. Richardson et al. (2008) reported a slight change in the distribution of bowhead whale calls in response to operational sounds on the Northstar Project. The southern edge of the call distribution was farther offshore, suggesting bowheads temporarily deviated around the sound source, apparently in response to industrial sound levels. This result, however, was only achieved after intensive statistical analyses, and Richardson et al. (2008) concluded it was not clear that this represented a biologically significant effect. Southall et al. (2007) reviewed a number of papers describing the responses of marine mammals to continuous sound from various oil and gas developments and other industrial activities. In general, little or no response was observed in bowheads and other marine mammals exposed at received levels from 90-120 dB. The probability of avoidance and other behavioral effects increased when received levels were 120 to 160 dB. Similar outcomes have been reported in the Beaufort Sea for bowheads exposed to underwater offshore drilling, where effects were no more than temporary and short-term with some whales occurring within 400 m (1,312 ft) of the sound source (Richardson et al. 1990; Brewer et al. 1993; and Hall et al. 1994).

Ringed seal densities recorded near the Northstar Project during construction, drilling, and production were similar to those farther away, indicating these activities had no noticeable effect on ringed seals (Moulton et al. 2003). Richardson and Williams (2004) concluded that there was little effect from the low to moderate level, low-frequency industrial sounds (machinery, generators, etc.) emanating from the Northstar Project on ringed seals during the open-water season and that the overall effects of the construction and operation of the facility were minor, short-term, and localized, with no consequences to seal populations as a whole.

Oil spills from oil and gas activities represent a potential impact to bowhead whales, ringed seals, and bearded seals in the Action Area. Over the more than 30-year North Slope history of oil and gas operations, the vast majority of the oil (plus other material) spills have been very small (less than 10 gallons) and very few have been greater than 100,000 gallons (NRC 2003). Except for a few small spills in the Beaufort Sea, almost all of the spills have been on land.

It is difficult to accurately predict the effects of oil on bowhead whales (or any cetacean) because of a lack of data on the metabolism of this species and because of inconclusive results of examinations of baleen whales found dead after major oil releases (Bratton et al., 1993; and Geraci 1990). Nevertheless, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Oil spills that occurred while bowheads were present could result in skin contact with the oil, eye irritation, baleen fouling, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas (Geraci 1990). Most likely, the effects of oil would be irritation to the respiratory membranes and absorption of hydrocarbons into the bloodstream (Geraci 1990). If an oil spill were concentrated in open-water leads, it is possible that a bowhead whale could inhale enough vapors from a fresh spill to affect its health. Inhalation of petroleum vapors can cause pneumonia in humans and animals due to large amounts of foreign material (vapors) entering the lungs (Lipscomb et al. 1994). It is unclear if vapor concentrations after an oil spill in the Arctic would reach levels where serious effects, such as pneumonia, would occur in bowhead whales. While these outcomes from a spill could occur, the authors of these published studies concluded that the consequences of an oil spill on bowhead whales are unclear and largely speculative.

Ringed and bearded seals could be impacted by oil spills in several ways. The greatest impacts would likely result from an oil spill during the ringed seal pupping season (St. Aubin 1990); bearded seals do not produce pups in the Beaufort Sea. Researchers have suggested that pups may be particularly vulnerable to fouling because of their dense lanugo coat (St. Aubin 1990; Jenssen 1996). Fouled pelage of neonates would have a lower insulative value, putting them at greater risk of low-temperature stress when out of the water (St. Aubin 1990), lower mass at weaning (Davis and Anderson 1976), and lower survival (Harding et al. 2005). Other acute effects of oil exposure include skin irritation, disorientation, lethargy, conjunctivitis, corneal ulcers, and liver lesions (St. Aubin 1988 and 1990). Many of these effects are thought to be largely reversible in adults, but others such as brain lesions and nerve damage may be fatal (Lowry et al. 1994; Spraker et al. 1994; and Salazar 2003). Direct ingestion of oil, ingestion of contaminated prey, or inhalation of volatile hydrocarbons transfers toxins to body fluids, muscle, liver, and blubber, causing effects that may lead to death, as suspected in dead gray and harbor seals found with oil in their stomachs (St. Aubin 1990; Lowry et al. 1994; Spraker et al. 1994; and Jenssen 1996). Freshly spilled oil contains high levels of toxic gas (aromatic compounds) that, if inhaled, could cause serious health effects or death in ringed seals, as occurred with harbor seals following the *Exxon Valdez* oil spill in Prince William Sound, Alaska (Lowry et al. 1994; and Spraker et al. 1994).

#### *4.1.1.3 Vessel and Barge Traffic*

Vessels and barges supporting oil and gas activities as well as servicing the Alaska Native communities during the open-water season have been shown to have no more than a temporary impact on bowhead whales and ringed and bearded seals (Richardson et al. 1995; Funk et al. 2009; Kelly et al. 2010; and Cameron et al. 2010).

Bowhead whales respond primarily to directly approaching vessels (Richardson et al. 1995). Impacts are mainly associated with bowhead whales temporarily changing course to avoid an oncoming vessel before returning to normal behavior (Richardson et al. 1995). Noise levels from such vessels are generally not sufficiently loud to disturb bowheads, except when at close range or directly approaching the animal (Richardson et al. 1995). Austin and Hannay (2010) conducted an underwater acoustic monitoring program to quantify noise levels produced by two tugs associated with the 2010 Point Thomson Project drilling activities in the Alaska Beaufort Sea. Noise levels for each tug were separately measured at speeds of 8-9 knots. Measurements were taken about 7 mi northwest of West Dock at Prudhoe Bay in about 30 ft of water. Noise levels produced by the tugs were 120 dB at 0.4 mi from the tugs based on the best statistical fit of the data.

Underwater noise levels for tugs towing barges have been reported for the Northstar Project near Prudhoe Bay. Garner and Hannay (2009) estimated sound pressure levels for various types of barges of 100 dB at distances ranging from approximately 2.4 to 3.7 km (1.5 to 2.3 mi). Blackwell (2004) reported that underwater sounds from two tugs towing a barge off the Northstar Project were about 110 dB at 100 Hz and 90 dB at 1 kHz measured at 400 m (1,312 ft) from the source; frequency values within the hearing range of bowhead whales. Funk et al. (2009) reported the following combination of characteristics for barge traffic servicing Pioneer's Oooguruk Drillsite in Harrison Bay resulting in the underwater noise from the tugs having no effect on bowheads: 1) low tug/barge noise levels (100 dB at 1.8 km [1 mi]), 2) relatively similar ambient noise levels (90 to 110 dB), and 3) the long average offshore distance (approximately 30 km [19 mi]) of migrating bowheads. Ambient noise levels measured offshore from the Northstar Project development ranged over 120 dB, and on average exceeded 100 dB during an 11-year monitoring program from 1984 to 2009 (Aerts and Richardson 2008, 2009, and 2010). This is the only long term study in the Alaskan Beaufort Sea of ambient noise that accounts for natural variation caused by sea state, sea ice, and other environmental factors. Since other studies cited in the text have found similar levels of ambient noise as reported at the Northstar Project, they suggest the values are applicable to other areas along the Beaufort Sea coast. All of these reported sound levels for transiting barges are near ambient noise levels and below 120 dB, except close to the noise source (barge), where bowhead whales and seals would not be expected to occur so close to a moving barge: the: the 120-dB noise level is designated by the NMFS as a take (Level B, disruption of behavioral patterns) for bowhead whales and seals (see Section 5.2 for discussion of take threshold levels). Consequently, underwater noise from barges is not expected to have a significant effect on bowhead whales or seals.

Ringed and bearded seals usually show little reaction to a passing vessel (Richardson et al. 1995; and Funk et al. 2009). The seals will move a short distance out of the path of an oncoming vessel (Richardson et al. 1995). Changes in behavior appear to be temporary and short-term (Richardson et al. 1995; and Funk et al. 2009). NMFS does not consider the response of seals (or marine mammals in general) to normal operations of a commercial vessel a take provided the vessel does not pursue or deviate from its course to harass a marine mammal. Nearly all shipping activity in the Arctic (with the exception of icebreaking) purposefully avoids areas of ice and primarily occurs during the ice-free or low-ice seasons, helping to mitigate the risks of shipping to ringed and bearded seals. This is important because these species are closely associated with ice at nearly all times of the year and especially during the whelping, breeding, and molting periods when the seals (especially young pups) may be most vulnerable to shipping impacts (Smith 1987; and Cameron et al. 2010).

While vessels could also strike a seal or a whale, there is no evidence of this occurring with seals and little evidence of this occurring more than rarely to bowheads (Allen and Angliss 2010; and Kelly et al. 2010); ice breakers could impact ringed seals by striking subnivian lairs in springtime when breaking ice (Kelly et al. 2010). The only study of vessel strikes of bowhead whale was reported by George et al. (1994) who found only a few harvested bowheads (less than 1 percent) showed scars from collisions with vessel propellers, but they did not associate the scars with specific types of vessel. However, vessel strikes of marine mammals have been shown to be caused by fast-moving ships or propellers from high-speed small boats and not from slow-speed, straight-line-moving vessels like barges (Richardson et al. 1995). MMOs on barges transporting materials between Prudhoe Bay and Point Thomson between July and September from 2008 to 2010 (166 round-trips) encountered no bowhead whales, recorded no collisions with seals, and only rarely observed a seal showing an escape response to the barges (ExxonMobil 2010).

#### *4.1.1.4 Aircraft Traffic*

Aircraft, including fixed-winged airplanes, and helicopters supporting oil and gas activities can have a temporary effect on seal and bowhead behavior (Richardson et al. 1995; and Patenaude et al. 2002). Bowheads have been reported to dive when approached by low-flying aircraft (Richardson et al. 1995). Bowheads return to normal behavior within a relatively short-time after being passed by an aircraft. Research has shown that aircraft flown above 457 m (1,500 ft) do not cause any noticeable change in bowhead behavior (Richardson et al. 1995; and Patenaude et al. 2002). NMFS has instituted restrictions in incidental take permits (Incidental Harassment Authorization, Letter of Authorization) requiring industry to fly above this altitude or over land to reduce aircraft effects on bowheads.

Low-flying aircraft can cause ringed and bearded seals to dive or abandon an ice floe (Richardson et al. 1995; and Burns and Harbo 1972), however, most of these disturbances would be minor and brief in nature (Kelly et al. 2010; and Cameron et al. 2010). Federal permit stipulations similar to those for bowhead whales are in place to minimize aircraft impacts on seals.

### 4.1.2 Subsistence Harvest

Bowhead whales, ringed seals, and bearded seals are important subsistence resources for residents of the communities along the BCB. Local communities (Barrow, Nuiqsut, and Kaktovik) along the Beaufort Sea coast historically and currently harvest bowhead whales during spring and fall (Allen and Angliss 2010).

The bowhead harvest is based on a quota, established by the International Whaling Commission and regulated by agreement between the AEWC and NMFS, according to the cultural and nutritional needs of Natives as well as based on estimates of the size and growth of the bowhead whale stock (Suydam and George 2004; and Allen and Angliss 2010). In 2007, the International Whaling Commission set a five-year block quota (2008-2012) of 67 strikes per year with a total landed not to exceed 255 whales (Allen and Angliss 2010). The most recently summarized information shows the mean number of whales landed between 1995 and 2006 was 41.8 whales per year (standard deviation of 6.8, Suydam et al. 2007). A total of 41 whales were landed in 2007 (Suydam et al. 2008). No documented harvest data are available for 2008 or 2009. The number of whales landed at each community varies greatly from year to year, as success is influenced by community effort, location, and ice and weather conditions. Barrow is the largest community, and it harvests the most whales each year (Suydam et al. 2007 and 2008). Bowhead whale hunting by Barrow and Kaktovik occurs a considerable distance from the Project area. Most bowhead whale hunting by Nuiqsut (hunting occurs from Cross Island) occurs west of the project area, but scouting trips by whalers have been documented in one instance as far east as Flaxman Island, outside of the barrier islands (Galginaitis 2009).

Ringed and bearded seals are harvested year-round, but primarily from spring to fall (Allen and Angliss 2010; and Bacon et al. 2009). Information on recent numbers of ringed and bearded seals harvested each year by hunters from each community is poorly documented (Allen and Angliss 2010). The most recent estimate of the number of ringed seals harvested for subsistence is for 2000, when 9,500 seals were taken by all of the communities in

Alaska; harvest was not broken down by community (Allen and Angliss 2010). The most recent harvest estimates (from 2003) for bearded seals cover only communities in the NSB, and suggest that a minimum of 1,545 bearded seals were taken from the eastern Chukchi and western Beaufort seas, including 32 seals from Point Lay, 729 from Wainwright, 776 from Barrow, and 8 from Kaktovik (Bacon et al. 2009). The actual number of seals taken during the hunt is higher since an estimated 25 to 50 percent of the seals struck are lost (Bacon et al. 2009). Currently, there is no comprehensive effort to quantify harvest levels of seals in Alaska (Allen and Angliss 2010). Seal hunting primarily occurs near the villages, which are a considerable distance (greater than 60 mi) from the Project area. There are no published records of seals harvested near the Project area.

### 4.1.3 Commercial Harvest

Commercial harvest is well-documented for bowhead whales but not for ringed or bearded seals in the Alaska Arctic (Cameron et al. 2010; Kelly et al. 2010; and Bockstoce and Burns 1993). Bowheads were commercially harvested in the 1800s and early 1900s, though changes in fashion caused the baleen market to collapse in 1909 (Bockstoce and Burns 1993). Few whales were taken after 1914, with the last whale commercially taken from the BCB bowhead population in 1921 (Bockstoce and Burns 1993). The best available data suggest that from 1848 to 1914 the BCB population was reduced from a maximum size of 23,000 to perhaps 3,000 (Bockstoce and Burns 1993). The population has increased since the late 1970s, and currently includes over 10,000 individuals (Gerber et al. 2007).

During the late 19th century, bearded and ringed seals were harvested commercially in large numbers causing local depletion (Cameron et al. 2010). Limited harvesting continued primarily by Natives until commercial harvest was prohibited by the enactment of the Marine Mammal Protection Act (MMPA) in 1972 (Frost 1985).

## 4.2 Existing Habitat Conditions and Species Trends

### 4.2.1 Existing Habitat Conditions

Bowheads primarily inhabit the shallow outer continental shelf waters year-round from the Bering Sea to the Canadian Beaufort Sea (Braham et al. 1984). They live in ice-covered waters most of the year, wintering in the Bering Sea, migrating in ice leads during spring, and summering in a combination of open and ice-covered waters in the Beaufort Sea (Brueggeman 1982). Their habitat is considered relatively high-quality because there is very little development throughout their range largely due to sea ice making it inaccessible most of the year (George et al. 2004 a and b). The favorable habitat conditions for bowhead whales were reaffirmed in the NMFS assessment of designating critical habitat in the Arctic as summarized below.

On February 22, 2000, NMFS received a petition from the Center for Biological Diversity and Marine Biodiversity Protection Center to designate critical habitat for the BCB bowhead stock. Petitioners asserted that the nearshore areas from the U.S.-Canada border to Barrow should be considered critical habitat. On August 30, 2002 (67 Federal Register 55767), NMFS announced the decision to not designate critical habitat for this population. NMFS found that designation of critical habitat was not necessary because the population is known to be increasing and approaching its pre-commercial whaling population size, there are no known habitat issues which are slowing the growth of the population, and because activities which occur in the petitioned area are already managed to minimize impacts to the population.

Bowhead habitat, however, is affected by noise from vessels, drillships, and seismic surveys. The geographic breadth of the noise depends on the source and a variety of conditions including water depth, sea ice cover, wind, water temperature, salinity, substrate, and seafloor topography (Richardson et al. 1995). Seismic surveys ensonify the largest area of the three sources. The only recent seismic surveys near Point Thomson, conducted by Shell, occurred over 15 km (9 mi) north of Point Thomson beyond the barrier islands in 2007 and 2008 (Funk et al. 2009). As mentioned earlier, bowheads have been shown to react to noise by altering behavior including temporarily deviating around or moving away from a sound source (Richardson et al. 1995; Richardson et al. 2008; and Southall et al. 2007). However, because the bowhead whale population is approaching its pre-exploitation population size and has been increasing at a roughly constant rate for over 20 years, noise impacts on individual survival and reproduction in the past have apparently been minor (Allen and Angliss 2010).

Subsistence fishers living in the communities bordering the coasts of the BCB harvest Arctic cod, which bowheads prey on in small amounts (Goetz et al. 2009), however, subsistence harvest is likely too small to have an effect on bowhead prey and their habitats due to the small size of the subsistence population and widely spaced communities combined with the small contribution fish represent in the bowhead diet (Goetz et al. 2009). Commercial harvest of marine resources is prohibited in the western Arctic Ocean. Therefore, the habitat comprising the ecosystem supporting bowheads and their prey in the Action Area is largely untouched by human activities (George et al. 2004a).

While this latter statement is correct, chemical contaminants have been reported in bowhead whales. Low levels of contaminants found in harvested bowhead whales suggest there are organochlorine contaminants in the Arctic (O'Hara et al. 1999; and Hoekstra et al. 2002). The source(s) of these contaminants is not known, but they could be carried by currents or deposited from the atmosphere from sources outside of the Arctic Ocean (Bratton et al. 1993). The current levels of contaminants appear to pose no harm to bowheads (O'Hara et al. 1999; Bratton et al. 1993).

Another concern in the Arctic is climate change, which has been most noticeable in high northern latitudes. There is evidence that over the last 10 to 15 years there has been a shift in regional weather patterns in the Arctic (Tynan and DeMaster 1997; and Stroeve et al. 2008). Ice-associated animals, such as the bowhead whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability (Tynan and DeMaster 1997; and Stroeve et al. 2008). Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on bowhead whales, however, the increasing population trend suggests there have been no noticeable effects on bowhead whales (Allen and Angliss 2010). George et al. (2005) reported that landed bowheads had better body condition during years of light ice cover. This, together with high calf production in recent years, suggests that the stock is currently tolerating the recent ice retreat (Allen and Angliss 2010).

Ringed seals are dependent on sea ice year-round for resting, pupping, nursing, and molting (Kelly et al. 2010). Sea ice provides ringed seals a platform for inhabiting subnivian lairs to shelter themselves and their pups, molt during spring, and rest during summer and fall (Kelly et al. 2010). Ringed seals primarily occur in nearshore pack ice and shorefast ice during spring, after which they move to offshore pack ice and ice remnants until winter freeze-up when they become widely dispersed over the sea ice (Kelly et al. 2010; Burns 1970; and Bengston et al. 2005). The area occupied by ringed seals in the Alaska Arctic Ocean is considered generally high-quality habitat because there is very little development and essentially no human activity during winter to spring breakup (George et al. 2004 a and b). Moreover, the fish stocks preyed upon by ringed seals are protected from commercial exploitation, although the local residents harvest fish near their communities. Pollutants (polychlorinated biphenyls [PCBs], DDT, etc.) have been found in the Beaufort Sea, but concentrations have not been linked to a decline in the populations of ringed seals or their prey (Kelly et al. 2010).

Ringed seal habitat has been affected by noise from oil and gas operations, however, as stated in the previous sections, studies have shown that noises from oil and gas exploration, construction, and operation have had a negligible effect on ringed seals and no biologically significant effect on the population. Correspondingly, there has been no reduction in the subsistence harvest associated with oil and gas operations (Kelly et al. 2010).

Climate change has the potential to impact ringed seals and their habitat. The biological rationale for the recent proposal to list ringed seals is almost entirely based on a reduction of sea ice caused by climate change (Kelly et al. 2010). There is undisputable evidence that sea ice cover has been reduced in the Arctic and breakup is occurring earlier in the spring and freeze-up later in the fall (Kelly et al. 2010). This has resulted in a corresponding reduction in ringed seal habitat (Kelly et al. 2010). If this trend continues unabated the resulting changes in habitat could affect the ringed seal population (Kelly et al. 2010).

Bearded seal habitat is similar to ringed seal habitat but restricted to the shallow outer continental shelf waters (Cameron et al. 2010). Bearded seals feed primarily on benthic organisms found on the substrate, preventing them from inhabiting the deeper waters off the outer continental shelf (Burns 1981; and Kelly 1988). While they occupy a subset of the ringed seal habitat, the condition of the habitat is generally high-quality, as described above for ringed seals. The response of bearded seals to habitat disturbance by oil and gas operations is also similar to that described for ringed seals, negligible to the individual bearded seals and biologically insignificant to the population. In addition, there has been no documented reduction in subsistence harvest in areas adjacent to oil and gas operations. As with ringed seals, the effect of climate change on bearded seal habitat was the basis for proposing to list the species as threatened. As an ice-dependent seal, a continued reduction of sea ice will change the habitat and affect the bearded seal population (Cameron et al. 2010).

### 4.2.2 Species Trends

The high quality of bowhead habitat is reflected in the health of the population. The population trend is one of increasing size since the mid-1970s, as shown in Figure 4.1 (Allen and Angliss 2010). Survey data indicate an estimated annual rate of increase from 1978 to 2001 of 3.4 percent (95 percent Confidence Interval 1.7 percent to 5 percent, George et al., 2004a and 2004b). The most recent documented count of 121 calves during the 2001 census was the highest recorded for the population (George et al. 2004a). The high calf count is reflected in a high pregnancy rate and short length at sexual maturity (i.e., sexual maturity occurs in younger-aged whales than found in a stable or declining population), which is characteristic of an increasing and healthy population (George et al. 2004b). The calf count provided corroborating evidence that the bowhead population is a healthy and increasing population (Allen and Angliss 2010).

Similar information on population trends for ringed and bearded seals is lacking (Allen and Angliss 2010). Population estimates made over the last 20 years are inappropriate to compare because data were collected by using different methods, different time periods, and applying incorrect or no correction factors to account for missed seals in the water (Kelly et al. 2010; and Cameron et al. 2010).

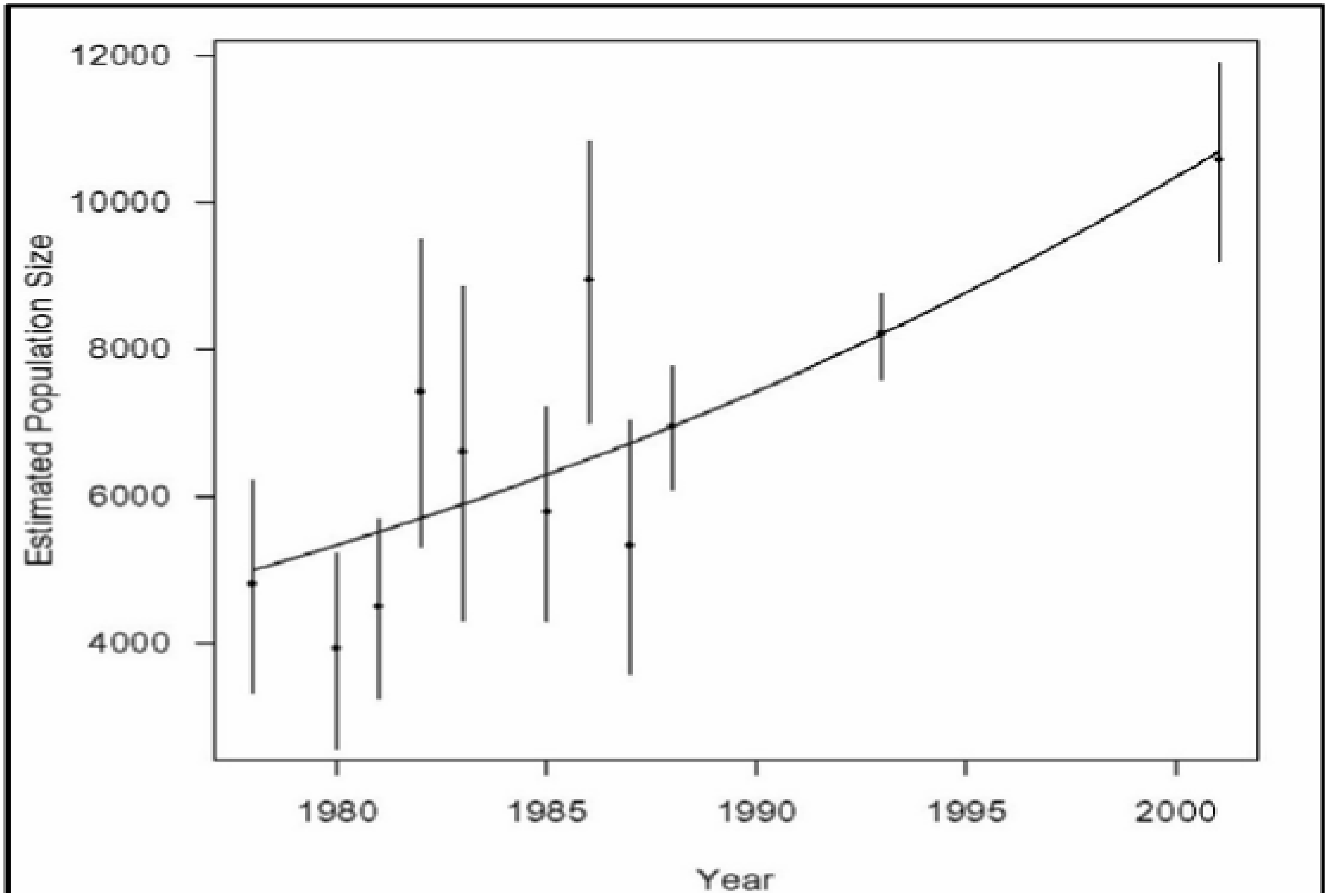


**Figure 4.1 Abundance Estimates and Standard Deviation for the Bering-Chukchi-Beaufort Sea bowhead Whale Stock (Zeh and Punt 2005). Error bars show +/- 1 standard error. (Figure taken from Allen and Angliss 2010).**

# 5.0 EFFECTS OF THE ACTION

The format of this section includes subsections on the definition of terms, applicable noise criteria, and the effects analysis for the three species. The effects analysis is structured so the three species are individually addressed under each phase of the project. This approach was taken to reduce redundancy and increase readability, since the subject species are exposed to many of the same project activities.

## 5.1 Definition of Terms

Effects of the action are defined under the ESA (50 CFR 402.02):

> *"…the direct and indirect effects of an action on the species or habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process."*

The different types of effects that need to be analyzed are further defined below.

**Direct effects –** Those immediate effects caused by the proposed action and occurring concurrently with the proposed action.

**Indirect effects –** Those effects that are caused by the proposed action and are later in time but still are reasonably certain to occur.

**Cumulative effects –** As defined in the ESA, cumulative effects are future state, tribal, local, or private activities, not involving federal activities that are reasonably certain to occur within the Action Area of the proposed action.

**Interrelated actions –** Those actions that are a part of a larger action and depend on the larger action for justification.

**Interdependent actions –** Those actions that have no independent utility apart from the action under consideration.

The Action Area for the Project is defined in the ESA (50 CFR 402.02) as the area within which all of the direct and indirect effects of the Project would occur.

This BA covers the potential effects of the Point Thomson oil and gas development on the endangered bowhead whale and the proposed threatened ringed and bearded seals. The Project includes the following three phases: Drilling, construction, and operation (production). Activities addressed in this BA that will occur during one or more of the three phases are barging, aerial flights, pier construction and associated dolphin placement, barge grounding for offloading materials, potential oil spills, and ice roads. No interdependent or interrelated actions have been identified with respect to the proposed action.

For each species, there are three possible determinations of effects, as defined by the ESA.

**No Effect –** The proposed action or interrelated or interdependent actions will not affect (positively or negatively) listed species or their habitat.

**May affect, not likely to adversely affect –** The proposed action or interrelated or interdependent actions may affect listed species or their habitat, but the effects are expected to be insignificant, discountable, or entirely beneficial. *Insignificant effects* relate to the size of the impact and should never reach the scale where a take would occur. The term insignificant effects and negligible are used interchangeably with "may affect but not likely to adversely affect" in the BA. Take is defined in the ESA implementing regulations as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." *Discountable effects* are those that are extremely unlikely to occur. Based on best judgment, one would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur. *Beneficial effects* are contemporaneous positive effects with no adverse effects to listed species.

**May affect, likely to adversely affect –** The proposed action or interrelated or interdependent actions may have measurable or significant adverse effects on listed species or their habitat. Such a determination requires formal ESA Section 7 consultation.

BAs are also intended to make determinations about the effects of the federal action on any designated critical habitat for listed species, however, NMFS decided to not designate critical habitat for the bowhead whale and NMFS is too early in the process of potentially listing ringed and bearded seals to designate critical habitat.

## 5.2 Applicable Noise Criteria

Under the MMPA, NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." The NMFS has adopted the MMPA take definition for the ESA for marine mammals.

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity in the ocean produces sound potentially resulting in impacts to a marine mammal and causing take by harassment (70 Federal Register 1871). The current Level A (injury) threshold for underwater noise (e.g., tug pushing a barge) is 180 dB root mean square (rms) for cetaceans (whales, dolphins, and porpoises) and 190 dB rms for pinnipeds (seals, sea lions). The current Level B (disturbance) threshold for underwater noise is 120 dB rms for cetaceans and pinnipeds.

## 5.3 Effects Analysis

The environmental consequences of the Project to bowhead whales, ringed seals, and bearded seals are evaluated for the three phases of the Project: Drilling, construction, and operations. Since the drilling and production facilities will be built and operated on land, most barge traffic will be inside the barrier islands, road and dock construction will occur during winter in water less than 3 m deep (10 ft), and aircraft will generally fly inland routes and not over marine water or sea ice, few if any bowhead whales and only small numbers of ringed and even smaller numbers of bearded seals are expected to be exposed to the Project. Furthermore, all underwater noises from the barges used by ExxonMobil are predicted to be near ambient noise levels and less than the Level B take levels for bowhead whales and seals. The Project location and configuration combined with mitigation measures, as well as those measures agreed to by ExxonMobil in the CAA, will result in the Project having no significant direct or indirect effects on bowhead whales, ringed seals, and bearded seals, their populations, or habitats.

### 5.3.1 Drilling

Drilling will occur on land and require transport of materials by barge and ice roads and the transport of workers by aircraft. Ice roads built over the sea ice will be located nearshore and within water depths generally ranging from 0 to 3 m (0 to 10 ft ); an area not used by seals during winter to early spring because the ice thickness renders the area between the ice and bottom substrate insufficient for use. Drilling may occur year-round, however, drilling into hydrocarbon zones is limited to the winter season (November 1 to April 15). The land-based location of drilling combined with modest noise levels associated with drilling and typically high ambient airborne noise levels from persistent winds will prevent drilling noises from being transmitted little if any distance beyond the coastline (Blackwell and Greene 2004). Similarly, airborne noises from drilling will not reach locations occupied by bowhead whales, which are typically not affected by industrial airborne noises from oil and gas facilities (Richardson et al. 1995). A small number of ringed seals and, in rare instances, bearded seals may be exposed to airborne drilling noise, but studies have demonstrated there is no noticeable effect on ringed seals and, by way of extension, bearded seals. Bearded seal responses to airborne noise have not been studied due to their small numbers in nearshore areas of the Beaufort Sea (Moulton et al. 2003; and Richardson and Williams 2004). Moreover, most ringed and bearded seals will be much farther offshore in the sea ice than near the Project (Kelly et al. 2010; and Cameron et al. 2010). Consequently, drilling is not anticipated to have any biologically significant effect on bowhead whales, ringed seals, or bearded seals.

Barging will occur during summer, generally between about July 15 and August 25, but may extend longer, and involve moving materials and personnel from Prudhoe Bay to the Project area. During the drilling phase of the Project, barging using coastal resupply barges will occur inside of the barrier islands, where barging activities are not likely to encounter bowhead whales, but may encounter a few ringed seals and, in rare instances, a bearded seal. Any unplanned barging outside the barrier islands could encounter small numbers of bowhead whales and small numbers of ringed and bearded seals. Bowhead whales could be exposed to underwater noise and the presence of the tugs pushing barges (Richardson et al. 1995), however, the underwater noise from the barges will be near ambient noise levels (measured at the Northstar Project) and well below the take levels for bowhead whales. In addition, any subtle effects on bowheads would be reduced by the low and steady engine noise levels and straight-line movement of the tugs, the long distance bowheads normally occur from shore, high ambient noise levels of the water; and the timing (typically September/October) of the fall migration in the Alaska Beaufort Sea, which is primarily after the cessation of barging operations (Funk et al. 2009). Similarly, studies have shown that ringed and bearded seals show little reaction to passing vessels (Richardson et al. 1995; and Brueggeman et al. 2009). The underwater noise levels will be below the take level for ringed and bearded seals. Moreover, most ringed and bearded seals move offshore to pack ice and remnant ice floes during summer and early fall, which are areas avoided by barges (Smith 1987). Any effects from barging are expected to be insignificant to the potentially small numbers of bowhead whales, ringed seals, and bearded seals potentially exposed to barging. It is also important to state that barging is a commercial operation common in the Beaufort Sea during summer for transporting materials to villages, oil and gas operations, and other North Slope developments or operations, and it is generally not subject to take regulation unless it is associated with a site-specific project activity such as seismic operations or marine mammal research involving intentional harassment.

It is not likely that a barge would strike and injure a bowhead whale and even less likely for a seal. The slow-speed and straight-line movement of the tugs pushing a barge combined with the long period of daylight would enable the captains, crew, and onboard MMOs to see and avoid striking a whale. All tug operators will be required follow measures to protect whales whenever safety is not an issue, and follow requirements of the CAA. Barges servicing the Northstar Project, the Oooguruk Drillsite, and ENI's Spy Island Drillsite in the Beaufort Sea made over 400 trips from July to October between 2006 and 2008, with no reported striking of a marine mammal (Funk et al. 2009). Correspondingly, the estimated distance traveled by barges for all activity in the Beaufort Sea during this same time period ranged from about 11,700 km to over 25,000 km (7,270 to over 15,534 mi), with no report of a collision with a marine mammal (Funk et al. 2009). Because of 1) the absence or near absence of vessel strikes (and no documented reports of barge strikes) of bowhead whales, ringed seals, or bearded seals published in the scientific literature (George et al. 1994; Kelly et al. 2010; and Cameron et al. 2010), 2) the absence of vessel strikes as a source of mortality in the NMFS stock assessment reports (Allen and Angliss 2010), 3) the characteristics of barge operation in the Arctic Ocean, and 4) data on recent barge traffic in the Beaufort Sea, the likelihood of a barge striking a bowhead whale, ringed seal, or bearded seal while servicing Point Thomson is insignificant.

In addition to barging, materials and personnel will be transported on ice roads built and maintained on the sea ice on or nearshore and within waters 0 to 3 m deep during winter, when bowheads and most bearded seals are not present in the Beaufort Sea and ringed seals are not known to occur within this water-depth zone (Moulton et al. 2001). NMFS does not consider this area ringed seal winter habitat when issuing incidental take permits. Therefore, ice road construction, maintenance, and vehicle travel will have no significant effect on bowhead whales, ringed seals, or bearded seals.

Aircraft transporting workers and supplies to and from the site year round should not affect bowhead whales and bearded seals from spring through fall, and ringed seals year-round. The airstrip will be 5 km (3 mi) inland from the coast, and will be primarily used by aircraft approximately the size of a Beechcraft 1900D or a Twin Otter. The runway will be designed and constructed to provide landing and take-off capabilities for a Hercules C-130 plane for emergency response or other special circumstances. Low-flying aircraft and helicopters have been demonstrated to cause temporary and short-term changes in bowhead whale, bearded seal, and ringed seal behavior (Richardson et al. 1995; and Burns and Harbo 1972). If an emergency requires an aircraft to fly over water, proven mitigation measures can prevent aircraft effects on bowhead whales, ringed seals, and bearded seals (Richardson et al. 1995; Kelly et al. 2010; and Cameron et al. 2010). These include avoiding flying over water during spring to fall and/or flying at altitudes scientifically demonstrated to not disturb bowhead whales (greater than 457 m [greater than 1,500 ft]). Aircraft are planned to follow an inland route, so there should be no effect of aircraft on bowhead whales, ringed seals, or bearded seals.

### 5.3.2 Construction

Construction will have similar effects on bowhead whales, ringed seals, and bearded seals as described above under drilling, since it will involve the same activities including barging materials, off-loading materials from grounded barges, building ice roads, and flying workers and materials to and from the site. In addition to coastal barges used during the drilling phase of the Project, oceangoing barges will be used to transport modules and supplies. A total of 7 to 10 sealift barges are planned to transport modules to the Project site during the 2013 to 2015 construction seasons generally between July 15 and August 25, but could be extended longer if necessary. A Sealift Bulkhead and Service Pier will be constructed and mooring dolphins installedto offload modules from the sealift barges and cargo from coastal barges. Pier and bulkhead construction (including pile driving and initial dredging and screeding) and dolphin placement will be during the first winter of the construction phase on sea ice in water depths less than 3 m (10 ft), which is too shallow to be inhabited by ringed seals. In addition, three barges will be temporarily grounded end-to-end in shallow water (less than 3 m deep [10 ft]) at the Project area for unloading materials from barges during summer. Grounding of the barges is expected to have no significant effect on bowhead whales, ringed seals, or bearded seals. Barge grounding would occur on- and nearshore in shallow water and sound transmission would be muted by the shallow-water location of the grounding (Richardson 1999) and not approach take levels. Noise levels would likely be below ambient levels (as measured at the Northstar Project) at the source or within a short distance from shore.

Some construction-related activities will occur more frequently and for longer periods of time over multiple years than the drilling phase of the Project. Sealift barges will primarily travel outside the barrier islands using established shipping routes, passing between the barrier islands through Challenge or Mary Sachs Entrance before landing at Point Thomson.

Bowhead whales, ringed seals, and bearded seals may be potentially exposed to more marine traffic during construction than during the drilling phase. Few if any bowhead whales and small numbers of ringed seals and even smaller numbers of bearded seals would be exposed to activities occurring within the barrier islands, since, as previously stated, most of these marine mammals occur beyond these islands. Furthermore, underwater noise from barging will be near ambient noise levels and below take levels for bowhead whales and seals. Barges outside of the barrier islands could encounter bowhead whales, but the number would be small, since bowheads are widely distributed in low densities over the outer continental shelf, typically a considerable distance (greater than 30 km [19 mi]) from the coast during the fall migration (Treacy et al. 2006). In addition, the fall migration from Canadian waters primarily begins after the end of barging operations, thereby, further reducing the likelihood of bowheads being exposed to barging, as stated earlier. Similarly, ringed and bearded seals are widely distributed in small numbers with most occurring in the pack ice located offshore of the barging routes (Cameron et al. 2010; and Kelly et al. 2010). Barge traffic during the construction phase is expected to have no biologically significant effect on bowhead whales, ringed seals, and bearded seals as reported in a number of studies examining effects of vessel noise and traffic on bowhead whales and seals (Richardson et al. 1995; LGL and Greeneridge 1996; Kelly et al. 2010; and Cameron et al. 2010). In addition, underwater noise levels from barging operations will be near ambient noise levels and below the take levels. MMOs on barges transporting materials between Prudhoe Bay and Point Thomson did not record any bowhead whales or note any more than a rare occurrence of an escape response (splash dive, etc.) by seals to the barges during 18, 120, and 28 trips during July, August, and September, respectively, from 2008 to 2010 (ExxonMobil 2010). Implementation of mitigation, including vessels altering courses to avoid bowhead whales, ringed seals, and bearded seals, is expected to further reduce exposure of bowhead whales and seals to barge traffic. Furthermore, bulkhead and pier construction and dolphin placement for the sealift and coastal barges will have no significant effect on bowhead whales, ringed seals, or bearded seals, because there would be no bowheads and bearded seals in the region during winter and water depths are too shallow at the construction site for winter use by ringed seals. Aircraft are not expected to affect bowhead whales, ringed seals, or bearded seals, since flights would generally occur inland from the coast.

Construction-related noise at the site is expected to be primarily airborne noise, which will have no effect on bowhead whales due to their characteristic respiration cycle of brief surfacing followed by long dives, the distance of the site from offshore areas typically used by bowhead whale, and relatively high ambient noise levels caused by persistent winds. While small numbers of ringed seals and fewer bearded seals may occur offshore from the construction site, studies have shown construction activity have no noticeable effect on ringed seals or, likely bearded seals (Moulton et al. 2003; and Richardson and Williams 2004). Moreover, during winter and early spring, ringed seals spend most of their time in snow lairs, where the snow has a dampening effect on airborne sounds (e.g., pile driving), considerably reducing the detectability of airborne sounds (Smith and Stirling 1975; and Blix and Lentfer 1992). Installation of pier pilings and dolphins will be done using pile driving through the ice during the winter, likely on grounded ice in water depths of less than 3 m (10 ft ) (not in ringed seal habitat). Any noise associated with this activity should be greatly attenuated by the combined sea ice and shallow depth of the water and snow cover on seal lairs in the air.

Dredging and screeding (leveling) of the seafloor would occur in the area in front of the Sealift Bulkhead and Service Pier during the winter through the ice (as described in Section 2.4.2) out to a depth of about 2 m (6 ft). Bowhead whales are not present during this period. Water depths within 10 m are not considered denning habitat for ringed seals, nor is this winter habitat for bearded seals. Therefore, none of these species would be in the immediate area during winter dredging and screeding and would therefore not be affected by these operations. If subsequent maintenance dredging and screeding is required during any of the three summer construction seasons to prepare for barge arrival, it would likely occur early during the open-water season, not later than mid-July. Bowhead whales would not have started their westward migration at this time and bearded seals would likely be further offshore near the ice edge. Neither of these two species would be affected by any noise and disturbance associated with summer maintenance dredging and screeding. Small numbers of ringed seals could be in the immediate area during these operations, and if so, would likely avoid the associated noise and disturbance. Such effects would be transitory, occurring during the short period (a few days up to 2 to 3 weeks) while the dredging and screeding was occurring. These effects would also be limited to the immediate area of the dredging and screeding, a very small area relative to their total habitat. No long-term effects from these operations are anticipated.

### 5.3.3 Operations

Operations will involve many of the same potential activities as construction, with the addition of on-site or barge-related potential oil spills. No more than a small number of bowhead whales and bearded seals during late summer or fall, and ringed seals year-round, would be potentially exposed to activities associated with operations. Similar to construction, operations are expected to have no significant effect on a small number of bowhead whales, ringed seals, and bearded seals potentially exposed to operations. No more than a very small proportion (less than 1 percent) of these populations are expected to be exposed to operations activities, since most bowhead whales, ringed seals, and bearded seals occur outside of the barrier islands and farther offshore in pack ice, where they are geographically widespread (Treacy et al. 2006; Kelly et al. 2010; and Cameron et al. 2010). Implementation of mitigation measures described for drilling and construction are expected to further mitigate any exposure of bowhead whales, ringed seals, and bearded seals to operations.

An oil spill during operations as well as during the drilling or construction phases of the Project is unlikely to affect bowhead whales, ringed seals, or bearded seals even if a spill occurred during spring breakup of the sea ice. The most likely spill scenario in the marine environment from the Project would be a small- (less than 100 gallons) to medium- (less than 1,000 gallons) size spill at the barge offloading area, which would be contained by booms or other containment equipment routinely placed around a barge as standard operating procedures. Any oil escaping from the containment equipment would likely be a small percentage and rapidly disperse by currents and waves. While such a spill could occur, there have been no oil spills from offshore or coastal oil and gas facilities or barges where more than small amounts (less than 100 gallons) of oil spilled into the Chukchi or Beaufort seas, thereby, posing no significant impact to no more than a few bowhead whales, ringed seals, bearded seals, their prey, or their habitats (Funk et al. 2009).

Another, but less likely scenario, would be from an oil spill from drilling operations reaching the marine environment during winter or spring. Oil spilled on solid ice during winter can be effectively recovered because it is restricted to the surface of the sea ice and the cold temperatures increase the viscosity and slow the movement of the oil. Oil would be more difficult to contain during spring when the ice is broken and moving, however, most bowheads would be considerably beyond the barrier islands at this time, since it would coincide with the spring migration when bowheads are widely distributed in time and space far offshore. Similarly, ringed and small numbers of bearded seals would also be widespread as singles or pairs of seals, with most offshore in the pack ice or on remnant ice floes as discussed in previous sections.

Historically, most spills in the Arctic during oil and gas operations have been small and quickly contained by the operator. In addition, oil and gas companies have oil spill response teams highly trained in spill containment and recovery. Warning systems are also in place for operators to quickly detect a spill and respond. Both the spill response teams and warning systems are expected to prevent any spill from becoming large enough to extend beyond the land and into the sea or outside the containment equipment, and have an effect on bowhead whales, ringed seals, and bearded seals. Therefore, potential effects of an oil spill would have no significant effect on bowhead whales, ringed seals, or bearded seals, their populations, or habitats.

Potential indirect effects to bowhead whales, ringed seals, and bearded seals from the project would be limited to 1) potential indirect loss of habitat through displacement by avoiding areas during barging as a result of increased noise and human activity, and 2) indirect effects through contamination of food resources resulting from potential oil spills. Their effects on these species, however, would be biologically insignificant for the same reasons discussed in the preceding section on operations. The probability, volume, and potential spread of different types of spills and the environmental components likely to be contaminated by them are summarized in Appendix A.

### 5.3.4 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that were reasonably certain to occur in the Action Area considered in this BA. Future federal actions that are unrelated to the proposed action, such as both onshore and offshore oil and gas activities, are not considered in this section because they require a separate consultation pursuant to Section 7 of the ESA. Non-federal actions that are reasonably certain to occur in the Action Area include subsistence harvests of fish and wildlife, marine traffic, and underwater noises from other oil and gas exploration and development activities.

Marine traffic, other than traffic associated with the Project or other federal actions, reasonably certain to occur, include resupply barges transiting the Action Area to and from Kaktovik. It is reasonably certain that the future levels of barge traffic to Kaktovik would be similar to current levels of barge traffic in the area. Impacts to bowheads and ringed and bearded seals from past barging activity (discussed above in Section 4.1.1.3) have not been significant. The same conclusion applies to reasonably certain future barging activities combined with underwater noise from other oil and gas operations.

It has been speculated, but is not reasonably certain, that there will be an increase in marine traffic (marine shipping and tourism) as sea ice diminishes due to climate change. It is also uncertain where or to what extent such activities might occur. An increase in marine traffic could potentially impact bowhead whales, and ringed and bearded seals through disturbance and fuel spills, however, such impacts cannot be assessed until the levels and risks become more fully known.

Subsistence harvests by residents of both Kaktovik and Nuiqsut in or near the Action Area for both whales, seals, and other species will also continue into the foreseeable future, at sustainable harvest levels as in the recent past (as described above in Section 4.1.2). Reasonably certain future subsistence activities within or near the Action Area are not expected to significantly impact bowhead whales, and ringed and bearded seals.

# 6.0 DETERMINATION OF EFFECTS

This BA considers the potential effects of the Project on the bowhead whale, ringed seal, and bearded seal and their habitats. The BA assesses the direct and indirect effects on these species and their habitats from each phase of the Project: Drilling, construction, and operations. Activities considered to potentially affect bowhead whales, ringed seals, and bearded seals during each of the three phases of the Project include underwater and airborne noise, barge traffic, oil spills, placement of grounded barges for offloading materials at the site, dock construction and dolphin placement, aircraft, and ice roads. The effects analysis shows that these activities would have no significant effect on bowhead whales, ringed seals, and bearded seals or their habitats. Consequently, all direct and indirect effects from the Project addressed in the analysis were determined to be insignificant to the bowhead whale, ringed seal, and bearded seals, their populations, and habitats as restated below.

The primary activity bowhead whales, ringed seals, and bearded seals could potentially be exposed to during the Project would be barge traffic. Barge traffic would occur during each phase of the Project, with most traffic planned to occur during the construction phase over a narrow window of time (most barging occurring approximately July 15 to August 25, but could extend beyond this period). Bowhead whales, ringed seals, and bearded seals could be exposed to barge traffic in three ways: Underwater vessel noise disturbing them, vessels colliding with them, or approaching vessels causing them to change course to avoid a collision. It is unlikely any more than a small number of bowhead whales, ringed seals, or bearded seals would be exposed to these activities, since most bowheads, ringed seals, and bearded seals occur farther offshore. Bowheads typically occur a considerable distance offshore (bowhead whales average over 31 km [19 mi] [Confidence Limits 30 to 42 km (19 to 26 mi)] during the fall migration) off the coast, where they are widely distributed in low densities over the outer continental shelf (Treacy et al. 2006). Ringed and bearded seals largely occur in offshore pack ice and ice remnants, areas avoided by barges. Underwater noise levels generated by barges would be near ambient noise levels and below the take level as designated by the NMFS for bowhead whales and seals as stated with supporting literature in previous sections. As described in the previous section, there is a substantial amount of barge and vessel traffic in the region during the open-water season that has occurred for many years without any documented effect on the health or growth of the bowhead whale, ringed seal, or bearded seal or their populations (Funk et al. 2009; and Allen and Angliss 2010). Moreover, commercial vessel traffic including barging is not considered by the NMFS as subject to incidental take regulations unless the vessel activity is site-specific (e.g., dredging), a seismic operation, marine mammal research, or engaged in intentional harassment such as chasing marine mammals.

Collisions or the visual presence of a barge will have no significant effects on bowhead whales, ringed seals, and bearded seals, since captains would be required to take actions to alter course to avoid these marine mammals whenever possible. Also, MMOs will be stationed on each lead vessel of a tug barge group to observe and alert captains of sightings to avoid and minimize disturbance of marine mammals. The slow movement and continuous noise of a traveling vessel typically does not disturb marine mammals, provided actions are taken to avoid directly approaching them as described earlier in this BA. Because barge traffic as well as other activities associated with each phase of the Project would have no significant effect on the small numbers of bowhead whales, ringed seals, and bearded seals potentially exposed to Project activities, the Project is *not likely to adversely affect* these species or their populations.

Based on these effect determinations, the Corps requests that NMFS concur with this determination and complete an informal consultation process without the preparation of a Biological Opinion for the Project.

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# APPENDIX A
## Oil Spill Preparedness

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ExxonMobil

POINT THOMSON PROJECT

# Oil Spill Preparedness

**June 17, 2011**

## Oil Spill Preparedness

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AAC | Alaska Administrative Code |
| ACS | Alaska Clean Seas |
| ADEC | Alaska Department of Environmental Conservation |
| ADNR | Alaska Department of Natural Resources |
| AOGCC | Alaska Oil and Gas Conservation Commission |
| Bbl | barrels |
| BCP | Blowout Contingency Plan |
| BHA | bottom-hole assembly |
| BPD | barrels per day |
| BOEMRE | Bureau of Ocean Energy Management, Regulation, and Enforcement |
| BOP | blowout preventer |
| BOPE | blowout prevention equipment |
| CRA | corrosion resistant alloy |
| EPA | United States Environmental Protection Agency |
| FBE | fusion bonded epoxy |
| FRP | Facility Response Plan |
| HAZOPs | Hazard and Operability analyses |
| Hazwoper | Hazardous Waste Operations and Emergency Response |
| ICS | Incident Command System |
| ILI | in-line inspection |
| IMT | Incident Management Team |
| IP3 | Integrated Pore Pressure Prediction |
| LWD | logging while drilling |
| MFL | Magnetic Flux Leakage |
| NARRT | North American Regional Response Team |
| NSB | North Slope Borough |
| NSSRT | North Slope Spill Response Team |
| NSTC | North Slope Training Cooperative |
| ODPCP | Oil Discharge Prevention and Contingency Plan |
| OIMS | Operations Integrity Management System |
| OSRO | Oil Spill Removal Organization |
| RAC | Response Action Contractor |
| RPS | Response Planning Standard |
| PCS | Plant Process Control System |
| Psi | per square inch |
| PTT | Protect Tomorrow. Today. |
| PWD | pressure while drilling |
| ROWs | right-of-ways |
| SCADA | supervisory control and data acquisition |
| SIS | Safety Instrumented System |
| SPCC | Spill Prevention Control and Countermeasures Plan |
| SRT | Onsite Spill Response Team |
| TRUE | Training to Reduce Unexpected Events |
| UOP | Unified Operating Procedures |
| USCG | United States Coast Guard |
| USFWS | U.S. Fish and Wildlife Service |

## INTRODUCTION

**This Appendix has been prepared by ExxonMobil to provide a summary of additional information with respect to Point Thomson Project oil spill prevention, preparedness and response.**

Spill prevention is the backbone of the Point Thomson Project's oil spill preparedness and is a fundamental part of the Project's spill response plan. This is in line with ExxonMobil's Corporate Environment Policy (http://www.exxonmobil.com/Corporate/community_ccr_envpolicy.aspx), which describes ExxonMobil's commitment to environmentally responsible operation. It is ExxonMobil's long-standing policy to conduct business in a manner that is compatible with the balanced environmental and economic needs of the communities in which ExxonMobil operates. ExxonMobil seeks to drive incidents with real environmental impact to zero, and to operate in a manner that is protective of the environment. ExxonMobil is committed to continuous efforts to improve environmental performance throughout its operations. Accordingly, the Point Thomson Project considers continuing improvement measures for environmental performance in areas such as: reducing air emissions, water discharges, ambient noise, light impacts, and waste; protecting wildlife; reducing the number and frequency of reportable environmental incidents, and eliminating spills.

For all activities, ExxonMobil strives to continuously improve upon its high safety and environmental performance. This is done primarily through rigid application of ExxonMobil's Operations Integrity Management System (OIMS), a mandatory internal requirement of all company operations at all levels at all times, and of the corporate environmental initiative **Protect Tomorrow. Today. (PTT).** PTT is the Corporate initiative providing guidance on environmental expectations. This management-driven initiative drives environmental progress with the goal of continuing improvement in environmental performance. ExxonMobil wants to achieve excellent environmental performance and be recognized as an industry leader who operates responsibly everywhere ExxonMobil does business, and be a Partner of Choice in Alaska. The Point Thomson Project fully embraces **Protect Tomorrow. Today.** in project design, construction, and future operations. ExxonMobil's vision for the Point Thomson Project includes the goal to be the Standard for Arctic Environmental Excellence. These are not just words, but fundamental ExxonMobil principles, management systems, and directives to operate safely, protect the environment, and, where appropriate, go beyond compliance with regulatory standards.

As stated, prevention is the backbone of Point Thomson's spill preparedness. Section 1 covers overall/project-wide preparedness and includes: design, construction, and operations prevention measures; training and special programs; and response capabilities and plans. Individual appendices emphasize prevention measures associated with pipelines (Section 2) and during drilling (Section 3). Additionally, Section 4 provides an overview of spill risks and potential spill scenarios.

# 1. PROJECT WIDE OIL SPILL PREPAREDNESS

## DESIGN, CONSTRUCTION, AND OPERATIONS PREVENTION MEASURES

Spill prevention and response are extremely important to the successful implementation of the Project. Spill prevention is the primary approach for oil spill preparedness. However, to be ready for any spills that may occur, comparable efforts are put into developing contingency plans used to respond to spills and providing training to personnel to ensure the prevention and response plans will be effectively implemented.

Numerous prevention and response measures have been and will be implemented at Point Thomson through the design, construction, drilling and operations phases. Each of these phases will have one or more separate management processes addressing spill prevention and response. Pipelines are discussed in Section 2. Drilling is discussed in Section 3.

Containment of hydrocarbons and prevention of spills is a major focus during Project design efforts. Similarly, construction and operations phases of the Project will employ numerous measures to prevent spills and to rapidly respond to any that may occur. Some of the general measures include:

- The well pad locations were chosen to allow development of offshore portions of the reservoir from onshore pads, thereby avoiding placement of drilling structures in marine waters. Small spills that might otherwise escape the pads and enter marine waters will be contained on the onshore pads or adjacent land.

- Formal Hazard and Operability analyses (HAZOPs), risk assessments, facility site reviews, design readiness review, independent project review and constructability reviews will be used to identify potential spill risks and associated prevention or response measures.

- Provisions have been made to ensure that the Point Thomson Project will not adversely impact North Slope subsistence users. ExxonMobil has established a Mitigation Agreement with the North Slope Borough (NSB) to provide rapid and direct financial assistance related to effects on subsistence resulting from a major marine spill.

- Storage tanks for oil and hazardous substances will be located within impermeable secondary containment areas. These storage tanks will not be stored within 100 feet of waterbodies, unless otherwise approved by the appropriate regulatory agencies.

- Spill response equipment and materials will be readily available at designated locations throughout the facility.

- Fuel transfers will follow BMPs, including using secondary containment devices. Refueling and transfer sites will be located away from the shoreline and river crossings and outside active floodplains.

*SPILL PREVENTION DURING FUEL TRANSPORT, STORAGE, AND USE*

Fuel transport, storage, and use will be conducted in accordance with applicable federal, state, and NSB requirements, and ExxonMobil's fuel transfer guidelines contained in the Point Thomson ODPCP. The Best Management Practice for spill prevention during fuel transfers established by ExxonMobil drew upon the guidelines and operating procedures applicable to North Slope operations developed by other operators and included in the North Slope Environmental Field Handbook Unified Operating Procedures (UOP). The UOP describes general fluid transfer guidelines, including conducting equipment inspections and checks, and positioning of equipment and hoses. The UOP has detailed descriptions of the proper use of surface liners and drip pans. The use of liners is mandated for: vacuum trucks, fuel trucks, sewage trucks, fluid transfers, all heavy and light duty parked vehicles, and support equipment (heaters, generators, etc.) within facilities. The UOP also describes secondary containment requirements, for hydrocarbon storage containers as well as for fluid transfers.

Visual monitoring is the primary method to determine fluid levels in tanks during loading and to detect leaks or spills during fuel transfers. All fuel transfers will be continuously staffed and visually monitored. Typically, diesel tanks will be filled via transfer of fuel from trucks using a fuel hose. Personnel involved in fluid transfers at Point Thomson will be specifically trained in accordance with fluid transfer guidelines. Personnel involved in the transfer will have radios and will be able to communicate quickly if a transfer needs to be stopped.

Diesel storage tanks on the site may be filled in the summer open-water season by transfer from a barge. Such transfers, if any, will comply with the requirements of 18 Alaska Administrative Code (AAC) 75, and will be covered by a U.S. Coast Guard-approved Facility Operations Manual and a U.S. Coast Guard-approved FRP (Title 33 of the Code of Federal Regulations, Part 154).

As described in the Point Thomson ODPCP, oil storage tanks will be located within secondary containment areas. These secondary containment areas will be constructed of bermed/diked retaining walls and will be lined with impermeable materials resistant to damage and weather conditions. These areas will be kept free of debris, including excess accumulated rainwater and snow accumulation during the winter season. They will be visually inspected by facility personnel as required by 18 AAC 75.075 (a) and SPCC Plans. In addition to being located within secondary containment, fuel storage tanks will be placed at least 100 feet from water bodies to the extent practicable. This is not practical in some cases, such as day tanks associated with pumps and light plants at water sources.

Tanks with capacities of 10,000 gallons (238 barrels) or more will conform to state regulations provided in 18 AAC 75.065. Inspections will be conducted in accordance with 18 AAC 75.065 (b).

To ensure proper reporting of spills and to improve spill prevention and response performance, ExxonMobil monitors and addresses all spills or potential incidents as follows:

- Reportable spills based on external guidelines and regulatory requirements Alaska Department of Environmental Conservation (ADEC), Alaska Department of Natural Resources (ADNR), Alaska Oil and Gas Conservation Commission (AOGCC), NSB, and National Response Center).

- Spills that are not agency reportable, but are internally reportable based on ExxonMobil guidelines.

- Near misses based upon ExxonMobil guidelines where no spill occurred, but an unintended or uncontrolled loss of containment could have led to a spill.

In all of these cases, ExxonMobil conducts a root cause analysis and implements appropriate corrective actions based on the results.

## TRAINING AND SPECIAL PROGRAMS FOR PREVENTION

The Project has a robust training system in place in order to ensure employee safety, regulatory compliance, and excellent environmental performance. General environmental, socioeconomic, and regulatory awareness training is mandated for all employee and contractor personnel assigned[1] to the North Slope. This training must be completed prior to arrival on the North Slope. Additional training will be provided, depending on the requirements of an individual's work assignment and the work to be performed.

The Project's overall training system covers different levels, from new worker orientation to periodic refreshers for experienced workers. The two primary components of this training program include the North Slope Training Cooperative (NSTC) Unescorted training program and the Arctic Pass training. Both programs ensure that Project personnel are aware of applicable regulatory approval conditions and requirements, as well as safety, health, environmental, socioeconomic, and security expectations and requirements related to working on the North Slope. The NSTC training was developed by other operators on the North Slope. It is a 1-day training seminar that is mandatory for all personnel working in, and unescorted visitors to, any operating field on the North Slope. Arctic Pass training was developed by ExxonMobil specifically for Point Thomson purposes and covers topics above and beyond NSTC training.

Arctic Pass training includes components related to environmental and cultural awareness, permit and regulatory compliance, wildlife interaction, the ODPCP and associated spill prevention and response efforts, and compliance with ExxonMobil and other applicable industry expectations.

Special prevention programs have also been and will continue to be developed where a need is identified. Examples include spill prevention plans developed specifically for barging and ice roads. These plans are unique to the Point Thomson Project and highlight the activities that present spill risks, special prevention measures to be implemented, and response procedures specific to the activity taking place. Key highlights of these programs are summarized as follows:

- Ice Road Spill Management Program
  - Project personnel are also considered to be "spill champions" on the ice roads, with the expectation that each individual is a steward of the environment, looking out for leaks on equipment, or for any other environmental hazards present during work activities.
  - A primary part of ice road activities includes a "Drips and Drops" Program to identify the causes/sources of small drips and drops, and learn from these observations to

[1] For personnel who will visit the North Slope 14 or more days in one year and will be working unescorted.

both reduce their number and avoid potentially larger spills. This program also includes strict vehicle maintenance and inspection and limiting use of older vehicles. All construction equipment is inspected to help identify/prevent leaks or other mechanical defects of vehicles prior to leaving Deadhorse or Point Thomson. Real time data collection (including number of drips, drip sources, number of equipment inspections performed, defects identified, etc) allows the Project to learn from previous performance and identify areas for improvement.

- Barging Spill Management Program
  - This program covers transportation of fuel as well as transportation of chemicals, materials, and equipment.
  - A primary element of this program is also that every team member is considered to be a "spill champion." As such, each individual is expected to be a steward of the environment, looking out for leaks on equipment, or for any other environmental hazards present during work activities.
  - Targeted equipment inspections are performed when the barge is loaded, to identify equipment that is leaking or has the potential to leak. This equipment can be repaired or replaced prior to traveling on the barge. This is very similar to the Drips and Drops program described as part of the Ice Road Spill Management Program.

**RESPONSE PLANS**

ExxonMobil is required to have several plans which relate to spill prevention and control. These include:

- An ADEC Oil Discharge Prevention and Contingency Plan (ODPCP)[2]
- A Federal Spill Prevention Control and Countermeasures Plan (SPCC)[3]
- United States Coast Guard (USCG) and United States Environmental Protection Agency (EPA) Facility Response Plans (FRPs)[4]

The ODPCP is the primary spill prevention and response document and, as required by ADEC in the current approved plan, will contain the following:

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[2] A copy of the current approved Point Thomson Project ODPCP as applicable to the recently completed drilling program has been submitted in the EIS process and is available from the Lead Federal Agency.

[3] SPCC plans for the initial drilling phase of the Project were developed and approved. SPCC plans covering the construction, operations, and future drilling phases will be developed and approved prior to initiation of those phases.

[4] Current FRPs are included in the ODPCP. Revisions will be developed in the future as the Project evolves.

- **Response Action Plan**: Describes all actions required by responders to effectively respond to a spill and includes an emergency action checklist and notification procedures, communications plan, deployment strategies, and response scenarios based on Response Planning Standards.

- **Prevention Plan**: Describes regular pollution prevention measures and programs to prevent spills (e.g., drilling well control systems, tank and pipeline leak prevention systems, and discharge detection and alarm systems). This plan also covers personnel training, site inspection schedules, and maintenance protocols.

- **Best Available Technology**: Presents analyses of various technologies used and/or available for use at the site for well source control, pipeline source control and leak detection, tank source control and leak detection, tank liquid level determination and overfill protection, and corrosion control and surveys.

- **Supplemental Information**: Describes the facility and the environment in the immediate vicinity of the facility. This section also includes information on response logistical support and equipment (mechanical and non-mechanical), realistic maximum response operating limitations, and the command system.

Together, these comprehensive spill prevention and response plans provide the overall framework for prevention and response. The plans will be maintained and updated to reflect the evolving nature of Project operations. The current ODPCP approval expires in March 2014, and a revision will be prepared for approval prior to that time. Updates to the current approved plan will be submitted as the Project evolves.

These Plans, approved by the appropriate agencies as required, are available for the current Point Thomson drilling program facilities and operations. However, these facilities will change over the next number of years as the Project transitions from drilling to construction and finally operation. The Plans are required to be responsive to the facilities at any point in time, and the Project team will modify them as substantial facility changes occur (such as when mobilization for construction begins). The Project will operate under an approved ODPCP for all phases (construction, drilling, and operations).

Throughout this time period, ExxonMobil will continue to maintain spill response capabilities:

- Properly staffed and trained teams

  - Onsite Spill Response Team (SRT)

  - Incident Management Team (IMT)

  - ExxonMobil's internal spill response organization, the North American Regional Response Team (NARRT)

- Contract with ACS as the primary Oil Spill Removal Organization (OSRO) and Response Action Contractor (RAC) for Point Thomson

- Participation in the North Slope Operator's Mutual Aid Agreement for Oil Spill Response

Although plan revisions will be responsive to facilities of the day; it should be noted that, for instance in the current ODPCP, the Response Planning Standards and Scenarios cover most of the situations ExxonMobil might anticipate in the future, including Thomson sand and Brookian blowouts during drilling, and a large diesel storage tank rupture. Thus, the scenarios and response tactics for blowouts and hydrocarbon storage in the current ODPCP would be similar to those in an ODPCP associated with the future operating facility.

An area not covered in the current ODPCP is associated with gathering and/or export pipelines. The pipeline design team has estimated that the maximum spill from an export pipeline rupture (large leak scenario with loss of 100% of the flow) would be 2,590 barrels. The maximum export pipeline spill calculated by the design team was 3,346 barrels, from a pinhole leak (0.7% of the flow lost) that continues undiscovered for 10 days. These are well below the Response Planning Standard (RPS) of 85,500 barrels for a Brookian blowout in the current ODPCP, indicating that a pipeline rupture would likely not be considered the worst case scenario discharge. However, ExxonMobil anticipates including a pipeline rupture scenario in a future revision of the ODPCP. Activities associated with transportation of diesel fuel to the Project site are also anticipated to increase, particularly when drilling of future wells is taking place. If an incident with a barge offloading fuel at Point Thomson was to occur, the amount of fuel involved would not exceed the Response Planning Standard.

## RESPONSE CAPABILITIES

Oil spill preparedness includes both spill prevention and response. While there is a strong focus on prevention and planning, a comprehensive plan cannot be effectively implemented without adequate response capabilities. To that end, the Project also has built a strong response capability to address any spills which may occur, small or large. Key plan components related to spill response include:

- Developing and implementing comprehensive spill response plans – ODPCP, SPCC, and FRPs. These plans are described in greater detail in the "Response Plans" section.
- Training and drills for personnel.
- Access to about 600 trained responders within 24 to 48 hours.
- On-site ACS personnel.
- On-site spill response equipment.
- Oil Spill Contingency Mitigation Agreement. This agreement with the NSB ensures that Point Thomson will not adversely impact North Slope subsistence users by providing rapid and direct financial assistance related to effects on subsistence resulting from a major marine spill.

To implement effective response plans, it will be necessary to have sufficient numbers of properly trained personnel. This is an ExxonMobil priority. Personnel are trained in the Incident Command System (ICS), Hazardous Waste Operations and Emergency Response (Hazwoper), and other specialties as needed by position. The response drills and exercises to maintain readiness will include federal, state, and NSB personnel as appropriate. There are currently estimated to be about 600 trained responders available within 24 to 48 hours, as summarized below (these numbers will vary over time):

- Point Thomson site SRT with approximately 10 personnel.

- An Anchorage-based IMT with about 60 members, prepared to respond to any spill event.

- ExxonMobil's North American Regional Response Team with over 130 members. About 45 personnel can be mobilized to Alaska in less than 24 hours in the event of a major spill response effort, as needed.

- ExxonMobil retains ACS as its OSRO and primary Response Action Contractor, as approved by the U.S. Coast Guard and ADEC, respectively. ACS owns response equipment totaling over $50 million and has about 80 employees, all of whom are available to assist in an oil spill response at Point Thomson.

- The North Slope Operators Mutual Aid Agreement for Oil Spill Response provides for maintains over 115 North Slope Spill Response Team (NSSRT) personnel on the Slope at any time who are trained and qualified to assist in spill response.

- Through ACS, ExxonMobil has access to over 250 qualified spill responders through contracts with the Auxiliary Contract Response Team.

- ACS Village Response Teams currently have over 15 qualified spill responders, and are continually recruiting new members.

ACS personnel will be on-site during drilling, construction, and operations. These personnel specialize in oil spill response and receive specific training to maintain their oil spill response capabilities. They are integral members of the Point Thomson Project team and work closely with the on-site Field Environmental Advisors. As they do for other North Slope oil production operations, ACS technicians will help assemble, store, maintain, and operate the Project's spill response equipment.

In addition to maintaining dedicated spill response professionals on-site, the Point Thomson Project will maintain spill response equipment on-site. The facilities design includes several oil spill response specific features, including:

- Dedicated maintenance, training, personal gear and equipment storage space for ACS personnel and equipment.

- Spill response vessels, such as shallow-draft boats capable of traversing the near shore waters common in the area, will be maintained at the Central Pad during the summer open-water season to respond to potential spills into streams and the near shore marine environment. Small barges for storing and hauling oil recovered from potential marine oil spills will also be staged, as appropriate.

- A launching ramp has been incorporated into the design of the Central Pad to facilitate oil spill response access by ACS.

- Oil spill response equipment will be primarily stored at the Central Pad. The equipment is expected to include containment and absorbent boom, skimmers, portable tanks, pumps, hoses, generators, and wildlife protection equipment. Snow machines and other vehicles for off-road access will also be stored on the Central Pad. Equipment will not typically be staged at the East and West Pads, but may be stored on these pads to provide timely response during certain operations.

- Other equipment used in day-to-day operations and not dedicated to oil spill response, such as loaders, earth moving equipment, and vacuum trucks, will supplement the dedicated spill response equipment, as required.

In addition to providing response personnel, response equipment, and maintenance, ACS provides a Technical Manual[5] which includes a Tactics Manual[6] that describe the various response techniques and equipment that are used by ACS spill response technicians. These response tactics are standard for all the areas in which ACS provides OSRO services, so that all responders are familiar with, and trained on, standardized techniques. These tactics are referenced in the spill response plans and will form the backbone of the response strategies implemented during spill response situations.

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[5] The ACS Technical Manual can be accessed at the following location on the internet: http://www.alaskacleanseas.org/tech-manual/

[6] The ACS Tactics Manual can be accessed at the following location on the internet: http://alaskacleanseas.org/wp-content/uploads/2010/12/ACS_Tech_Manual_Rev9_Vol1-TACTICS.pdf

# 2. PIPELINE SPILL PREVENTION AND CONTROL MEASURES

## SUMMARY

The design of the Point Thomson Export Pipeline and gathering pipelines employs the best available technology with the goal to go beyond regulatory requirements related to health, safety, and environment.

Design of the Export Pipeline and gathering lines incorporates many elements intended to prevent possible corrosion, both internal (dehydration and corrosion inhibitor on Export Pipeline; and internal corrosion resistant alloy (CRA) lining/cladding on the gathering lines) and external (fusion bonded epoxy coating beneath a jacketed insulation system on Export Pipeline and gathering lines). With these measures in place the possibility of a leak is considered very unlikely.

In addition, measures will be taken during construction and pipeline operation to avoid and/or minimize potential spills. These include: pipeline hydrostatic testing; corrosion prevention and monitoring through the use of the use of cleaning and in-line inspection tools, and Electric Resistance probes and Corrosion Coupons; leak detection systems; and pipeline surveillance.

For a future ODPCP, a pipeline spill scenario will be included. A loss of containment study was therefore done to provide a basis for that future scenario.

Further details on design and operational mitigation measures, and the loss of containment study are provided below.

## DESIGN MITIGATION MEASURES

The Export Pipeline will be a nominal 12-inch diameter, 22 mile long pipeline designed, constructed and operated in accordance with 49 CFR 195 and 18 AAC 75.047. The infield gathering lines will consist of two nominal eight-inch diameter, 5 mile long (each) pipelines. The infield lines will be designed, constructed, and operated in accordance with 18 AAC 75.047 which includes corrosion monitoring and control standards.

### *CORROSION CONTROL*

Consistent with current North Slope practices, the Export Pipeline and gathering lines will have a shop applied fusion bonded epoxy (FBE) external coating to further reduce the risk of external corrosion. The lines will also be covered by three inches of polyurethane foam encapsulated with a roll-formed, interlocked, metal jacket. This insulation-jacket system has a proven North Slope track record of preventing moisture ingress.

Field joints will be coated with field-applied FBE or two part epoxy coating, insulated, and jacketed to coincide with best available North Slope practices for preventing external corrosion.

Internal corrosion in the Export Pipeline will be controlled by dehydration of the liquid hydrocarbon product, and injection of corrosion inhibitors as needed.

The Export Pipeline will also have a 0.125-inch corrosion allowance included in the wall thickness, while the gathering lines will incorporate the use of corrosion resistant alloy in the design.

All lines will be designed to allow maintenance pigging to remove any sediments or other deposits.

*OTHER MEASURES*

The first 4.4 miles of the Export Pipeline will have an additional allowance applied to the wall thickness to reduce the likelihood of damage from incidental bullet strikes during subsistence hunting activities (these activities typically occur in bays and inlets along the coast). The amount of additional wall thickness to be added as protection against accidental bullet strikes was based on both tabletop calculations and actual field testing. The remainder of the Export Pipeline has sufficient setback from the coast that no additional wall thickness is necessary.

The wall thickness required for design pressure (full well head shut-in pressure) containment of the gathering pipelines is sufficient to provide protection against accidental bullet strikes and no additional wall thickness is necessary.

**OPERATIONAL CONTROLS**

*CORROSION MONITORING*

The Export Pipeline and gathering lines will accommodate a range of in-line inspection (ILI) tools, including Magnetic Flux Leakage (MFL) for detection of internal and external metal loss, and other ferrous anomalies; and Geometry/Deformation for locating, sizing, and determining the orientation of diameter reductions (dents, wrinkles, etc.). The launcher and receiver facilities are capable of handling the latest generation of instrumented “smart” pigs that can provide pipeline integrity monitoring.

The Export Pipeline and gathering lines are also designed with electric resistance probes and corrosion coupons at strategic locations on the pipeline system. Electric resistance probes will be used to provide immediate corrosion readings without line interruptions, while corrosion coupons will be used to determine the average corrosion rate over time.

*SURVEILLANCE*

Regular surveillance of the Export Pipeline, and gathering lines will be conducted in accordance with Federal Regulations (49 CFR 195), ADEC Regulations (18 AAC 75), ASME B31.4 requirements (for Export Pipeline), and ASME B31.8 requirements (for gathering lines).

Visual monitoring of the Export Pipeline and gathering lines will typically be conducted weekly by aerial surveillance, unless precluded by safety or weather conditions.

*HYDROSTATIC TESTING*

The Export Pipeline will be hydrostatically tested to a minimum test pressure above required regulatory minimum (150% of MOP versus 125% of MOP per code). This measure provides better assurance of integrity.

The gathering lines will be hydrostatically tested to a minimum test pressure of 125% of MAOP per ASME B31.8.

**LEAK DETECTION**

A leak detection system will be installed on the Export Pipeline, which meets ADEC requirements section 18 AAC 75.055 and 18 AAC 75.425 (e)(4) part 4. This system will use a state of the art computational leak detection system to perform real-time monitoring for pipeline leaks, and will be continually updated via a supervisory control and data acquisition (SCADA) system. To provide a second level of protection, which goes beyond the regulatory requirements, ExxonMobil is also installing a proprietary leak detection system which relies on data from pressure transmitters to detect leaks.

The SCADA function will be an integral part of the Plant Process Control System (PCS) and Safety Instrumented System (SIS). The system is still being designed, and the final system will have similar leak detection capability to that described below.

As currently planned, there would be SCADA facilities at both ends of the 22 mile long 12-inch nominal diameter pipeline. There would be no intermediate valve stations or instrumentation between these two SCADA facilities.

The main functions of the above system are to provide:

- Custody transfer metering at Point Thomson Central Pad facilities utilizing coriolis flow and density measurement
- Remote SIS actuated safety shutoff valves at both facilities
- A meter based leak detection capability
- Line Pressure and Temperature monitoring at both ends
- Data to leak detection software

Data would be transmitted from Badami to the CPF via microwave.

The computational leak detection system chosen for real-time pipeline leak monitoring is ATMOS™ Pipe, which is a statistical detection and location system. ATMOS™ Pipe is one of the most tested leak detection systems in the world. It has been successfully applied to oil, gas, multiphase, chemicals, water and multi-product pipelines both on land and subsea; including Shell, BP, ExxonMobil, Dow, Air Liquide and many other pipeline companies.

ATMOS™ Pipe applies the Sequential Probability Ratio Test to the corrected flow balance system after a comprehensive data validation process. The system does not use complicated hydraulic models to simulate a pipeline. Instead, it continuously calculates the statistical probability of a leak based on fluid flow and pressure measured at the inlets and outlets of a pipeline. Depending on the control and operation of a pipeline, pattern recognition techniques are used to identify changes in the relationship between the pipeline pressure and flow when a leak occurs.

ATMOS™ Pipe has detected more than 400 real leaks in gas and liquid pipelines. In gas pipelines ATMOS™ Pipe has detected leaks as small as 1% of throughput. However, sensitivity in gas pipelines is generally not as good as in liquid pipelines, therefore detection of leaks as small as 1% of throughput in liquid lines is quite normal. This does of course depend on the performance of the instrumentation, especially the flow meters. With detection at ≤1% of the nominal flowrate, the smallest detectable leak would be 100 barrels per day (BPD) based on a nominal pipeline flowrate of 10,000 BPD.

The ability to detect leaks under transient conditions without false alarms makes ATMOS™ Pipe unique among all leak detection technologies. As soon as a leak warning is generated, ATMOS™ Pipe provides the leak-rate and location estimates.

The SCADA data is collected and transmitted to the CPF continuously with a 2-4 second cycle time. This data is continuously input to Leak Detection Software run on a dedicated PC.

The gathering pipelines are not amenable to leak detection by the same system due to the nature of the product (three-phase flow). Leak detection on gathering lines will be performed by pressure monitoring and visual observations and inspections.

**LOSS OF CONTAINMENT CALCULATION**

*EXPORT PIPELINE*

A study of the Export Pipeline was conducted to ascertain the potential spill volumes should a leak develop in the system, taking into consideration the elevation profile changes along the alignment.

In the event of a pipeline failure, the amount of oil spilled is the sum of several components. The components included in the loss of containment study are:

- Length of time to detection
- Operator reaction time
- Valve closure time and pipeline/fluid decompression
- Pipeline drainage

This approach is in compliance with 49 CFR 194.105 and 18 AAC 75.4.436.

The Export Pipeline will have isolation valves installed at the pipeline inlet on the Central Pad and outlet at Badami. At the largest creek crossing, East Badami Creek, vertical loops have been incorporated into the design as isolation devices in lieu of valves. The use of vertical loops in these situations has been approved on other North Slope pipelines (e.g., Alpine).

Four leak scenarios were investigated:

- A pinhole leak just below the detectable limit of the system of 0.7% of flow, discovered within 10 days via visual surveillance
- A small leak of 2.5% of flow detected within 24 hours. (Note: Minimum threshold of detection is 0.7% of flow.)
- A medium leak of 5% of flow detected within 1 hour

- A large leak (catastrophic guillotine failure) of 100% of flow detected within 5 minutes

Estimated spill volumes for each leak scenario were calculated at each end of the line, all creek crossings, and other identified low points along the alignment. All calculations were done assuming peak production of 13,000 bpd (nominal production rate is 10,000 bpd) even though this rate is not expected to be achieved except for very short periods of time due to variations in composition of the produced fluids. A summary of the volumes estimated is presented in the table below.

| **Location** | **Pinhole Leak (barrels) 0.7% of flow** | **Small Leak (barrels) 2.5% of flow** | **Medium Leak (barrels) 5% of flow** | **Large Leak (barrels) 100% of flow** |
|---|---|---|---|---|
| CP | 2,152 | 1,567 | 1,270 | 1,362 |
| “C” Creek | 2,486 | 1,901 | 1,604 | 1,723 |
| “D” Creek | 3,245 | 2,660 | 2,362 | 2,480 |
| “E” Creek & Creek 18A | 3,346 | 2,761 | 2,463 | 2,590 |
| Low Point between "E" and "F" Creeks | 1,798 | 1,213 | 916 | 1,047 |
| “F” & “G” Creeks | 2,687 | 2,102 | 1,805 | 1,931 |
| “H” & “I” Creeks | 2,514 | 1,931 | 1,633 | 1,757 |
| “J” Creek | 1,443 | 858 | 560 | 692 |
| “K” Creek | 2,632 | 2,046 | 1,749 | 1,884 |
| “L” Creek | 2,290 | 1,704 | 1,407 | 1,543 |
| Low Point between "L" and "M" Creeks | 2,279 | 1,694 | 1,396 | 1,544 |
| “M” Creek | 1,942 | 1,357 | 1,059 | 1,209 |
| “N” Creek | 1,699 | 1,113 | 816 | 968 |
| First Low Point between "N" and "O" Creek | 1,849 | 1,262 | 965 | 1,117 |
| Second Low Point between "N" and "O" Creek | 1,709 | 1,123 | 826 | 980 |
| “O” Creek | 1,625 | 1,040 | 743 | 919 |
| East Badami Creek | 1,356 | 771 | 473 | 642 |
| Middle Badami Creek | 1,948 | 1,363 | 1,066 | 1,250 |
| West Badami Creek | 1,809 | 1,224 | 926 | 1,101 |
| Low Point between West Badami Creek and Badami | 2,141 | 1,556 | 1,258 | 1,435 |

| Location | Pinhole Leak (barrels) 0.7% of flow | Small Leak (barrels) 2.5% of flow | Medium Leak (barrels) 5% of flow | Large Leak (barrels) 100% of flow |
|---|---|---|---|---|
| Badami | 2,135 | 1,550 | 1,252 | 1,493 |

The potential maximum spill volumes for the four scenarios are summarized as follows:

- Pinhole leak scenario (0.7% of flow) is 3,346 barrels
- Small leak scenario(2.5% of flow) is 2,761 barrels
- Medium leak  scenario (5% of flow) is 2,463 barrels
- Large leak scenario (100% of flow) is 2,590 barrels

The potential leak volumes for the Export Pipeline discussed above were based on worst case conditions in all cases. The summary results above show that the pinhole leak will be the possible worst case spill scenario (3,346 barrels of potential spill) instead of the large leak scenario (2,590 barrels of potential spill), because the detection time used to calculate the pinhole leak analysis was 10 days (which is the possible worst case detection time). This assumes that normal weekly surveillance is delayed due to extreme weather (the study determined that a 3-day delay due to extreme weather was a reasonable assumption).  Thus, the analyses employed the most conservative possible assumptions for (1) peak flow, that is likely only sustainable for a few hours at most, and (2) the maximum time to detect, which in the case of the pin-hole leak means (a) the leak would have to occur immediately following a weekly surveillance and (b) the next weekly surveillance is also delayed by extreme weather.

*EAST AND WEST GATHERING LINES*

The potential release volumes for the east and west gathering pipelines were calculated assuming:

- Length of time to detection
- Operator reaction time
- Large leak scenario (100% of flow)
- Contents in gas phase resulting in complete evacuation of the lines and discharge of entire equivalent liquid volume
- Summer and shut-in conditions
- All liquid hydrocarbon is lost before any containment can be mobilized and implemented

The East Gathering Pipeline is approximately 25,700 feet in length (4.9 miles) with a total volume of gas of approximately 4.0 million standard cubic feet. The maximum equivalent volume of liquids that might be lost is 550 barrels.

Similar calculations for the West Gathering Pipeline with an approximate length of 25,300 feet (4.8 miles), indicates that the maximum equivalent volume of liquids that might be lost is 546 barrels.

## 3. DRILLING PREVENTION MEASURES

Numerous spill prevention and response measures have been and will be implemented at Point Thomson through the design, construction, drilling and operations phases. Each of these phases will have one or more separate management processes addressing spill prevention and response. This section focuses on Drilling. Pipelines are discussed in Section 2. Other overall project-wide oil spill preparedness measures are discussed in Section 1.

Drilling operations at Point Thomson are unique to the North Slope of Alaska and many special spill prevention and response measures are used. While some drilling measures are regulatory conditions (e.g., limiting drilling into hydrocarbon zones during certain seasons of the year or AOGCC drilling related regulations), most of the following are based on ExxonMobil's drilling experience and practices.

The primary drilling related oil spill prevention measures include:

- Comprehensive well planning process
- Drilling rig designed/upgraded specifically to meet Point Thomson drilling requirements
- Four-ram type blowout preventers vs. three for normal North Slope operations
- Comprehensive Well Control Blowout Contingency Plan
- Adherence to seasonal drilling restrictions which limit drilling into hydrocarbon zones to winter conditions

Measures implemented during drilling have included, and will continue to include as appropriate, these and others, which are described in some detail in this Appendix.

### TRAINING

Having well-trained personnel is critical to safe and successful drilling operations. It is necessary to provide training to ensure drilling personnel understand the procedures to safely maintain control of the wells. Key training activities will include certified well control training for: drilling supervisors, operations superintendents, drilling engineers, contractor rig drillers, tool pushers, assistant drillers, derrickmen, and other appropriate personnel. The curriculum consists of training in blowout prevention technology and well control, and Training to Reduce Unexpected Events (TRUE).

TRUE involves a multifunctional team made up of rig contractor, service company, and operator personnel prior to commencing operations. It focuses on increasing knowledge and awareness to prevent and deal with potential hazards. The training is based specifically on Point Thomson wells, and its goal is to provide site-specific solutions to potential problems before they occur. Potential hazards are defined by the team, including well control and lost returns. Action plans are developed to identify roles and responsibilities, warning signs, how to react to an event, and lines of communication. Special emphasis is placed on abnormal pressure detection and well control. The training establishes a team concept and a team approach to identifying and solving problems.

## WELL PLANNING

The comprehensive well planning process for the Point Thomson PTU-15 and PTU-16 wells was the first step in preventing spills or releases, and ensuring the safe drilling of the wells. This planning process will be applied to the drilling of future Point Thomson wells.

During well planning, ExxonMobil uses an Integrated Pore Pressure Prediction (IP3) Team consisting of reservoir engineers, geologists, drilling engineers, and computer modelers. The IP3 Team analyzes seismic data, data from exploration wells, and geologic models to predict pore pressure and fracture gradients, and to develop a detailed understanding of the reservoir. The use of advanced technology enables accurate prediction of formation behavior as wells are drilled, and allows the engineer to plan a well that minimizes the risk of a well control incident. In addition, bottom-hole pressure data from other wells in the area and seismic data have been reviewed to ascertain the expected bottom-hole pressure at the proposed well location.

The bottom-hole pressure predictions are used to design a drilling mud program with sufficient hydrostatic head (determined by the mud density or “weight” and height of the mud column) to overbalance the formation pressures from surface to total well depth. Other factors influencing the mud weight design are shale conditions, fractures, lost circulation zones, under-pressured formations, and stuck-pipe prevention. The well casing program is designed to allow for containment and circulation of formation fluid influx out of the wellbore without fracturing open formations.

## DRILLING RIG AND WELL CONTROL/BLOWOUT PREVENTION EQUIPMENT

More and higher pressure-rated blowout prevention equipment (BOPE) than other North Slope drilling will be used for Point Thomson. During drilling operations below the surface-hole, the Point Thomson BOPE will consist of:

- A minimum of four; 13 5/8-inch, 10,000 pounds per square inch (psi) working pressure, ram-type preventers
- One 13 5/8-inch annular preventer (rated to 10,000 psi)
- Choke and kill lines that provide circulating paths from/to the choke manifold
- A two-choke manifold that allows for safe circulation of well influx out of the wellbore
- A hydraulic control system with accumulator backup closing capability

While most North Slope drilling operations use four preventers (three ram-type and one annular type), a fifth preventer was incorporated into the blowout preventer (BOP) stack arrangement to further reduce risk at Point Thomson. A BOP stack with four sets of rams and one annular preventer will be used to drill below surface casing, providing one more preventer than required by AOGCC regulations. This arrangement allows two preventers to close on the casing and liners and, in the case of liners, permits two ram-type and one annular preventer to be used on the drill-pipe running-string without having to stop and change out rams. The extra ram preventer will also provide added redundancy.

Prior to acceptance of the drilling rig, comprehensive inspection and testing will be performed on the BOPE, including:

- Test BOPE to the full rated working pressure (10,000 psi)
- Test choke manifold equipment to the full rated working pressure
- Test the BOP accumulator unit to confirm that closing times meet American Petroleum Institute standards and meet or exceed AOGCC requirements
- Verify pre-charge pressure and total volume of the accumulator bottles
- Install new ring gaskets and seals between each BOP component
- Test pressure integrity of the high-pressure mud system
- Inspect drill string and bottom-hole assembly (BHA) components to the most stringent "T.H. Hill DS-1 Category 5 level."[7] While operating, the BOPE will be tested according to AOGCC and ExxonMobil requirements, which is typically every 7 or 14 days. AOGCC field inspectors may witness these pressure tests.

## WELL CONTROL WHILE DRILLING BELOW THE SURFACE HOLE

*Well Control Monitoring and Procedures.* While drilling, the well will constantly be monitored for pressure control. The mud weight (the primary well control mechanism) will be monitored and adjusted to meet actual wellbore requirements. A range of mud weights will be used as the well is drilled to provide the proper well control for the formation conditions encountered. Automatic and manual monitoring equipment will be installed to detect abnormal variation in the mud system volumes and drilling parameters.

If an influx of formation fluid (kick) occurs, secondary well control methods will be employed. Constant monitoring of the total fluid circulating volume and other drilling parameters will ensure that a kick is quickly detected. The well annulus will be shut-in using the BOPE. The drill pipe will be shut-in by a down hole check valve near the bit and a surface-mounted valve. This will contain the influx and any associated build-up of surface pressure. It will also prevent further influx of formation fluid into the wellbore. After the well is stabilized, a well kill procedure will be developed and implemented to circulate kill-weight mud and safely remove formation fluids from the hole. Mud-gas separators and degassers will be used to remove gas from the mud as it is circulated out of the hole. After this procedure is completed, the kill effectiveness will be confirmed and the well will be opened up and the fluid levels monitored. Drilling operations will not resume until conditions are normal.

BOP drills will be performed on a frequent basis to ensure the drilling crews can quickly and properly shut-in the well. Certified training of Point Thomson personnel will include hands-on simulator practice at recognizing kicks, well shut-in, and circulating the kicks out of the wellbore.

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[7] "T.H. Hill DS-1 Category 5 level" refers to an inspection and qualification document written by T.H. Hill Associates, Inc., that is considered industry standard for drill string and BHA inspections, as well as quality control of the drill string equipment.

*Bottom-Hole Pressure Measurements.* ExxonMobil will measure bottom-hole pressure while drilling, with computer-assisted analysis of drilling fluids circulation. State-of-the-art technology will be used to enhance drilling performance and mitigate risk. Several of the technologies are known as logging while drilling (LWD) and pressure while drilling (PWD). The LWD system enhances early detection of over-pressured intervals or possible lost circulation zones. The PWD system directly monitors bottom-hole pressures to maintain sufficient overbalance without compromising formation integrity. Early detection of overpressure and maintaining sufficient overbalance while drilling will minimize any chance of a well control event.

*Overbalanced Drilling Confirmation Technique.* The “10/10/10 Test” developed by ExxonMobil is an analytical technique to help evaluate whether an overbalanced situation exists in the wellbore. It can provide accurate and early diagnostics of the formation pressure before the potential kick interval is reached. The 10/10/10 Test involves circulating the well for 10 minutes to establish background gas, discontinuing mud circulation for 10 minutes to reduce equivalent circulating density, and circulating the wellbore for an additional 10 minutes. Mud is then circulated from the bottom of the well, without further drilling, to the surface. Gas concentrations are measured, and an evaluation is done to determine whether the overbalance is sufficient.

*Computer-aided Management of Inspection, Maintenance, and Repair.* ExxonMobil will use a computerized preventive maintenance program to help manage inspection, maintenance, and repair of the drilling rig and associated equipment. The drilling contractor’s preventive maintenance program will be reviewed, a gap analysis will be performed, and an agreed-upon computer-aided system will be followed. The contractor will have the responsibility to maintain the program, while the operator closely monitors the inspection, maintenance, and repair program.

*Well Control Blowout Contingency Plan.* While the potential for a blowout at Point Thomson is extremely low, ExxonMobil has developed a Well Control Blowout Contingency Plan (BCP) to address controlling a potential blowout in the shortest possible time. This plan relies upon well capping as the primary means of controlling a blowout. Well capping is proven and will normally control a blowout in far less time than a relief well. The BCP address critical logistical elements of bringing the well capping equipment to the location.

A key element of the BCP is to ignite a Thomson Sand gas condensate blowout. This is an effective method of “source control.” Air quality modeling has demonstrated that such a blowout would burn cleanly and would not violate national ambient air quality standards. ADEC has granted pre-approval for wellhead ignition and ExxonMobil will be prepared to implement well ignition within two hours of a blowout occurring, if that is the chosen response measure.

## 4. SPILL RISKS AND POTENTIAL SPILL SCENARIOS

Spill events could result in the increased risk of mortality or injury to biological species as a result of contact or ingestion of oil or other contaminants spilled at drilling/production facilities, on roads, near pipelines, or into the marine environment along barging routes.

### POTENTIAL FOR SPILLS ON THE NORTH SLOPE

The greater than 40 year history of North Slope oil exploration, development, and production shows that the vast majority of oil, produced fluids, salt water, and other material spills have been very small (fewer than 10 gallons (0.24 barrels)) and very few have been greater than 100,000 gallons (2,381 barrels) (NRC 2003, Mach et al. 2000, MMS 2007). History also indicates that small spills have and will occur over the life of the Project. However, based on the empirical experience of North Slope oil companies, the record of spills in the ADEC database (2010), and the experience of oil field operations in the contiguous United States, the likelihood of a very large spill greater than 100,000 gallons (2,381 barrels) would be extremely low, and the likelihood of a large spill over 1,000 gallons (23.8 barrels) would be low. Most spills have been contained on gravel pads or roads (NRC 2003), and most of those that have reached the tundra have covered fewer than 5 acres. On detection, spills that have occurred were promptly cleaned up as required by state, federal, and borough regulations (NRC 2003). Impacts from most of these spills were judged minor, and natural, or human-assisted restoration has generally occurred within a few months to years (NRC 2003).

In this analysis potential spills are categorized as follows:

- Very small spills — less than 10 gallons (0.24 barrels)
- Small spills — 10 to 99.5 gallons (0.24 to 2.4 barrels)
- Medium spills — 100 to 999.5 gallons (2.4 barrels to 23.8 barrels)
- Large spills — 1,000 to 100,000 gallons (23.8 barrels to 2,381 barrels)
- Very large spills — greater than 100,000 gallons (2,381 barrels)

Types of materials that could be spilled during the life of the Project include:

- Produced fluids – fluids directly from the formation reservoir and composed predominately of gas condensate and natural gas, but may also include crude oil, produced water, and formation sand
- Produced water – brine, seawater, and formation water separated from the produced fluids and re-injected in the Class I disposal well at the Central Pad
- Export hydrocarbons – gas condensate and potentially crude oil transported by the export pipeline, eventually to the TAPS for shipment to market
- Refined products – arctic diesel, aviation fuel, unleaded gasoline, hydraulic fluid, transmission oil, lubricating oil, grease, waste oil, mineral oil, transformer oil, and other petroleum hydrocarbon products

- Other hazardous materials – methanol, antifreeze, water-soluble chemicals, chlorine, corrosion and scale inhibitors, drag-reducing and emulsion-breaking agents, biocides, and possibly a small amount of hydrogen sulfide associated with the produced fluids and gas

Reviews evaluating North Slope spill history (National Research Council 2003b; Maxim and Niebo 2001a, 2001b, 2001c; MMS 2007: and Mach et al. 2000) indicate that the probability of very small, small, and even medium size spills would be relatively high, with the probability of very small and small spills being very likely over the life of the project. The likelihood of large spills would be substantially less, but there would likely be at least one over the life of the project. Finally, based on past experience on the North Slope, a very large spill associated with the Project would be very unlikely to occur. The detailed statistical analyses done by Maxim et al. and reported in the Liberty EA (MMS 2007) are generally applicable to the Point Thomson project. Their overall conclusion, based on the analyses and metrics used, was that there was a less than 1 percent chance of a large spill (greater than 200 bbl or 8,400 gallons) over the 25-year expected life of the Liberty project and, though the chances of a small spill were essentially 100 percent, the total annual spill volume was estimated to be on the order of 100 gallons (2.4 barrels) per year.

## USFWS SPILL ANALYSIS FOR POLAR BEAR INCIDENTAL TAKE RULE

The U.S. Fish and Wildlife Service (USFWS) recently proposed a rule for incidental take of polar bears during oil and gas activities in the Beaufort Sea and adjacent northern coast of Alaska (50 CFR Part 18, March 11, 2011). Based upon USFWS review of the nature, scope and timing of proposed oil and gas activities and mitigation measures, and in consideration of the best available scientific information, USFWS determined that proposed activities would have a negligible impact on polar bears. This negligible impact determination included an extensive offshore oil spill analysis which was highly conservative overall, and even more so as it might be applied specifically with regard to Point Thomson. Conservative elements included:

- Assumptions in the model used (Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE)):

  - The constituents of large spills do not weather. However, Point Thomson produces light condensate, much of which would be lost to evaporation. This is not the case for crude oil.

  - Cleanup scenarios are not simulated. In the model, oil spill trajectories move as though no response action was taken. When response actions such as booming, mechanical recovery, and burning are taken, they will limit the residence and potential for further oil movement in the environment.

- Developments targeted by the analysis were offshore while Point Thomson is onshore.

- The analysis states that to date no major offshore oil spills have occurred in the Alaska Beaufort Sea and, although it is reasonable to assume the chances of one or more large spills occurring is low, for the purposes of the analysis a large spill was assumed.

## POTENTIAL FOR SPILLS AT POINT THOMSON

This assessment assumes spills of produced fluids and export hydrocarbons (primarily gas condensate and possibly crude oil), refined products, and oil based drilling fluids. These materials are the most likely to be spilled in sufficient volume and frequency at locations where the spilled material could reach the natural environment and could result in impacts to the listed species.

Activities during different project phases (construction, drilling, and operations) may introduce or remove potential spill sources or influence the size of potential spills. Most construction spills are small and composed of refined products (diesel, gasoline, and lubricating oil and hydraulic fluid) largely resulting from vehicle and equipment maintenance and refueling. Tanker truck and fuel or maintenance truck accidents, or fuel storage day tank failures, would be the most likely sources of large construction spills. The potential maximum spill volume from these sources is based on the container size for each source, and would be about 6000 gallons (143 barrels) for diesel or gasoline, and about 330 gallons (7.9 barrels) for lubricating or hydraulic fluid. Oil storage tanks at each staging area would have secondary containment berms for 110 percent of the capacity of the largest tank. Portable oil storage containers would also have secondary containment that hold 110 percent of the total capacity of the largest container(s) inside the containment. Similar to construction spills, most drilling spills are small and composed of refined products from fueling and maintaining vehicles and equipment. Well blowouts during drilling are an additional but very low probability potential source of a produced fluids spill. A well blowout could result in a potentially large to very large spill over an extended period (several days or possibly weeks). Spills during operation activities would include similar but less frequent spills of refined products (vehicle maintenance and refueling) as with construction, but would also include potential spills of produced fluids or export hydrocarbons associated with leaks and spills from gathering and export pipelines. These leaks and spills could occur from the pipelines along their ROWs and from pumps, valves, and pigging facilities. Large spills during operations could also result from a large break in the pipeline, failure of a large storage tank, or loss of containment in a fuel barge or tug in the marine environment.

The most common, and hence most likely, spill scenario would be the very small and small spills of material, usually diesel, hydraulic fluid, transmission oil, and antifreeze, on gravel or ice infrastructure (pads and roads). These spills would be confined to small areas on pads, roads, and the airstrip, where containment and cleanup would be easily accomplished. Rarely would these spilled materials reach the tundra or water bodies. Small spills could also result from slow or small (pin hole) leaks of produced fluids or export hydrocarbons from the gathering or export pipelines. In these cases small areas on the tundra or streams could receive these fluids remote from the roads or pads.

Medium spills could also occur from the same sources as small spills. The most likely medium spills would be from vehicular accidents at or in transit to construction or operations sites near roads, pipelines, and pads. Such spills would consist of refined products such as diesel, gasoline, and lubricants.

Sources of large spills, although these are unlikely to occur, would be produced fluids released from gathering or export pipelines and would likely occur in the pipeline right-of-ways (ROWs). Both medium and large spills could result from tanker truck accidents, major failure of fuel storage tanks at construction sites, or catastrophic failure of the pipeline. Medium and large spills would be more likely to reach the tundra, or water bodies (streams, ponds, and lakes) adjacent to the pipeline ROW, roads, or pads. For those spills that do reach water bodies, especially flowing creeks, the impact area would generally be more extensive than for small spills. The maximum predicted spills from a pipeline would be estimated at 3,346 barrels for the export line, and 550 and 546 barrels from the east and west gathering lines, respectively.

Very large spills (greater than 100,000 gallons (2,381 barrels)), a very unlikely event, could occur from a major blowout (during drilling) or uncontrolled release (during operations) at one of the production facilities, a complete and simultaneous failure of one of the fuel storage tanks and the containment berm around the tanks, or from a fuel barge delivering diesel fuel to the project during the summer open water season. A very large spill from either a blowout or uncontrolled release, or from a containment berm failure, could extend beyond the limits of the gravel pad potentially reaching both the tundra and adjacent water-bodies (ponds, lakes, creeks, and rivers). Spills flowing onto the adjacent tundra may impact only a few acres, as the tundra would act to slow the flow and aid containment, or in high winds spilled fluids could be blown or misted over a much larger area (tens or hundreds of acres). Spills could also reach flowing streams dispersing downstream as far as Lion Bay, or enter Lion Bay directly, resulting in a greater dispersion of produced fluid along the near-shore marine environment. Spills occurring during the winter would not disperse as rapidly and could be entrapped in the snow and pooled onto ice, enabling enhanced containment and cleanup efforts. However, spills occurring at or near breakup in the spring could result in more spread of spilled material during melting and runoff.

For wells associated with the Project, gas condensate is the likely produced fluid that would be encountered. ExxonMobil's current ODPCP (2009) describes a simulated 27,000 barrel-per-day blowout scenario during drilling which incorporates voluntary combustion (ignition) of the gas condensate at the wellhead as the primary response tactic. Under this scenario, it was estimated that less 1500 barrels of gas condensate would be released into the environment over a 15 day period, with the remainder being lost to combustion and evaporation. A crude oil blowout could also occur, and would introduce a substantially greater volume of produced fluid (oil) into the environment. ExxonMobil operates under seasonal drilling restrictions which would reduce the impact of a well blowout.

The Project will follow all applicable regulations regarding fuel transport and transfer. In addition, the Project will have both a USCG and EPA Facility Response Plan (FRP) for fuel transfers. The very unlikely occurrence of a very large spill from a tug/barge accident could result if some or all of the bulk tanks or compartments were breached. Such an accident could occur due to barge grounding or sinking along any part of the barging routes resulting in a release of refined products (diesel fuel, gasoline, aviation fuel, bunker oil, or lubricants) into the marine environment. However, as noted above, a USFWS recent analysis (50 CFR Part 18, March 11, 2011) indicated that "To date, no major offshore oil spill has occurred in the Alaska Beaufort Sea". Based on extensive modeling done in that analysis, USFWS concluded that oil and gas activities in the Beaufort Sea and adjacent northern coast of Alaska would have a negligible impact on polar bears.

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