Appendix M

Biological Assessments

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
REGULATORY DIVISION
P.O. BOX 6898
JBER, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

JAN 24 2012

Regulatory Division
POA-2001-1082-M1

National Oceanic and Atmospheric Administration
National Marine Fishery Service
Attention: Lieutenant Amy Cox
222 West 7th Avenue, #43
Anchorage, AK 99513-7577

Dear Lieutenant Cox:

Enclosed is the US Army Corps of Engineers' (Corps) Biological Assessment (BA) prepared to address expected impacts to Listed Species associated with a Department of the Army (DA) permit application received from Exxon Mobil Corporation and PTE Pipeline LLC (ExxonMobil) for their proposed Point Thomson Project. A printed copy and electronic copy (CD) are provided. The permit application has been assigned Corps' file number POA-2001-1082-M1, Beaufort Sea. The project would be located along the Beaufort Seacoast near Mary Sachs and Flaxman Islands approximately 60 miles west of Kaktovik, AK.

ExxonMobil proposes to construct infrastructure to produce liquid hydrocarbons and to further delineate the Thomson Sand and Brookian Sandstone Reservoirs, located mostly offshore, by directional drilling. ExxonMobil would construct 3 on-shore gravel pads, connecting gravel roads, above-ground pipelines, a gravel mine site, airstrip, ice roads, a marine barging facility, and conduct barging operations during ice free periods.

The Point Thomson Project BA is provided to NOAA, National Marine Fisheries Service (Service), for review and coordination with us under the Endangered Species Act (ESA), Section 7(a)(2). For the Point Thomson Project, ExxonMobil was designated as our non-Federal representative by letter to you dated March 19, 2010 (copy enclosed).

The Point Thomson Project BA was prepared to ensure ESA, Section 7, consultation procedures occur between the Service and action agency (Corps). The BA evaluates Service Listed Species which may be present in the action area and addresses potential Point Thomson Project impacts to the Listed Species populations.

Pursuant to the ESA, a Biological Assessment (BA) is required for Federal actions of "major construction activities" when listed species or critical habitats may be present in the proposed project area. The proposed project is within the range of the endangered Bowhead whale *(Balaena mysticetus)*, the proposed for listing Ringed seal (*Phoco hispida*), and the proposed for listing Bearded seal (*Erignathus barbatus*). The subspecies of Ringed seal which occurs in the proposed project area is *Phoco hispida hispida,* and is among the 4 subspecies proposed for listing as threatened. The subspecies of Bearded seal which occurs in the proposed project area is *Erignathus barbatus nauticus*, which is proposed for listing as threatened. The enclosed BA includes an evaluation of the expected impacts to the Bowhead whale, Ringed seal, and Bearded seal.

We have prepared a Draft Environmental Impact Statement (DEIS) and Public Notice of Application for Permit (PN) for the Point Thomson Project which are currently available for public comment until January 18, 2012. Pursuant to the National Environmental Policy Act, the BA is required because of our major Federal action determination resulting from ExxonMobil's proposed project. A draft BA is included in the DEIS at Appendix M. The DA permit application is included in Appendix A. There is a project website located at www.pointthomsonprojecteis.com. The PN is located at the Alaska District Regulatory website www.poa.usace.army.mil/reg/PNNew.htm).

The BA includes a Determination of Effect of "not likely to adversely affect" for all 3 evaluated species. We request your review the BA for a determination of completeness, and if complete, a determination of concurrence or non-concurrence with the accuracy of the BA.

Please contact me at the letterhead address, ATTN: CEPOA-RD-N, by e-mail message at harry.a.baij@usace.army.mil, by telephone at 907-753-2784 (office), or at 907-350-5097 (cell). I would appreciate working closely with the Service throughout the consultation process.

Sincerely,

HBaij

Harry A. Baij Jr.
Project Manager

Enclosures

REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
REGULATORY DIVISION
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

MAR 1 9 2010

Regulatory Division
POA-2001-1082-M1

Ms. Amy Cox
NOAA Fisheries' National Marine Fisheries Service
222 West 7th Avenue, Box 43
Anchorage, Alaska 99513

Dear Ms. Cox:

This is in regard to Exxon Mobil Corporation's proposed Point Thomson Project; file number POA-2001-1082-M1, Beaufort Sea, to recover hydrocarbons from the Thomson Sands reservoir. We are preparing a Draft Environmental Impact Statement for the project.

Pursuant to the Endangered Species Act, a biological assessment is required for Federal actions that are "major construction activities" when listed species or critical habitat may be present in the proposed project area. According to your letter of March 2, 2010, endangered bowhead whales (*Balaena mysticetus*) may be found in or adjacent to the proposed Point Thomson Project area.

The Federal action agency, in this case the US Army Corps of Engineers, may designate the applicant or a non-Federal representative to prepare the biological assessment. The action agency remains responsible for the content of the assessment and for the findings of effect. For the Point Thomson Project EIS, we designate Exxon Mobil Corporation to prepare the biological assessment. We will ultimately be responsible for the content and for the findings of effect. We look forward to working with your agency as the biological assessment is developed.

You may contact me via email at julie.w.mckim@usace.army.mil, by mail at the address above, by phone at (907) 753-2773, or toll free from within Alaska at (800) 478-2712, if you have questions.

Sincerely,

Julie W. McKim

Julie W. McKim
Project Manager

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

Prepared by

Jay Brueggeman
Canyon Creek Consulting LLC
1147 21st Ave E., Seattle, WA 98112

for

URS Corporation
Anchorage, AK

November 2011

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

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.

January 5, 2012 – 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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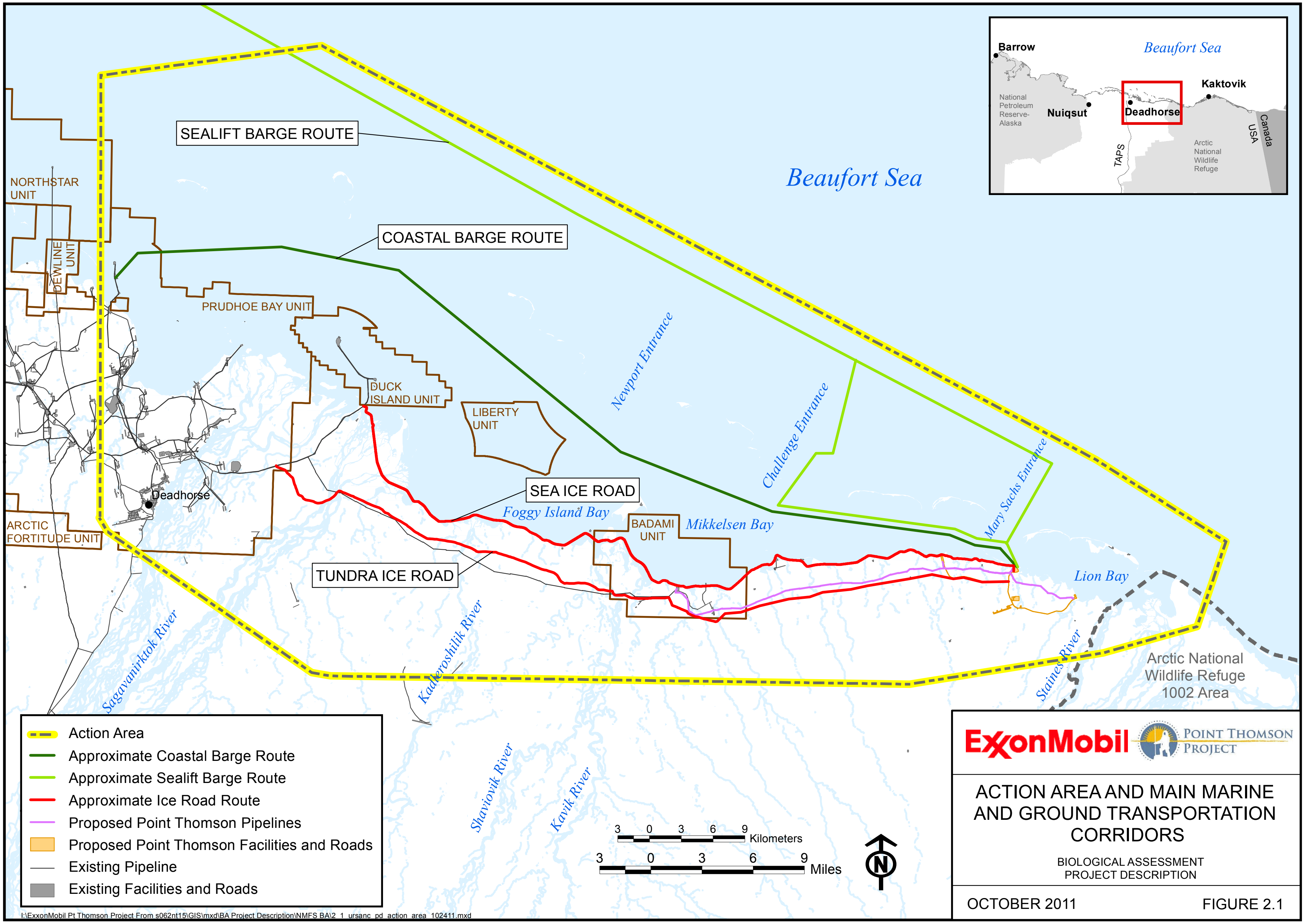

SEALIFT BARGE ROUTE
COASTAL BARGE ROUTE
SEA ICE ROAD
TUNDRA ICE ROAD
Beaufort Sea
NORTHSTAR UNIT
DEWLINE UNIT
PRUDHOE BAY UNIT
DUCK ISLAND UNIT
LIBERTY UNIT
BADAMI UNIT
ARCTIC FORTITUDE UNIT
Deadhorse
Newport Entrance
Challenge Entrance
Mary Sachs Entrance
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Sagavanirktok River
Kadleroshilik River
Shaviovik River
Kavik River
Staines River
Arctic National Wildlife Refuge 1002 Area
Barrow
Beaufort Sea
Kaktovik
Nuiqsut
Deadhorse
National Petroleum Reserve-Alaska
Arctic National Wildlife Refuge
TAPS
USA
Canada
Action Area
Approximate Coastal Barge Route
Approximate Sealift Barge Route
Approximate Ice Road Route
Proposed Point Thomson Pipelines
Proposed Point Thomson Facilities and Roads
Existing Pipeline
Existing Facilities and Roads
3 0 3 6 9 Kilometers
3 0 3 6 9 Miles
N
ExxonMobil
POINT THOMSON PROJECT
ACTION AREA AND MAIN MARINE AND GROUND TRANSPORTATION CORRIDORS
BIOLOGICAL ASSESSMENT PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.1
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\2_1_ursanc_pd_action_area_102411.mxd

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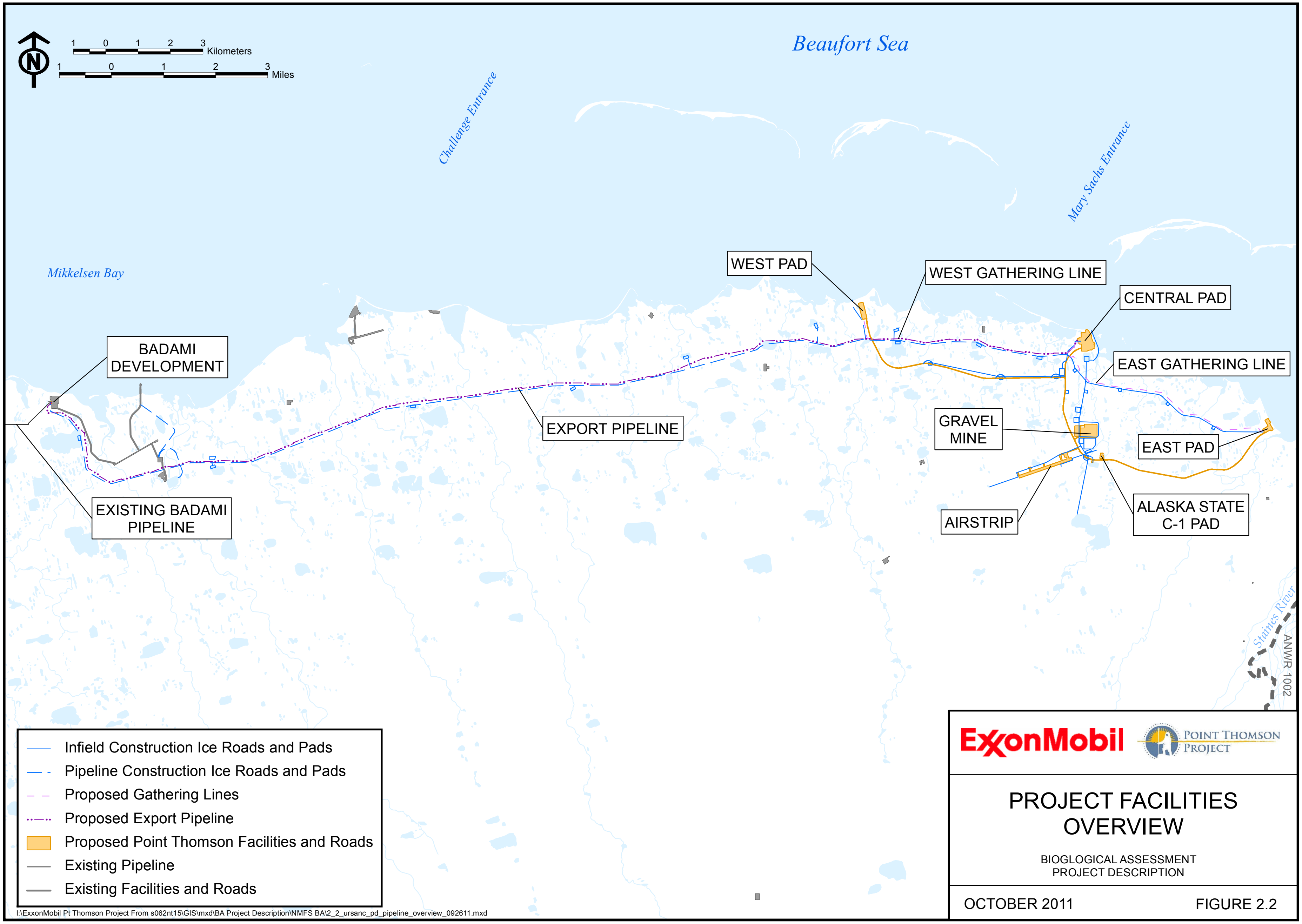
Kilometers
Miles
Beaufort Sea
Challenge Entrance
Mary Sachs Entrance
Mikkelsen Bay
WEST PAD
WEST GATHERING LINE
CENTRAL PAD
EAST GATHERING LINE
BADAMI DEVELOPMENT
EXPORT PIPELINE
GRAVEL MINE
EAST PAD
EXISTING BADAMI PIPELINE
AIRSTRIP
ALASKA STATE C-1 PAD
Staines River
ANWR 1002
Infield Construction Ice Roads and Pads
Pipeline Construction Ice Roads and Pads
Proposed Gathering Lines
Proposed Export Pipeline
Proposed Point Thomson Facilities and Roads
Existing Pipeline
Existing Facilities and Roads
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\2_2_ursanc_pd_pipeline_overview_092611.mxd
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.

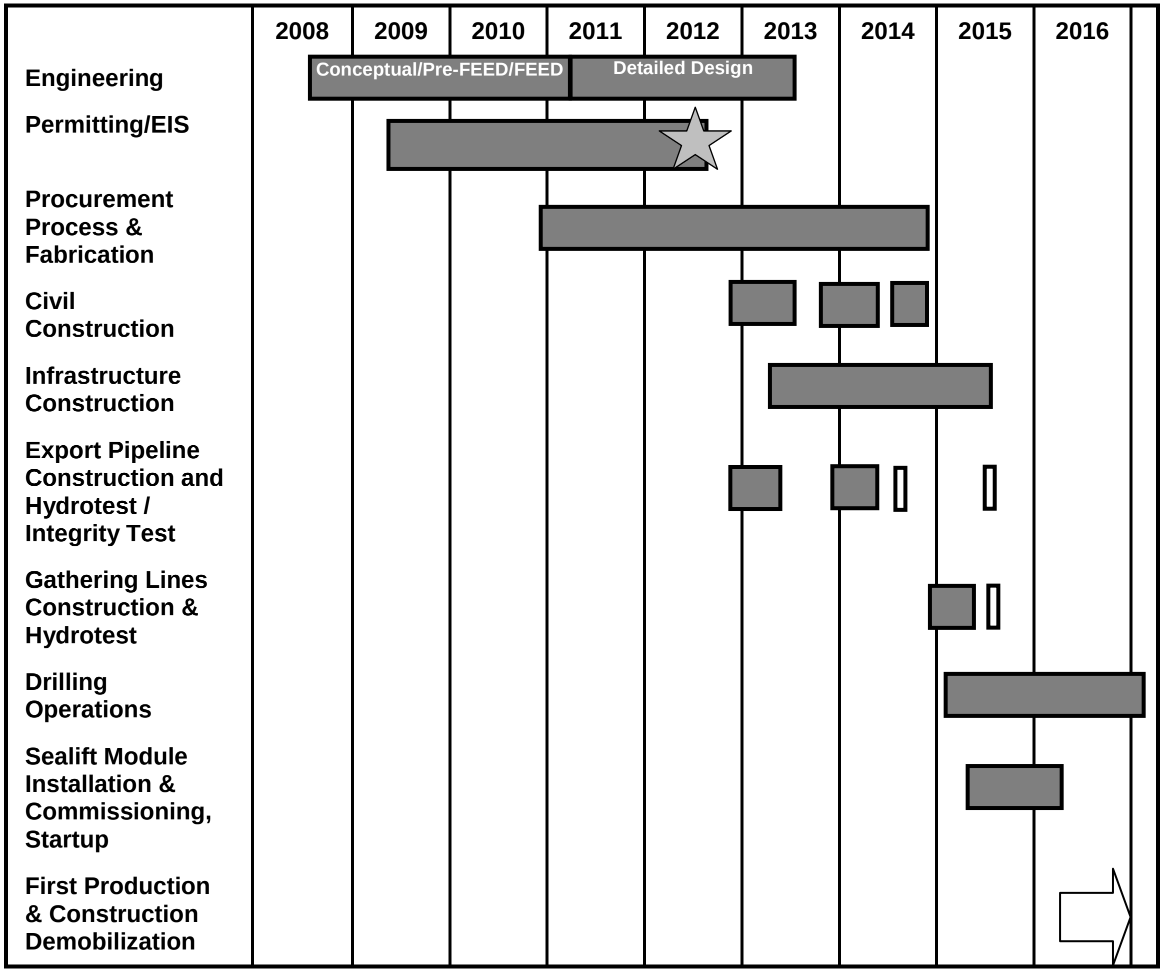
The design life of Project facilities is predicted to be approximately 30 years. Detailed facility abandonment procedures will be developed prior to terminating the operations.

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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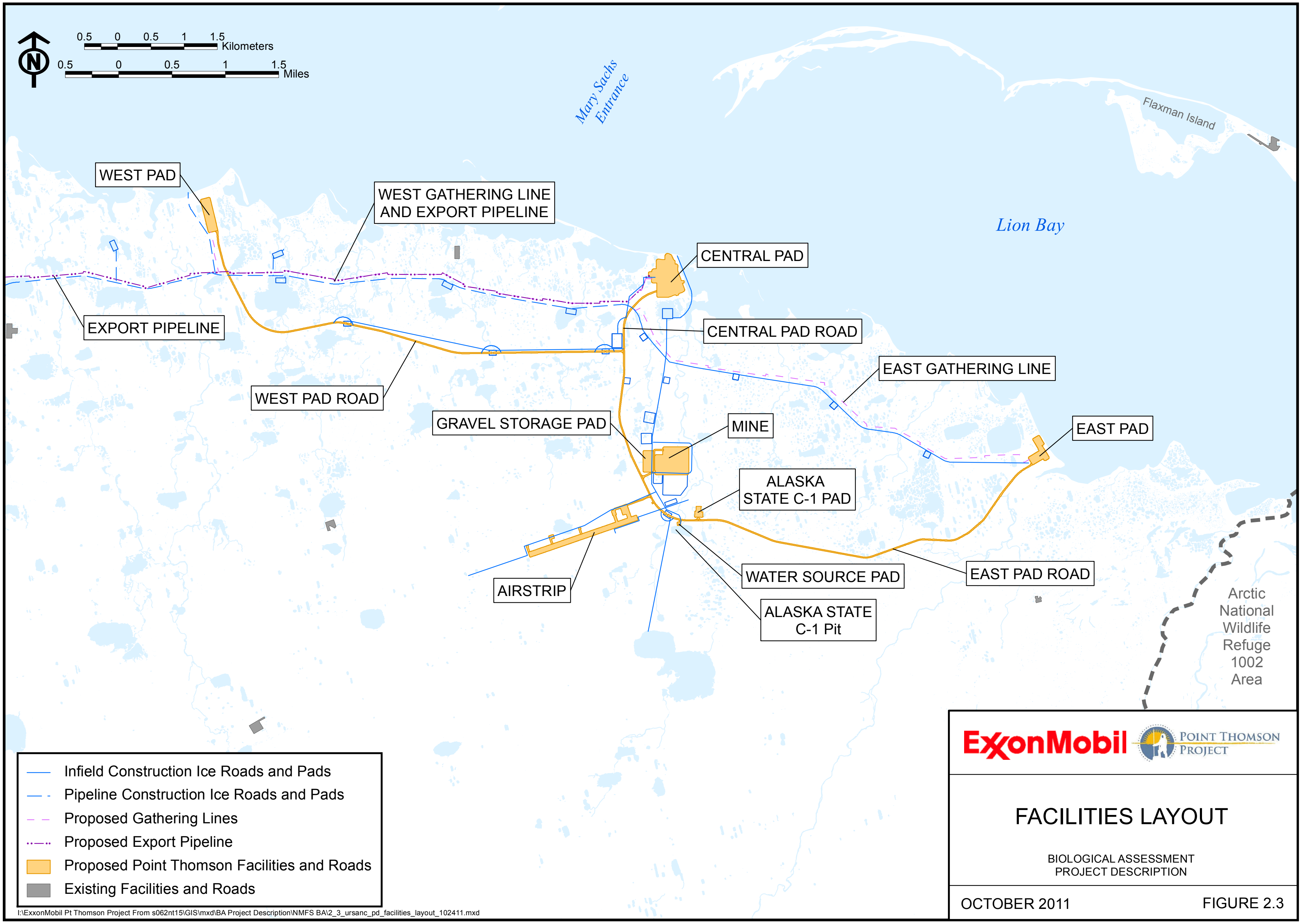

FACILITIES LAYOUT

BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION

OCTOBER 2011

FIGURE 2.3

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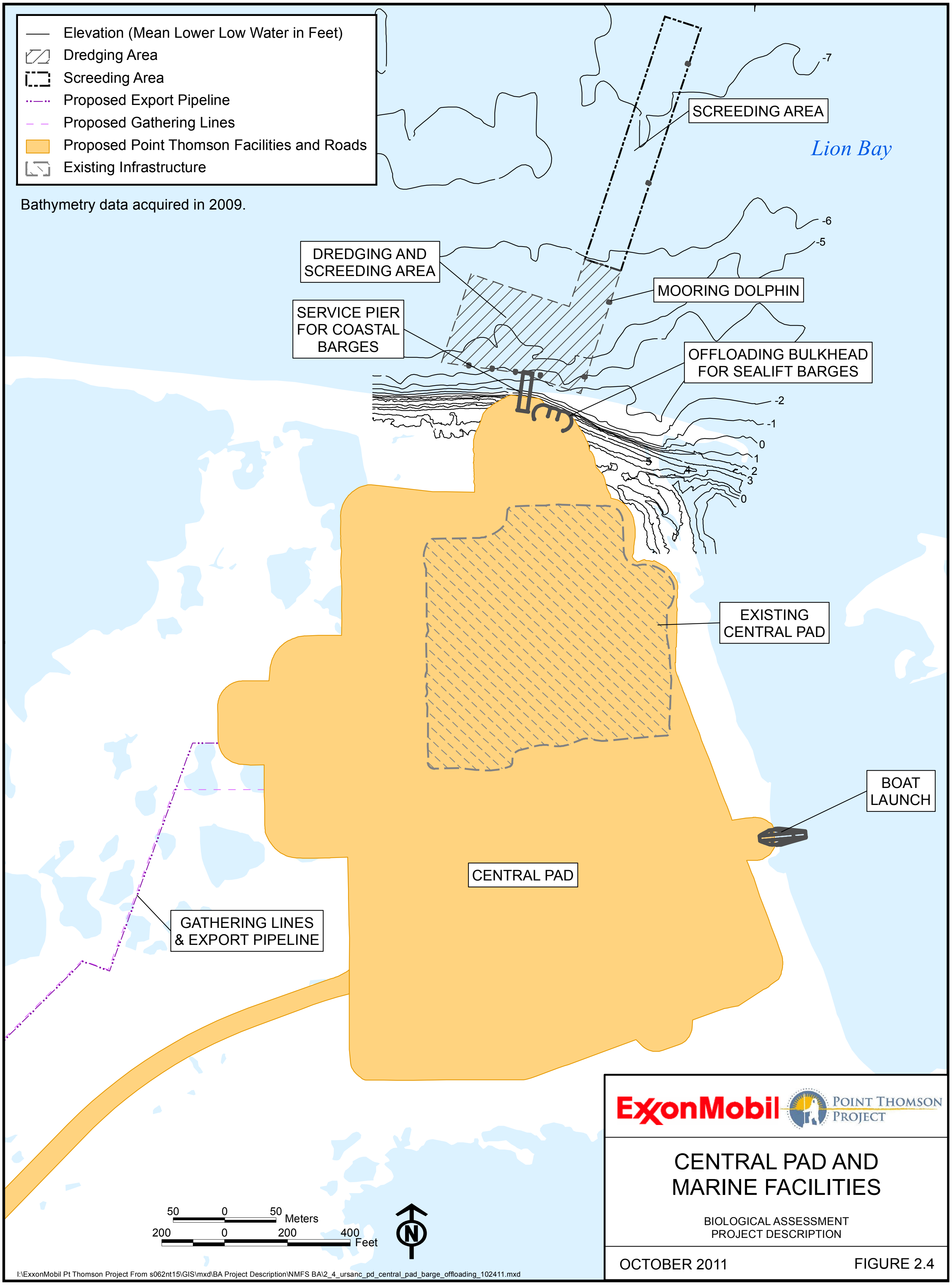
Elevation (Mean Lower Low Water in Feet)
Dredging Area
Screeding Area
Proposed Export Pipeline
Proposed Gathering Lines
Proposed Point Thomson Facilities and Roads
Existing Infrastructure
Bathymetry data acquired in 2009.
SCREEDING AREA
Lion Bay
DREDGING AND SCREEDING AREA
MOORING DOLPHIN
SERVICE PIER FOR COASTAL BARGES
OFFLOADING BULKHEAD FOR SEALIFT BARGES
EXISTING CENTRAL PAD
BOAT LAUNCH
CENTRAL PAD
GATHERING LINES & EXPORT PIPELINE
-7
-6
-5
-2
-1
0
1
2
3
0
50
0
50
Meters
200
0
200
400
Feet
N
ExxonMobil
POINT THOMSON PROJECT
CENTRAL PAD AND MARINE FACILITIES
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.4
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\2_4_ursanc_pd_central_pad_barge_offloading_102411.mxd

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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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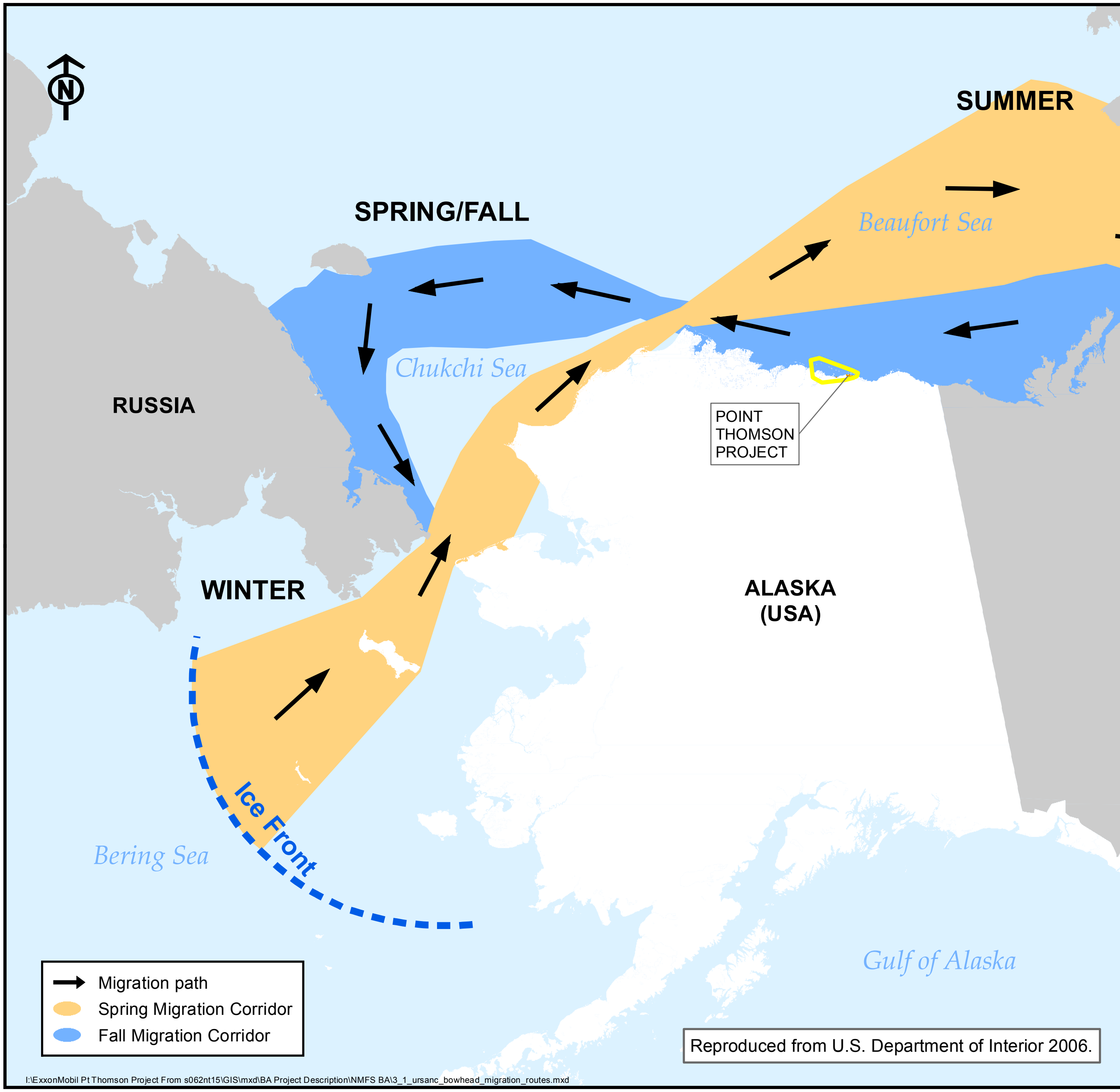

BOWHEAD WHALE SPRING AND FALL MIGRATION ROUTES

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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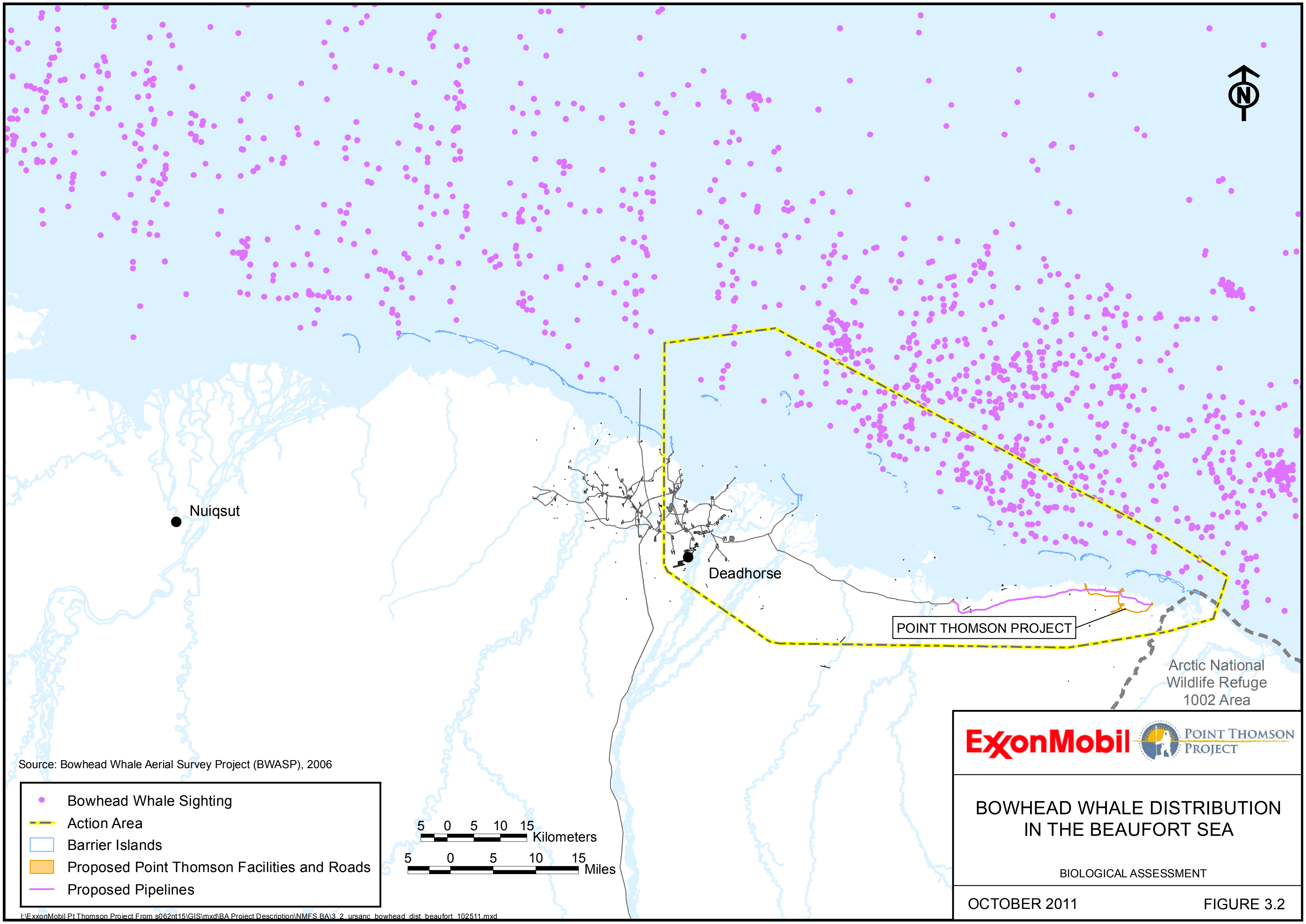

N
Nuiqsut
Deadhorse
POINT THOMSON PROJECT
Arctic National Wildlife Refuge 1002 Area
Source: Bowhead Whale Aerial Survey Project (BWASP), 2006
Bowhead Whale Sighting
Action Area
Barrier Islands
Proposed Point Thomson Facilities and Roads
Proposed Pipelines
5 0 5 10 15 Kilometers
5 0 5 10 15 Miles
ExxonMobil
POINT THOMSON PROJECT
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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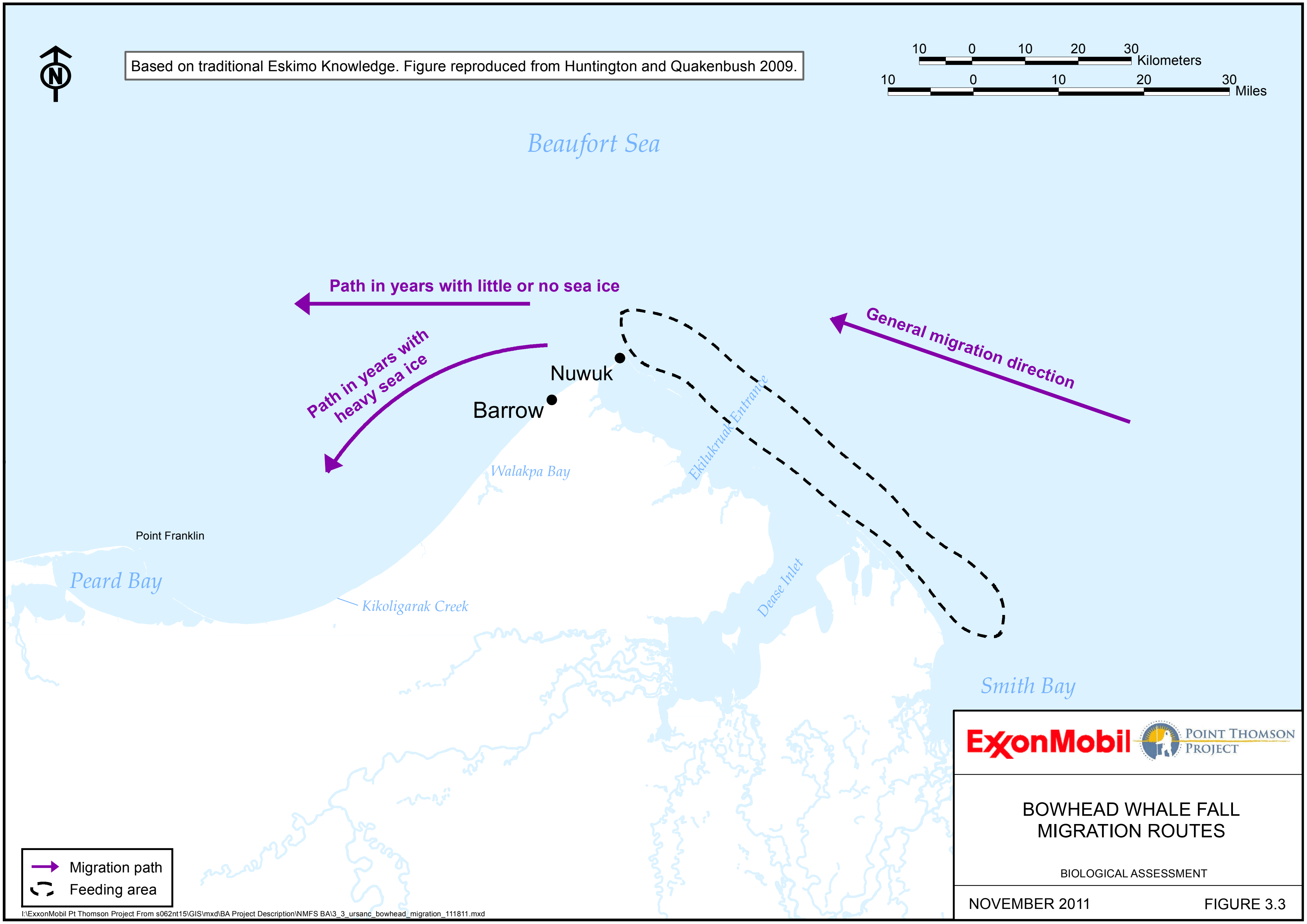
Based on traditional Eskimo Knowledge. Figure reproduced from Huntington and Quakenbush 2009.
10 0 10 20 30 Kilometers
10 0 10 20 30 Miles
Beaufort Sea
Path in years with little or no sea ice
Path in years with heavy sea ice
General migration direction
Nuwuk
Barrow
Walakpa Bay
Ekilukruak Entrance
Point Franklin
Peard Bay
Kikoligarak Creek
Dease Inlet
Smith Bay
Migration path
Feeding area
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\3_3_ursanc_bowhead_migration_111811.mxd
ExxonMobil
Point Thomson Project
BOWHEAD WHALE FALL MIGRATION ROUTES
BIOLOGICAL ASSESSMENT
NOVEMBER 2011
FIGURE 3.3

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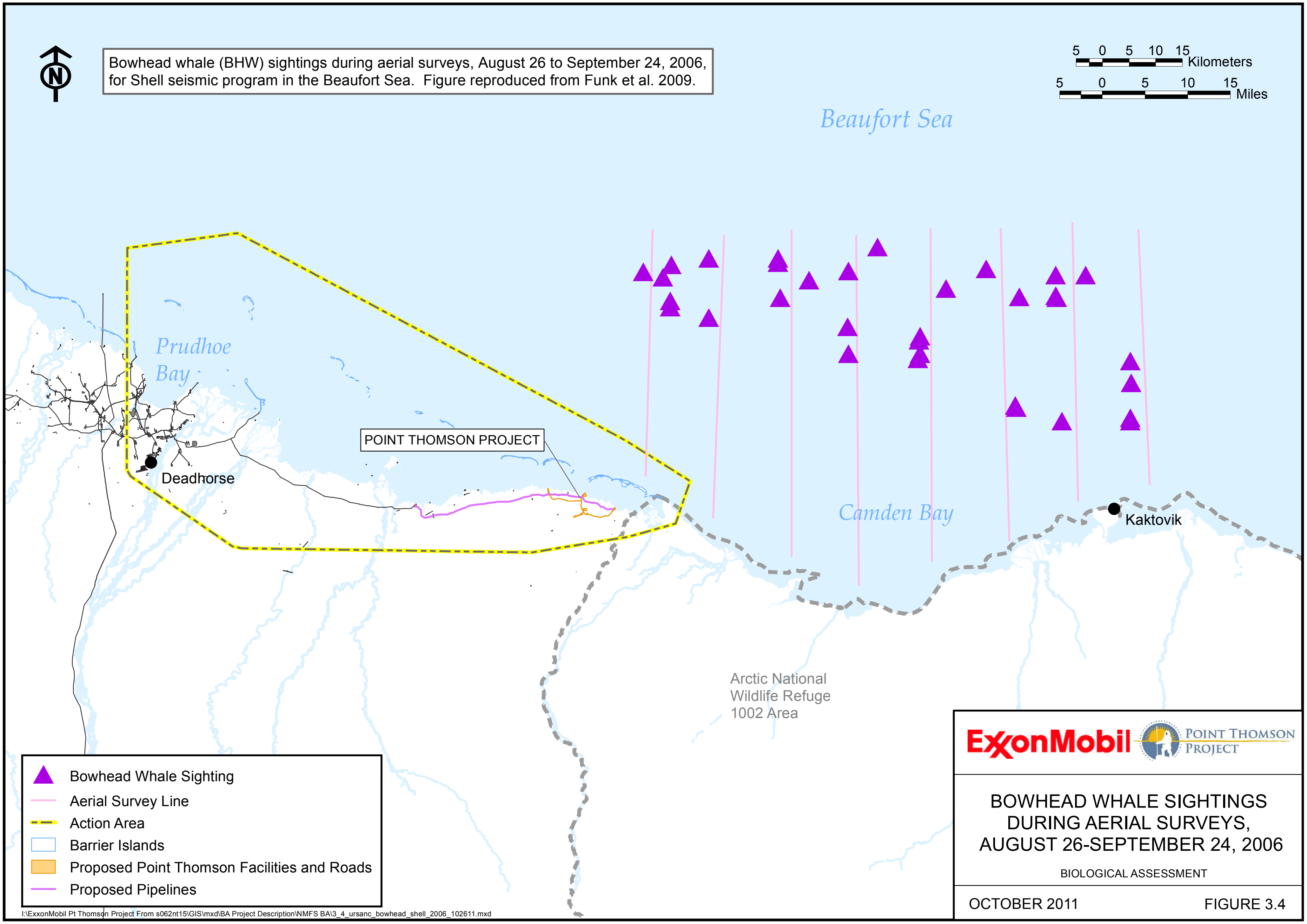
3.1.4 Communication and Hearing

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 (BHW) sightings during aerial surveys, August 26 to September 24, 2006, for Shell seismic program in the Beaufort Sea. Figure reproduced from Funk et al. 2009.
5 0 5 10 15 Kilometers
5 0 5 10 15 Miles
Beaufort Sea
Prudhoe Bay
POINT THOMSON PROJECT
Deadhorse
Camden Bay
Kaktovik
Arctic National Wildlife Refuge 1002 Area
Bowhead Whale Sighting
Aerial Survey Line
Action Area
Barrier Islands
Proposed Point Thomson Facilities and Roads
Proposed Pipelines
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\3_4_ursanc_bowhead_shell_2006_102611.mxd
ExxonMobil
POINT THOMSON PROJECT
BOWHEAD WHALE SIGHTINGS DURING AERIAL SURVEYS, AUGUST 26-SEPTEMBER 24, 2006
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.4

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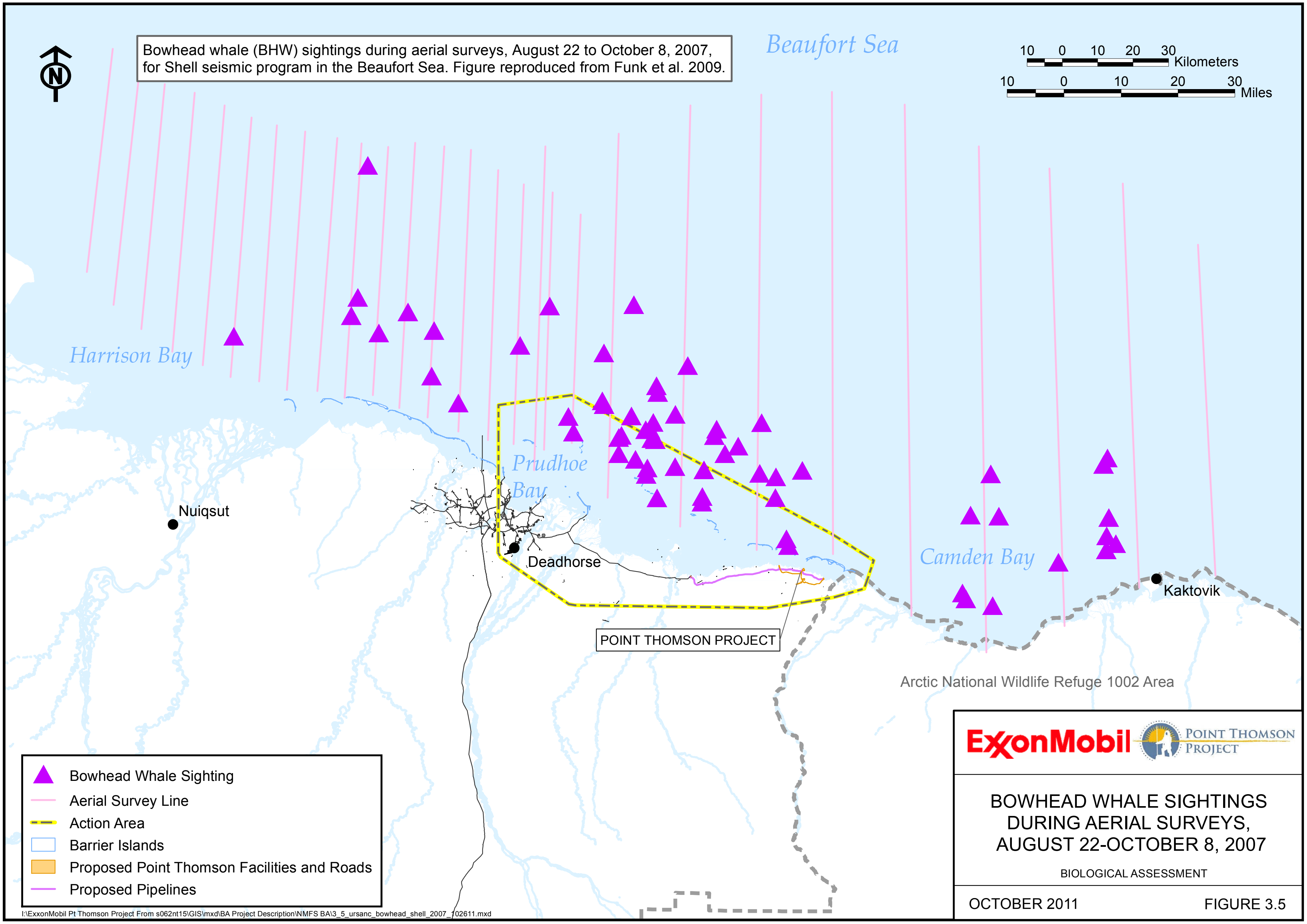
Bowhead whale (BHW) sightings during aerial surveys, August 22 to October 8, 2007, for Shell seismic program in the Beaufort Sea. Figure reproduced from Funk et al. 2009.
N
Beaufort Sea
10 0 10 20 30 Kilometers
10 0 10 20 30 Miles
Harrison Bay
Prudhoe Bay
Nuiqsut
Deadhorse
POINT THOMSON PROJECT
Camden Bay
Kaktovik
Arctic National Wildlife Refuge 1002 Area
Bowhead Whale Sighting
Aerial Survey Line
Action Area
Barrier Islands
Proposed Point Thomson Facilities and Roads
Proposed Pipelines
ExxonMobil
POINT THOMSON PROJECT
BOWHEAD WHALE SIGHTINGS DURING AERIAL SURVEYS, AUGUST 22-OCTOBER 8, 2007
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.5
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\3_5_ursanc_bowhead_shell_2007_102611.mxd

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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).

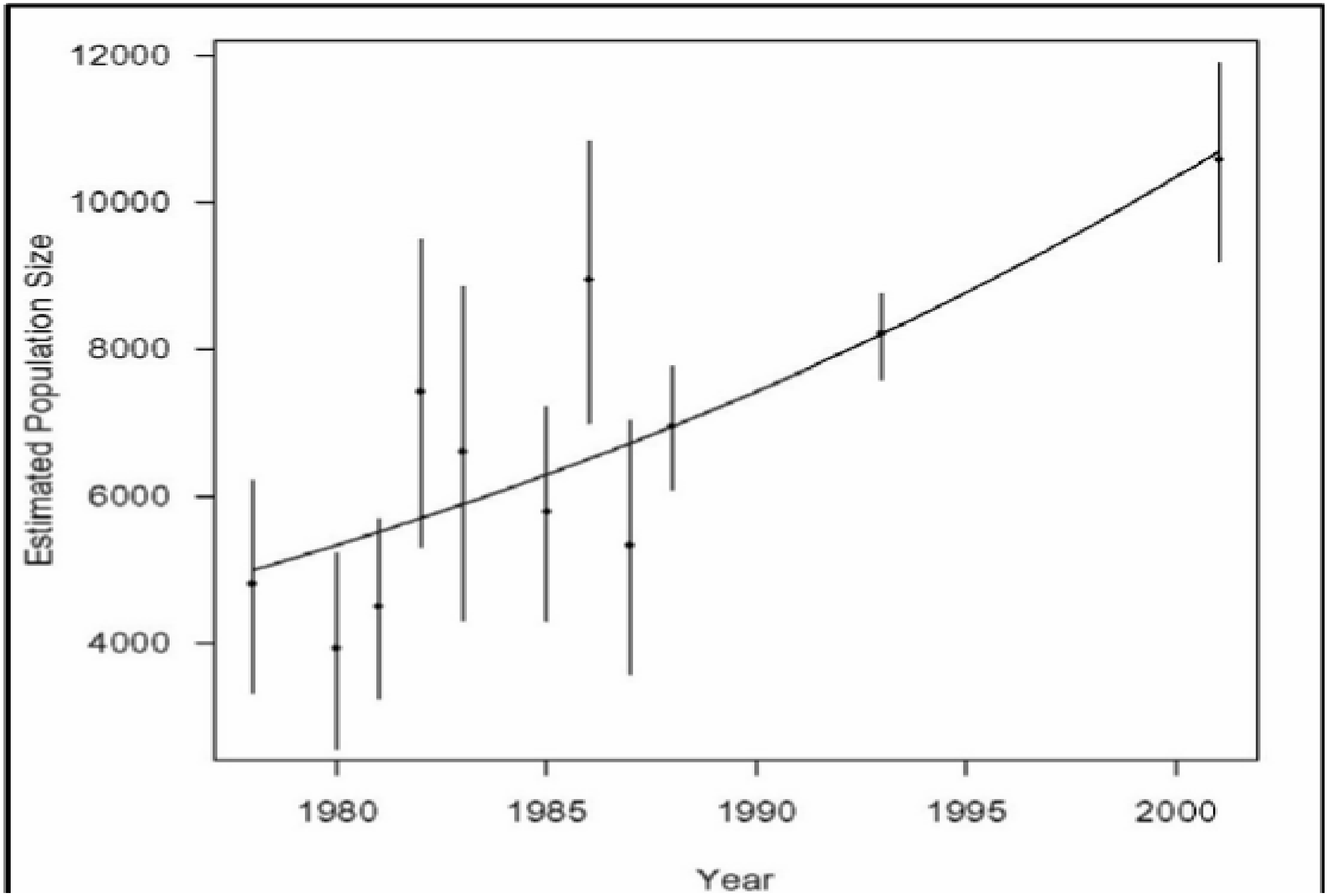

Figure 4.1 Abundance Estimates and Standard Deviation for the Bering-Chukchi-Beaufort Sea bowhead Whale Stock (Zeh and Punt 2005). Error bars show +/- 1 standard error. (Figure taken from Allen and Angliss 2010).

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.

7.0 REFERENCES AND PERSONAL COMMUNICATIONS CITED

Aerts, L.A.M. and W.J. Richardson (eds.). 2008. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar Oil Development, Alaskan Beaufort Sea, 2007: Annual summary report. LGL Rep. P1 005b. rep. from LGL Alaska Research Associates (Anchorage, AK), Greeneridge Sciences Inc. (Santa Barbara, CA) and Applied Sociocultural Research (Anchorage, AK) for BP Exploration (Alaska) Inc., Anchorage, AK.

Aerts, L.A.M. and W.J. Richardson (eds.). 2009. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar Oil Development, Alaskan Beaufort Sea, 2008: Annual summary report. LGL Rep. P1081. Rep. from LGL Alaska Res. Assoc. Inc. (Anchorage, AK), Greeneridge Sciences Inc. (Santa Barbara, CA) and Applied Sociocultural Res. (Anchorage, AK) for BP Exploration (Alaska) Inc., Anchorage, AK.

Aerts, L.A.M. and W.J. Richardson (eds.). 2010. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar Oil Development, Alaskan Beaufort Sea, 2009: Annual summary report. LGL Rep. P1132. Rep. from LGL Alaska Res. Assoc. Inc. (Anchorage, AK), Greeneridge Sciences Inc. (Santa Barbara, CA) and Applied Sociocultural Res. (Anchorage, AK) for BP Exploration (Alaska) Inc., Anchorage, AK.142 p.

Allen, B.M., and R.P. Angliss. 2010. Alaska marine mammal stock assessments, 2009. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-206, 276 pp.

Ashjian, C.J, S.R. Braund, R.G. Campbell, J.C. George, J. Kruse, W. Maslowki, S.E. Moore, C.R. Nicolson, S.R. Okkonen, B.F. Sherr, E.B. Sherr, and Y.H. Spitz. 2010. Climate variability, oceanography, bowhead whale distribution and Inupiat subsistence whaling near Barrow, Alaska. Arctic 63(2):179-194.

Austin, M. and D.E. Hannay.2010. Characterization of underwater noise for vessels involved with ExxonMobil's Pt. Thomson project: Prudhoe Bay Alaska. 2010. Version 2.0. Technical report prepared for JAGO Contracting and Management, on behalf of ExxonMobil Corp. by JASCO Applied Sciences.11 pp.

Bacon, J. J., T. R. Hepa, H. K. Brower, Jr., M. Pederson, T. P. Olemaun, J. C. George, and B. G. Corrigan. 2009. Estimates of subsistence harvest for villages on the North Slope of Alaska, 1994-2003. North Slope Borough Department of Wildlife Management. 107 pp.

Bengtson, J.L., L.M. Hiruki-Raring, M.A. Simpkins, and P.L. Boveng. 2005. Ringed and bearded seal densities in the eastern Chukchi Sea, 1999-2000. Polar Biology. 28:833-845.

Blackwell, S.B., J.W. Lawson, and M.T. Willilams. 2003. Tolerance by ringed seals to impact pile driving and construction sounds at an oil production island. 2003. J. Acoust. Soc. Am. 115 (5):2346-2357.

Blackwell, S.B. 2004. Sound measurement 2003 open water season: berm reconstruction and hover craft. Chapter 2 *In*: W.J. Richardson and M.W. Williams (*eds*., 2004, q.v.). LGL Rep. TA2931-2.

Blackwell, S.B., R.G. Norman, C.R. Greene Jr., M.W. McLennan, T.L. McDonald and W.J. Richardson. 2004. Acoustic monitoring of bowhead whale migration, Autumn 2003. Pp. 7-1 to 7-45. In W.J. Richardson and M.T. Williams, *eds*. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar oil development, Alaskan Beaufort Sea, 1999-2003. LGL Rep. TA4002-1. Rep. from LGL Ltd. (King City, Ont.), Greenridge Sciences Inc. (Santa Barbara, CA) and WEST Inc. (Cheyenne, WY), for BP Explor. (Alaska) Inc., Anchorage, AK.

Blackwell, S.B., and C.R. Green. 2004. Sounds from Northstar in the open-water season: characteristics and contribution of vessels. In: Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar Oil Development, Alaskan Beaufort Sea, 1999-2003. W.J. Richardson and M.T. Williams (eds.) LGL report TA4-002-4. Anchorage, AK: BPXA Chapter 4.

Blackwell, S.B., WJ. Richardson, C.R. Greene, and B. Streever. 2007. Bowhead whale migrations and calling behavior in the Alaskan Beaufort Sea, autumn 2001-2004: an acoustic localization study. Arctic. 60:255-270.

Blackwell, S.B., W.C. Burgess, K.H. Kim, R.G. Norman, C.R. Greene, Jr., M.W. McLennan, and L.A.M. Aerts. 2009. Sounds recorded at Northstar and in the offshore DASAR array, autumn 2008. Chapter 3 In: Aerts, L.A.M. and W.J. Richardson (*eds.*). 2008. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar Oil Development, Alaskan Beaufort Sea, 2008. Annual summary report. LGL Rep. P1081. LGL Alaska Res. Assoc, Inc. (Anchorage, AK), Greenridge Sciences, Inc. (Santa Barbara, CA), and Applied Sociocultural Res. (Anchorage, AK) for BP Exploration (AK) Inc.

Blix, A.S., and J.W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and development activities. Arctic 45:20-24.

Bockstoce, J.J., and J.J. Burns. 1993. Commercial whaling in the North Pacific sector. pp. 563-577. In J.J. Burns, J.J Montague, and C.J. Cowles (eds.). The Bowhead Whale. Soc. Mar. Mammal., Spec. Publ. No. 2.

Braham, H.W., B.D. Krogman, and G.M. Carroll. 1984. Bowhead and white whale migration, distribution, and abundance in the Bering, Chukchi, and Beaufort seas, 1975-78. NOAA Tech. Rep. NMFS SSRF-778. USDOC/NOAA/NMFS. 39 pp. NTIS PB84-157908

Brandon, J., and P.R. Wade. 2004. Assessment of the Bering-Chukchi-Beaufort Seas stock of bowhead whales. Unpub. report submitted to Int. Whal. Comm. (SC/56/BRG20). 32 pp.

Bratton, G.R., C.B. Spainhour, W. Flory, M. Reed, and K. Jayko. 1993. Presence and potential effects of contaminants. pp. 701-744. *In* J.J. Burns, J.J Montague, and C.J. Cowles (*eds.*). The Bowhead Whale. Soc. Mar. Mammal., Spec. Publ. No. 2.

Brewer, K.D., M.L. Gallagher, P.R. Regos, P.E. Isert, and J.D. Hall. 1993. Kuvlum #1 exploration prospect final report – site specific monitoring program. Report from Coastal & Offshore Pacific Corporation, Walnut Creek, CA, for ARCO Alaska. Inc.

Brueggeman, J.J. 1982. Early spring distribution of bowhead whales in the Bering Sea. J. Wild. Manage. 46:1036-1044.

Brueggeman, J.J., B. Watts, M. Wahl, P. Seiser, and A. Cyr. 2009. Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2008 open water season. Prepared for ConocoPhillips Inc. and Shell Exploration and Production. 45 pp.

Burns, J.J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi Seas. J. Mammal. 51(3):445-454.

Burns, J.J., and S. J. Harbo. 1972. An aerial census of ringed seals, northern coast of Alaska. Arctic 25:179-290.

Burns, J.J., and K. J. Frost. 1979. The natural history and ecology of the bearded seal, Erignathus barbatus. Alaska Department of Fish and Game. 77 pp.

Burns, J.J., L.H. Shapiro, and F.H. Fay. 1980. The relationship of marine mammal distributions, densities, and activities to sea ice conditions. Outer Continental Shelf Environmental Assessment Program, NOAA-BLM, Boulder, CO. 127 pp.

Burns, J.J. 1981. Bearded seal Erignathus barbatus Erxleben, 1777. p. 145-170 *In*: S.H. Ridgway and R.J. Harrison (*eds*.), Handbook of Marine Mammals. Vol. 2. Seals. Academic Press, New York.

Cameron, M. F., J. L. Bengtson, P. L. Boveng, J. K. Jansen, B. P. Kelly, S. P. Dahle, E. A. Logerwell, J. E. Overland, C. L. Sabine, G. T. Waring, and J. M. Wilder. 2010. Status review of the bearded seal (Erignathus barbatus). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-211, 246 pp.

Davis, J. E., and S. S. Anderson. 1976. Effects of oil pollution on breeding grey seals. Marine Pollution Bulletin 7:115-118.

ExxonMobil. 2010. Marine mammal monitoring and protection report. 1 November 2009 to 28 October 2010. 6 pp + appendices.

Finley, K.J., G.W. Miller, R.A. Davis, and W.R. Koski. 1983. A distinctive large breeding population of ringed seals (*Phoca hispida*) inhabiting the Baffin Bay pack ice. Arctic 36(2):162-173.

Frost, K. J. 1985. The ringed seal (*Phoca hispida*). Pages 79-87. *In*: J. J. Burns, K. J. Frost, and L. F. Lowry, editors. Marine Mammals Species Accounts. Alaska Department Fish and Game, Juneau, AK.

Frost, K.J., L.F. Lowry, G. Pendleton, and H.R. Nute. 2002. Monitoring distribution and abundance of ringed seals in northern Alaska. OCS Study MMS 2002-2004. Final report from the Alaska Department of Fish and Game, Juneau, AK, for U.S. Minerals Management Service, Anchorage, AK. 66 pp + appendices.

Frost, K. J., L. F. Lowry, G. Pendleton, and H. R. Nute. 2004. Factors affecting the observed densities of ringed seals, *Phoca hispida*, in the Alaskan Beaufort Sea, 1996-99. Arctic 57:115-128.

Frost, K. J., M. F. Cameron, M. Simpkins, C. Schaeffer, and A. Whiting. 2005. Diving behavior, habitat use, and movements of bearded seal (*Erignathus barbatus*) pups in Kotzebue Sound and Chukchi Sea. Pages 98-99 in Proceedings of the Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA. Society for Marine Mammalogy.

Funk, D.W., D.S. Ireland, R. Rodrigues, and W.R. Koski (eds). 2009. Joint monitoring program in the Chukchi and Beaufort Seas, open water seasons, 2006-2008. LGL Alaska Report P1050-1, Report from LGL Alaska Research Associates, Inc., LGL Ltd, Greeneridge Sciences, Inc., JASCO Research, Ltd for Shell Offshore Inc. and other industry contributors, and National Marine Fisheries Service, United States Fish and Wildlife Service. 488 pp + appendices.

Galginaitis, M. 2009. Annual Assessment of Subsistence Bowhead Whaling Near Cross Island, 2001-2007. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage, AK

Garner, W., and D. Hannay. 2009. Sound measurements of Pioneer vessels. Chapter 2 *In:* Link, M.R. and R. Rodrigues (*eds.*). Monitoring of in-water sounds and bowhead whales near the Oooguruk and Spy Island drillsites in eastern Harrison Bay, Alaskan Beaufort Sea, 2008. Rep. from LGL Alaska Research Associates, Inc., Anchorage, AK, Greeneridge Sciences, Inc., Santa Barbara, CA, and JASCO Applied Sciences, Victoria, BC, for Pioneer Natural Resources, Inc., Anchorage, AK, and Eni US Operating Co. Inc., Anchorage, AK.

George, J.C., L.M. Philo, K. Hazard, D. Withrow, G.M. Carroll, and R. Suydam. 1994. Frequency of killer whale attacks and ship collisions based on scarring on bowhead whales of the Bering-Chukchi-Beaufort seas stock. Arctic 47(3):247-255.

George, J.C., J. Zeh, R. Suydam, and C. Clark. 2004a. Abundance and population trends (1978-2001) of western arctic bowhead whales surveyed near Barrow, Alaska. Mar. Mamm. Sci. 20(4):755-773.

George, J.C., R. Suydam, J. Zeh, and W. Koski. 2004b. Estimated pregnancy rates of bowhead whales from examination of landed whales. Paper SC/56/BRG10 presented to the Scientific Committee of the International Whaling Commission.

George, J. C., C. Nicolson, S. Drobot, J. Maslanik, and R. Suydam. 2005. Sea ice density and bowhead whale body condition preliminary findings. Poster presented at the 16 Biennial Conference on the Biology of Marine Mammals, December 12-16, 2005, San Diego, CA.

Geraci, J.R. and D.J. St. Aubin. (eds.) 1990. Sea Mammals and Oil: Confronting the Risks. San Diego, CA: Academic Press, 282 pp.

Gerber, L.R., A.C. Keller, D.P. DeMaster. 2007. Ten thousand and increasing: is the western Arctic population of bowhead whales endangered? Biological Conservation 137:577-583.

Givens, G.H., R.M. Huebinger, J.C. Patton, L.D. Postma, M. Lindsay, R.S. Suydam, J.C. George, C.W. Matson, and J.W. Bickham. 2010. Population genetics of bowhead whales (*Balaena mysticetus*) in the western Arctic. Arctic 63(1):1-12.

Greene, C.R., Jr. 1997. Physical acoustics measurements. (Chap. 3, 63 pp.) In: W.J. Richardson (ed.), 1997. Northstar Marine Mammal Marine Monitoring Program, 1996. Marine mammal and acoustical monitoring of a seismic program in the Alaskan Beaufort Sea. Rep. TA2121-2. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for BP Explor. (Alaska) Inc., Anchorage, AK, and U.S. Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 245 pp.

Greene, C.R., Jr., N.S. Altman, and W.J. Richardson. 1999. Bowhead whale calls. pp. 6-1 to 6-23 In: W.J. Richardson (*ed.*), Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Ltd., King City, ON, and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and U.S. Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 pp.

Goetz, K.T., D.J. Rugh, and J.A. Mocklin. 2009. Bowhead whale feeding study in the western Beaufort Sea. Section I: aerial surveys of bowhead whales in the vicinity of Barrow, August to September 2009. 2009 annual report, Minerals Management Services, Anchorage, AK. 63 pp.

Hall, J.D., M.L. Gallagher, K.D. Brewer, P.R. Regos, and P.E. Isert. 1994. 1993 Kuvlum exploration area site-specific monitoring program. Coastal & Offshore Pacific Corporation, for Arco Alaska, Inc. 219 pp.

Hannay, D., B. Martin, M. Laurinolli, and J. Delarue. 2009. Chukchi Sea Acoustic Monitoring Program. In: Funk, D.W., Funk, D.S., Rodrigues, R., and Koski, W.R. (*eds*.). Joint monitoring program in the Chukchi and Beaufort seas, open water seasons 2006-2008. LGL Alaska Report P1050-1, Report from LGL Alaska Research Associates, Inc., LGL Ltd., Greenridge Sciences, Inc., and JASCO Research, Ltd., for Shell Offshore, Inc. and other industry contributors, and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 288 pp. + appendices.

Harding, K. C., M. Fujiwara, Y. Axberg, and T. Härkönen. 2005. Mass-dependent energetics and survival in harbour seal pups. Functional Ecology 19:129-135.

Harwood, L.A., F. McLaughlin, R.M. Allen, J. Illasiak Jr. and J. Alikamik. 2005. First-ever marine mammal and bird observations in the deep Canada Basin and Beaufort/Chukchi seas: expeditions during 2002. Polar Biol. 28(3):250-253.

Hashagen K.L., G.A. Green, and B. Adams. 2009. Observation of humpback whales in the Beaufort Sea, Alaska. Northwest Naturalist 90:160-162.

Hoekstra, P.F., T.M. O'Hara, S.J. Pallant, K.R. Solomon, and D.C.G. Muir. 2002. Bioaccumulation of organochlorine contaminants in bowhead whales from Barrow, Alaska. Arch. Environ. Contam. Toxicol. 42:497-507.

Huntington, H.P., and L.T. Quakenbush. 2009. Traditional knowledge of bowhead migration patterns near Kaktovik and Barrow, Alaska. Report prepared for the Barrow and Kaktovik Whaling Captains Associations and Alaska Eskimo Whaling Commission. 15 pp.

Jenssen, B. M. 1996. An overview of exposure to, and effects of, petroleum oil and organochlorine pollution in grey seals (*Halichoerus grypus*). Science of the Total Environment 186:109-118.

Kelly, B. P. 1988. Bearded seal, Erignathus barbatus. Pages 77-94 *In*: J. W. Lentifer, editor. Selected marine mammal species of Alaska: species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

Kelly, B.P., J. L. Bengtson, P. L. Boveng, M. F. Cameron, S. P. Dahle, J. K. Jansen, E. A. Logerwell, J. E. Overland, C. L. Sabine, G. T. Waring, and J. M. Wilder 2010. Status review of the ringed seal (*Phoca hispida*).U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-212, 250 pp.

King, J. E. 1983. Seals of the world. 2nd edition. British Museum (Natural History) and Oxford University Press, London, UK. 240 pp.

LGL and Greeneridge. 1996. Northstar Marine Mammal Monitoring Program, 1995: Baseline surveys and retrospective analyses of marine mammal and ambient noise data from the

Central Alaskan Beaufort Sea. Rep. from LGL Ltd., King City, ON., and Greeneridge Sciences Inc., Santa Barbara, CA, for BP Explor. (Alaska) Inc., Anchorage, AK. 104 pp.

Link, M. R., T. L. Olson, and M. T. Williams. 1999. Ringed seal distribution and abundance near potential oildevelopment sites in the central Alaskan Beaufort Sea, spring 1998. LGL Rep. P-430, Anchorage, Alaska: Prepared by LGL Alaska Research Associates, Inc. for BP Exploration (Alaska), Inc.,

Lipscomb, T.P., R.K. Harris, A.H. Rebar, B.E. Ballachey, and R.J. Haebler. 1994. Pathology of Sea Otters. Pp. 265-279. In T.R. Loughlin, *ed*. Marine Mammals and the Exxon Valdez. Academic Press, San Diego.

Ljungblad, D.K., S.E. Moore and D.R. Van Schoik. 1986. Seasonal patterns of distribution, abundance, migration and behavior of the Western Arctic stock of bowhead whales, *Balaena mysticetus* in Alaskan seas. Rep. Int. Whal. Comm., Spec. Is. 8:177:205.

Ljungblad, D.K., S.E. Moore, J.T. Clarke and J.C. Bennett. 1987. Distribution, abundance, behavior and bioacoustics of endangered whales in the Alaskan Beaufort and eastern Chukchi Seas, 1979-86. NOSC Tech. Rep. 1177; OCS Study MMS 87-0039. Rep. from Naval Ocean Systems Center, San Diego, CA, for U.S. Minerals Manage. Serv., Anchorage, AK. 391 pp. NTIS PB88-116470.

Lowry, L.F. 1993. Foods and Feeding Ecology. Pages 201-238. *In:* The Bowhead Whale Book (J.J. Burns, J.J. Montague, and C.J. Cowles, *eds*.). Special Publication of The Society for Marine Mammalogy. The Society for Marine Mammalogy. Lawrence, Kansas.

Lowry, L. F., K. J. Frost, and K. W. Pitcher. 1994. Observations of oiling of harbor seals in Prince William Sound. Pages 209-225 in T. R. Loughlin, editor. Marine Mammals and the Exxon Valdez. Academic Press, Inc., San Diego, CA.

McDonald, T.L., W.J. Richardson, C.R. Greene, Jr., S.B. Blackwell, C. Nations, and R. Neilson. 2008. Detecting changes in distribution of calling bowhead whales exponsed to fluctuating anthropogenic sound. Chapter 9. *In*: W.J. Richardson (*ed.*). 2008. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar oil development, Alaskan Beaufort Sea, 1000-2004. LGL Rep. P1004. Rep. from LGL Ltd. (King City, Ont.), Greeneridge SciencesInc., (Santa Barbara, CA) and WEST Inc. (Cheyene, WY) for BP Explor. (Alaska) Inc., Anchorage, AK.

Martin, B., M. Laurinolli, D. Hannay, and R. Bohan. 2008. Chukchi Sea Acoustic Monitoring Program. *In*: Funk, D.W., Rodrigues, R., Funk, D.S., and Koski, W.R. (*eds*). Joint monitoring program in the Chukchi and Beaufort seas, July-November 2007. LGL Alaska Report P971-1, Report from LGL Alaska Research Associates, Inc., LGL Ltd., JASCO Research, Ltd., and Greeneridge Sciences, Inc., for Shell Offshore, Inc., ConocoPhillips Alaska, Inc., and National Marine Fisheries Service, U.S. Fish and Wildlife Service. 445 pp. + appendices.

Miller, G.W., R.E. Elliott, W.R. Koski, V.D. Moulton and W.J. Richardson. 1999. Whales. pp. 5-1 to 5-109. *In:* W.J. Richardson (*ed*.), Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houstan, TX and U.S. Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 pp.

Miller, G.W., V.D. Moulton, R.A. Davis, M. Holst, P. Millman, A. MacGillivray, and D. Hannay. 2005. Monitoring seismic effects on marine mammals-southeastern Beaufort Sea, 2001-2002. *In:* S.L. Armsworthy, P.J. Cranford, and K. Lee (*eds.*), Offshore oil and gas environmental effects monitoring/approaches and technologies. Battelle Press, Columbus, OH.

Moore, S.E., J.T. Clarke, and D.K. Ljungblad. 1989. Bowhead whale (*Balaena mysticetus*) spatial and temporal distribution in the central Beaufort Sea during late summer and early fall 1979-86. Rep. Int. Whal. Comm. 39:283-290.

Moore, S.E. and R.R. Reeves. 1993. Distribution and movement. p. 313-386. *In*: J.J. Burns, J.J. Montague and C.J. Cowles (*eds.*), The bowhead whale. Spec. Publ. 2. Soc. Mar. Mammal., Lawrence, KS. 787 pp.

Moore, S.E. 2000. Variability in cetacean distribution and habitat selection in the Alaskan Arctic, autumn 1982-91. Arctic 53(4):448-460.

Moore, S.E., K.M. Stafford, and L.M. Munger. 2010a. Acoustic and visual surveys for bowhead whales in the western Beaufort and far northeastern Chukchi seas. Deep-Sea Research II 57:153-157.

Moore, S.E., J.C. George, G. Sheffield, J. Bacon, and C.J. Ashjian. 2010b. Bowhead whale distribution and feeding near Barrow, Alaska, in late summer 2005-2006. Arctic 63(2):195-205.

Moulton. V.D., R.E. Elliott, and M.T. Williams. 2001. Fixed-wing aerial surveys of seals near BP's Northstar and Liberty sites, 2001. LGL Report T A2570-1. Rep. from LGL Ltd. King City, ON for BP Exploration (Alaska) Inc., Anchorage, AK 31 pp.

Moulton, V.D., W. J. Richardson, T.L. McDonald, R.E. Elliott, and M.T. Williams. 2002. Factors influencing local abundance and haulout behavior of ringed seals on landfast ice of the Alaskan Beaufort Sea. Can. J. Zool. 80:1900-1917.

Moulton, V.D. and J.W. Lawson. 2002. Seals, 2001. pp. 3-1 to 3-46. *In*: W.J. Richardson and J.W. Lawson (*eds.*), Marine mammal monitoring of WesternGeco's open-water seismic program in the Alaskan Beaufort Sea, 2001. LGL Rep. TA2564-4. Rep. from LGL Ltd., King City, Ont., for WesternGeco LLC, Anchorage, AK; BP Explor. (Alaska) Inc., Anchorage, AK; and Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 95 pp.

Moulton, V.D., W. J. Richardson, M.T. Williams, and S.B. Blackwell. 2003. Ringed seal densities and noise near an icebound artificial island with construction and drilling. Acoustics Research Letters Online. 21 July 2003:112-117.

Moulton, V.D., W. J. Richardson, R.E. Elliott, T.L. McDonald, C. Nations, and M.T. Williams. 2005. Effects of an offshore oil development on local abundance and distribution of ringed seals of the Alaskan Beaufort Sea. Marine Mammal Science, 21(2): 217-242.

Nowacek, D. P., L. H. Thorne, D. W. Johnston, and P. L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Rev. 37:81-115.

NRC 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Research Council of the National Academies. Washington DC: National Academic Press. 288 pp.

O'Hara, T.M., M.M. Krahn, D. Boyde, P.R. Becker, and L.M. Philo. 1999. Organochlorine contaminant levels in Eskimo harvested bowhead whales of Arctic Alaska. J. Wildl. Disease 35(4):741-752.

Patenaude, N.J., W.J. Richardson, M.A. Smultea, W.R. Koski, and G.W. Miller. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. Marine Mammal Science 18(2):309-335.

Quakenbush, L.T., J.J. Citta, J.C. George, R. Smith, and M.P. Heide-Jorgensen. 2009. Fall movements of bowhead whales in the Chukchi Sea. Paper presented at the Alaska Marine Science Symposium, January 19-23, 2009, Anchorage, AK.

Quakenbush, L.T., J.J. Citta, J.C. George, R.J. Small, M.P. Heide-Jørgensen. 2010. Fall and winter movements of bowhead whales (*Balaena mysticetus*) in the Chukchi Sea and within a potential petroleum development area. Arctic.63 (3): 289-307.

Reeves, R.R. 1980. Spitsbergen bowhead stock: a short review. Mar. Fish. Rev. 42(9/10):65-69.

Richardson, W.J., B. Würsig, and C.R. Greene. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am. 79(4):1117-1128.

Richardson, W. J., Greene, C. R., Jr., W.R. Koski, C.I. Malme, G.W. Miller, and M.A. Smultea. (1990). Acoustic effects of oil production activities on bowhead and white whales visible during spring migration near Point Barrow, Alaska—1989 phase (OCS Study MMS 90-0017; NTIS PB91-105486). LGL Ltd. report for U.S. Minerals Management Service, Herndon, VA. 284 pp.

Richardson, W.J., Greene, C.R. Jr., Malme C.I., and Thomson D.H. 1995. Marine mammals and noise. Academic Press, San Diego. 576 pp.

Richardson, W.J. 1999. Marine mammal and acoustical monitoring of Western Geophysical's open water acoustic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. From LGL Ltd., King City, Ont., and Greenridge Sciences, Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and NMFS, Anchorage, AK, and Silver Springs, MD, 390 pp.

Richardson, W.J. and D.H. Thomson (*eds*). 2002. Bowhead whale feeding in the eastern Alaskan Beaufort Sea: update of scientific and traditional information. OCS Study MMS 2002-012; LGL Rep. TA2196-7. Rep. from LGL Ltd., King City, ON, for Minerals Manage. Serv., Anchorage, AK, and Herndon, VA. 697 pp. 2 volumes NTIS PB2004-101568. Available from www.mms.gov/alaska/ref/AKPUBS.HTM#2002.

Richardson, W. J., and M. T. Williams (*eds*). 2004. Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar oil development, Alaskan Beaufort Sea, 1999-2003. Annual and comprehensive report, Dec 2004. LGL Report TA 4001. Rep. from LGL Ltd. (King City, Ont.), Greenridge Sciences Inc. (Santa Barbara, CA), and WEST Inc. (Cheyenne, WY) for BP Exploration (Alaska) Inc., Anchorage, AK.

Richardson, W.J., T.L. McDonald, C.R. Greene, Jr., and S.B. Blackwell. 2008. Effects of Northstar on distribution of calling bowhead whales 2001-2004. Chapter 10. *In*: Richardson, W.J. (*ed.*). 2008. Monitoring of industrial sounds, seals, and bowhead whale calls near BP's Northstar Oil Development, Alaskan Beaufort Sea, 1999-2004. Comprehensive Report, 3rd Update, Feb. 2008. LGL Rep. P1004. Rep. from LGL Ltd. (King City, ON), Greeneridge Sciences, Inc. (Santa Barbara, CA), WEST, Inc., (Cheyenne, WY), and Applied Sociocultural Research (Anchorage, AK), for BP Exploration (Alaska) Inc., (Anchorage, AK).

Salazar, S. 2003. Impacts of the Jessica oil spill on sea lion (Zalophus wollebaeki) populations. Marine Pollution Bulletin 47:313-318.

Shelden, K.E.W., D.P. DeMaster, D.J. Fugh, and A.M. Olson. 2001. Developing classification criteria under the U.S. Endangered Species Act: bowhead whales as a case study. Cons.Bio. 15(5):1300-1307.

Smith, T .G. and I. Stirling. 1975. The breeding habitat of the ringed seal (*Phoca hispida*). The birth lair and associated structures. Can. J. Zool. 53:1297-1305.

Smith, T. G. 1987. The ringed seal, *Phoca hispida,* of the Canadian western Arctic. Bulletin Fisheries Research Board of Canada. 81 pp.

Southall, B.L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. K. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Special Issue of Aquatic Mammals, 33(4): 412-522.

Spraker, T. R., L. F. Lowry, and K. J. Frost. 1994. Gross necropsy and histopathological lesions found in harbor seals. Pages 281-311. *In:* T. R. Loughlin, editor. Marine Mammals and the Exxon Valdez. Academic Press, Inc., San Diego, CA.

St. Aubin, D. J. 1988. Physiological and toxicologic effects on pinnipeds. Pages 120-142. *In*: J. R. Geraci and D. J. St. Aubin, *(ed*). Synthesis of effects of oil on marine mammals. U.S. Department of the Interior, Minerals Management Service, Atlantic OCS Region, New Orleans, LA.

St. Aubin, D. J. 1990. Physiological and toxic effects on pinnipeds. Pages 103-127. *In:* J. R. Geraci and D. J. St. Aubin, editors. Sea Mammals and Oil: Confronting the Risks. Academic Press, Inc., San Diego, CA.

Stirling, I., M. Kingsley and W. Calvert. 1982. The distribution and abundance of seals in the eastern Beaufort Sea, 1974-79. Can. Wildl. Serv. Occas. Pap. 47. 25 pp.

Stroeve, J., M. Serreze, S. Drobot, S. Gearheard, M. Holland, J., Maslanik, W. Meier, and T. Scamobs. 2008. Arctic sea ice extent plumments in 2007. EOS, Transactions, American Geophysical Union. 89(2):13-14.

Suydam, R., and J.C. George. 2004. Subsistence harvest of bowhead whales by Alaskan Eskimos, 1974-2003. Paper SC/56/BRG12 presented to the Scientific Committee of the International Whaling Commission. 7 pp.

Suydam, R., J.C. George, C. Rosa, B. Person, C. Hanns, G. Sheffield, and J. Bacon. 2007. Subsistence harvest of bowhead whales by Alaskan Eskimos during 2006. Paper SC/59/BRG4 presented to the Scientific Committee of the International Whaling Commission.

Suydam, R., J.C. George, C. Rosa, B. Person, C. Hanns, G. Sheffield, and J. Bacon. 2008. Subsistence harvest of bowhead whales (Balaena mysticetus) by Alaskan Eskimos during 2007. Unpubl. report submitted to Int. Whal. Commn. (SC/60/BRG10). 7 pp.

Tynan, C. T., and D. P. DeMaster. 1997. Observations and predictions of Arctic climate change: potential effects on marine mammals. Arctic 50(4):308-322.

Treacy, S.D., J.S. Gleason, and C.J. Cowles, 2006. Offshore distances of bowhead whales observed during fall in the Beaufort Sea, 1982-2000: an alternative interpretation. Arctic: 59(1):83-90.

USDI MMS. 2003. Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202. Final Environmental Impact Statement. USDI MMS Alaska OSC Region. Anchorage, Alaska.

Wiig, Ø. 1991. Seven bowhead whales *(Balaena mysticetus)* observed at Franz Josef in 1990. Mar. Mamm. Sci. 7(3):316-319.

Williams, M.T., C.S. Nations, T.G. Smith, V.D. Moulton, and P.J.Perham. 2006. Ringed seal use of subnivean structure in the Alaskan Beaufort Sea during development of an oil production facility. Aquatic Mammals. 32(3):311-324.

Woodby, D.A., and D.B. Botkin. 1993. Stock sizes prior to commercial whaling. pp. 387-407. *In*: J.J. Burns, J.J. Montague and C.J. Cowles (*eds*.), The bowhead whale. Spec. Publ. 2. Soc. Mar. Mamm., Lawrence, KS. 787 pp.

Zeh, J.E., and A.E. Punt. 2005. Updated 1978-2001 abundance estimate and their correlations for the Bering-Chukchi-Beaufort Seas stock of bowhead whales. J. Cetaceans Res. Manage 7(2):169-175.

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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

Table of Contents

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.

REFERENCES

ADEC 2010. Spill sites database. Available online at: http://dec.state.ak.us/spar/perp/search. Accessed 2010.

ExxonMobil Corporation. 2009. Point Thomson Project Environmental Report (November 2009). ExxonMobil Corporation, Anchorage, AK. 796 pp.NRC 2003

Mach, J.L., R.L. Sandefeur, and J.H. Lee. 2000. Estimation of Oil Spill Risk from Alaska North Slope, Trans-Alaska Pipeline, and Arctic Canada Oil Spill Data Sets. Final Report for Mineral Management Service under contract No. 01-99-PO-16128. 149 pp.

Maxim, L.D., and R.W. Niebo. 2001a. Analysis of Spills Associated with Alaska North Slope (ANS) Exploration and Production (E&P) Activities. Draft. Prepared by Everest Consulting Associates, Cranbury, NJ, for TAPS Owners Alaska, Anchorage.

Maxim, L.D., and R.W. Niebo. 2001b. Appendix B. Oil Spill Analysis for North Slope Oil Production and Transportation Operations. Environmental Report for TAPS Right-of-Way Renewal. Draft. [Online] Availablehttp://tapseis.anl.gov/documents/report.cfm.

Maxim, L.D., and R.W. Niebo. 2001c. Water Spills on the Alaska North Slope. Prepared by Everest Consulting Associates, Cranbury, NJ, for Alaska Oil and Gas Association, Alaska, Anchorage.

NRC 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Research Council of the National Academies. Washington DC: National Academic Press. 288 pp.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
REGULATORY DIVISION
P.O. BOX 6898, CEPOA-RD
JBER, ALASKA 99506-0898

REPLY TO
ATTENTION OF:

January 24, 2012

Regulatory Division
POA-2001-1082-M1

Ms. Sarah Conn
U.S. Fish and Wildlife Service
FFWFO, 101 12th Avenue, Room 110
Fairbanks, Alaska 99701

Dear Ms. Conn:

Enclosed is the US Army Corps of Engineers' (Corps) Biological Assessment (BA) prepared to address expected impacts to Listed Species associated with a Department of the Army (DA) permit application received from Exxon Mobil Corporation and PTE Pipeline LLC (ExxonMobil) for their proposed Point Thomson Project. A printed copy and electronic copy (CD) are provided. The permit application has been assigned Corps' file number POA-2001-1082-M1, Beaufort Sea. The project would be located along the Beaufort Seacoast near Mary Sachs and Flaxman Islands approximately 60 miles west of Kaktovik, Alaska.

ExxonMobil proposes to construct infrastructure to produce liquid hydrocarbons and to further delineate the Thomson Sand and Brookian Sandstone Reservoirs, located mostly offshore, by directional drilling. ExxonMobil would construct 3 on-shore gravel pads, connecting gravel roads, above-ground pipelines, a gravel mine site, airstrip, ice roads, a marine barging facility, and conduct barging operations during ice free periods.

The Point Thomson Project BA is provided to the U.S. Fish and Wildlife Service (Service), for review and coordination with us under the Endangered Species Act (ESA), Section 7(a)(2). For the Point Thomson Project, ExxonMobil was designated as our non-Federal representative to prepare the BA by letter addressed to Ms. Kate Martin dated March 19, 2010, (copy enclosed).

The Point Thomson Project BA was prepared to ensure ESA, Section 7, consultation procedures occur between the Service and action agency (Corps). The BA evaluates Service Listed Species which may be present in the action area and addresses potential Point Thomson Project impacts to the Listed Species populations.

Pursuant to the ESA, a Biological Assessment (BA) is required for Federal actions of "major construction activities" when listed species or critical habitats may be present in the proposed project area. The proposed project is within the range of the threatened polar bear (*Ursus maritimus*) and their designated critical habitat area, threatened spectacled eider (*Somateria fischeri*), and threatened Alaska-breeding Steller's eider (*Polysticta stelleri*). The yellow-billed loon (*Gavia adamsii*) and Pacific walrus (*Odobenus rosmarus divergens*), candidate species for listing under ESA, also may occur in the project action area. The Pacific walrus is introduced in the BA but is not discussed in detail because the Beaufort Sea is beyond the normal range of the species and the likelihood of encountering walruses in the action area appears to be low. We request an informal conference report from the Service on the Pacific walrus.

We have prepared a Draft Environmental Impact Statement (DEIS) and Public Notice of Application for Permit (PN) for the Point Thomson Project which were recently available for public comment until January 18, 2012. Pursuant to the National Environmental Policy Act, the BA is required because of our major Federal action determination resulting from ExxonMobil's proposed project. A draft BA was included in the DEIS at Appendix M. The applicant's DA permit application is included in Appendix A. There is a project website located at www.pointthomsonprojecteis.com. The PN is located at the Alaska District Regulatory website: www.poa.usace.army.mil/reg/PNNew.htm.

The BA includes a Determination of Effect of "not likely to affect" for the Steller's eider; "not likely to adversely affect" for the Polar bear, Spectacled eider, and Yellow-billed loon; and "may effect, but not likely to cause destruction or adverse modification" for Polar bear critical habitat area. We request your review the BA for a determination of completeness, and if complete, a determination of concurrence or non-concurrence with the accuracy of the BA.

Please contact me at the letterhead address, by e-mail message at harry.a.baij@usace.army.mil, by telephone at 907-753-2784 (office), or at 907-350-5097 (cell). I appreciate this opportunity to work closely with the Service throughout the consultation process.

Sincerely,

H. Baij

Harry A. Baij Jr.
Project Manager

Enclosures

REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
REGULATORY DIVISION
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

MAR 19 2010

Regulatory Division
POA-2001-1082-M1

Ms. Kate Martin
US Fish and Wildlife Service
101 12th Avenue, Room 110
Fairbanks, Alaska 99701

Dear Ms. Martin:

This is in regard to Exxon Mobil Corporation's proposed Point Thomson Project; file number POA-2001-1082-M1, Beaufort Sea, to recover hydrocarbons from the Thomson Sands reservoir. We are preparing a Draft Environmental Impact Statement for the project.

Pursuant to the Endangered Species Act, a biological assessment is required for Federal actions that are "major construction activities" when listed species or critical habitat may be present in the proposed project area. According to your letter of March 3, 2010, the proposed project is within the range of threatened polar bears (*Ursus maritimus*), spectacled eiders (*Somateria fischeri*), and Alaska-breeding Steller's eiders (*Polysticta stelleri*).

The Federal action agency, in this case the US Army Corps of Engineers, may designate the applicant or a non-Federal representative to prepare the biological assessment. The action agency remains responsible for the content of the assessment and for the findings of effect. For the Point Thomson Project EIS, we designate Exxon Mobil Corporation to prepare the biological assessment. We will ultimately be responsible for the content and for the findings of effect. We look forward to working with your agency as the biological assessment is developed.

You may contact me via email at julie.w.mckim@usace.army.mil, by mail at the address above, by phone at (907) 753-2773, or toll free from within Alaska at (800) 478-2712, if you have questions.

Sincerely,

Julie W. McKim

Julie W. McKim
Project Manager

Biological Assessment
of the
Polar Bear (*Ursus maritimus*), Spectacled Eider (*Somateria fischeri*), Steller's Eider (*Polysticta stelleri*), and Yellow-Billed Loon (*Gavia adamsii*)

Prepared for

ExxonMobil

Point Thomson Project

North Slope, Alaska

Prepared by

Charles B. Johnson
Brian E. Lawhead
Ann M. Wildman

ABR, Inc.—Environmental Research & Services
Fairbanks and Anchorage, Alaska

and

URS Corporation
Anchorage, AK

November 2011

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ac	acres
ACP	Arctic Coastal Plain
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AOGCC	Alaska Oil and Gas Conservation Commission
APDES	Alaska Pollutant Discharge Elimination System
BMPs	Best Management Practices
bbl	barrels
bpd	barrels per day
BWASP	Bowhead Whale Aerial Survey Program
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
CPF	Central Processing Facility
CS	Chukchi Sea
Corps	United States Army Corps of Engineers
dBA	decibels measured using A-weighted scale
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ExxonMobil	Exxon Mobil Corporation
FEED	Front-end Engineering Design
ft	feet
FLIR	Forward-looking Infrared
FRP	Facility Response Plans
gal	gallons
ha	hectares
HP	High-pressure
ITR	Incidental Take Regulations
km	kilometers
km^2	square kilometers
kW	kilowatts
L	liters
LOA	Letter(s) of Authorization
LP	low-pressure
m	meters
m^3	cubic meters
mi	miles
mi^2	square miles

MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
mmscfd	million standard cubic feet per day
mmscmd	million standard cubic meters per day
NBS	Northern Beaufort Sea
NMFS	National Marine Fisheries Service
NPRA	National Petroleum Reserve–Alaska
NPDES	National Pollutant Discharge Elimination System
NSB	North Slope Borough
NRC	National Response Center
ODPCP	Oil Discharge Prevention and Contingency Plan
O&M	Operations and Maintenance
PBR	Potential Biological Removal
PCEs	Primary Constituent Elements of critical habitat
Project	Point Thomson Project
Red Book	*Alaska Waste Disposal and Reuse Guide*
ROW	right-of-ways
SBS	Southern Beaufort Sea
SPCC	Spill Prevention, Control, and Countermeasures
SPMTs	Self-propelled Module Transporters
SWPPP	Stormwater Pollution Prevention Plan
tonnes	metric tonnes
UOP	Unified Operating Procedures
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VHF	very high frequency
VSMs	vertical support members
yd	yards
yd^3	cubic yards
YKD	Yukon-Kuskokwim Delta

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1.0 EXECUTIVE SUMMARY

Exxon Mobil Corporation (ExxonMobil) is proposing to initiate development of a hydrocarbon reservoir at Point Thomson on State of Alaska leases on the Arctic Coastal Plain (ACP), approximately 80 kilometers (km) (50 miles [mi]) east of Prudhoe Bay and approximately 3–10 km (2–6 mi) west of the Arctic National Wildlife Refuge (also referred to herein as the Arctic Refuge). The proposed Point Thomson Project (Project) is in the range of three species listed under the Endangered Species Act (ESA) that are managed by the U.S. Fish and Wildlife Service (USFWS): polar bear (*Ursus maritimus*), Spectacled Eider (*Somateria fischeri*), and Steller's Eider (*Polysticta stelleri*). Two candidate species for listing under the ESA, which are also managed by USFWS, may occur near the Project. The Pacific walrus (*Odobenus rosmarus divergens*) has been recorded in the area occasionally, whereas the Yellow-billed Loon (*Gavia adamsii*) occurs regularly in very low numbers in the marine zone near the Project. The Point Thomson Project is located within designated critical habitat for the polar bear, but not within critical habitat for the other listed species managed by USFWS.

The lead federal action agency on the Point Thomson Project is the United States Army Corps of Engineers (Corps), which has issuing authority for permits to fill wetlands and waters under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, respectively. The applicant and designated non-federal representative is the Exxon Mobil Corporation. The PTE Pipeline LLC is a joint applicant.

The footprint for the proposed Point Thomson Project will encompass approximately 117 hectares (1.17 square kilometers [km^2] or 289 acres [ac]) of tundra. The primary Project elements are two well pads; a pad with processing facility, personnel camp, a Service Pier, and sealift barge offloading facility (Sealift Bulkhead and mooring dolphins); an airstrip; a gravel mine site; 18.4 km (11.4 mi) of interconnecting gravel roads; 239.3 km (~150 mi) of seasonal ice roads; 35 km (22 mi) of export pipeline; 16 km (10 mi) infield gathering lines and supporting buildings and structures. The Project will not be connected to other oilfields, the Alaska highway system, or any communities by an all-season road; instead, seasonal ice roads, aircraft, and sea-going barges will allow equipment, materials, supplies, and personnel transport. Major construction is planned to occur during three winter seasons (2012/2013–2014/2015), thereby minimizing impacts on sensitive habitats and migratory bird species. Facility commissioning/startup and construction demobilization will occur in late 2015–early 2016. Drilling has already occurred but additional drilling will be necessary beginning in 2015. The operational life of the Point Thomson Project is expected to be approximately 30 years. Although the greatest impacts, due to temporary disturbance, will occur during the actual construction period (just over three years), the effects analyzed here are based on the 30 years of the project.

The direct, indirect, and cumulative effects of facilities and activities related to the Point Thomson Project were evaluated for the listed species, polar bear critical habitat, and the candidate species. Based on the analysis of published and unpublished information on each of the species and the identified effects from construction, drilling, and operation of the project, none of the species is likely to incur population-level adverse effects, and polar bear critical habitat is not likely to be destroyed or adversely modified.

Any adverse effects on individuals of these listed species or constituent elements of polar bear critical habitat units are unlikely to result in significant adverse effects throughout the species' ranges, or to appreciably diminish the capability of the polar bear critical habitat to satisfy essential requirements of the species.A summary of the effects determinations is presented in Table 1.1 below.

Table 1.1 Effects Determinations for Listed Species and Critical Habitat in the Point Thomson Project Action Area.

Species/Critical Habitat	Status	Determination
Polar Bear	Threatened	Not likely to adversely affect
Polar Bear Critical Habitat	Designated	May affect, but not likely to cause destruction or adverse modification
Spectacled Eider	Threatened	Not likely to adversely affect
Steller's Eider	Threatened	Not likely to affect
Yellow-billed Loon	Candidate	Not likely to adversely affect

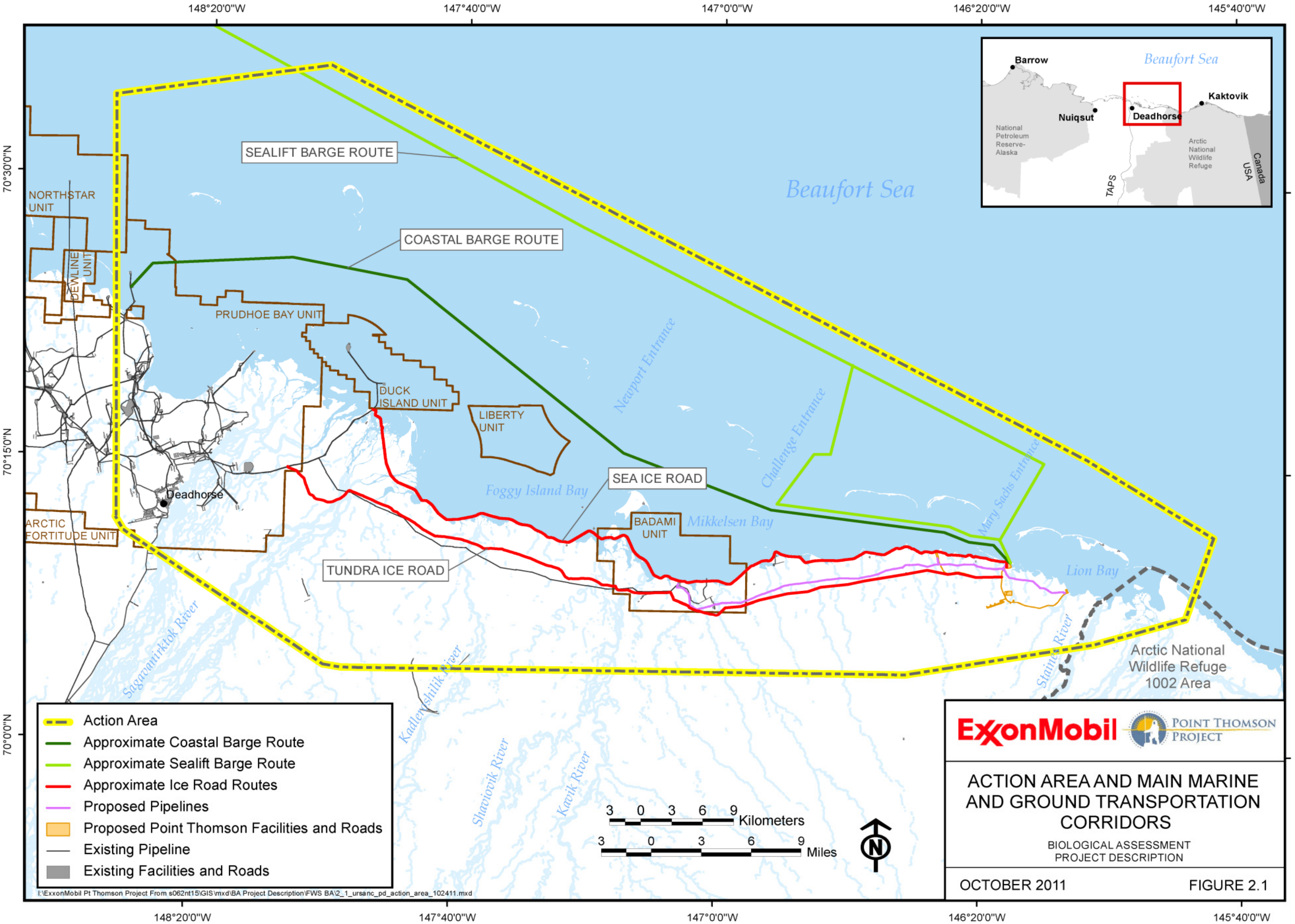
2.0 PROJECT DESCRIPTION

ExxonMobil is proposing to initiate hydrocarbon production from the Thomson Sand reservoir on the ACP of Alaska, with surface development located approximately 80 km (50 mi) east of Prudhoe Bay and approximately 3–10 km (2–6 mi) west of the Staines River, which is the western boundary of the Arctic Refuge (Figure 2.1). ExxonMobil proposes to produce gas from the Thomson Sand reservoir, recover liquid hydrocarbons, and re-inject the residual gas back into the Thomson Sand reservoir. 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 that is essential in determining subsequent development plans.

The proposed project (hereafter, the Point Thomson Project) location is in an area used seasonally by low densities of Spectacled Eiders (*Somateria fischeri*) and polar bears (*Ursus maritimus*). The Point Thomson Project also is within the historical range of the Steller's Eider (*Polysticta stelleri*), although the species has been absent from this area in recent years. All three species are listed as threatened under the ESA of 1973, as amended (PL 93-205; 16 USC §§1531–1544). Two other species that may occur near the Project are candidates for listing under the ESA: the Pacific walrus (*Odobenus rosmarus divergens*) and the Yellow-billed Loon (*Gavia adamsii*). The walrus is rare east of Point Barrow and is not discussed in detail here; the Yellow-billed Loon occurs in the Project area on a regular basis in very low numbers in marine areas. Section 7 of the ESA requires federal agencies to consult with the USFWS 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 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 Biological Assessment (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 four species in the Point Thomson area to support the Section 7 consultation process. Also included in this BA are mitigation measures proposed to minimize the impacts of the proposed action on threatened species. Following review of the BA, the USFWS will assess whether the proposed action is likely to jeopardize the populations of each species or result in the destruction or adverse modification of critical habitat (for polar bears only).

The consultation process began in February 2010 with a request by the Corps for a list of species for the Point Thomson area that are listed as endangered or threatened under ESA. The history for this consultation includes the following milestones to date:

- 19 February 2010—District Engineer, Alaska District, Corps requests information (species list) on threatened and endangered species from the USFWS.
- 3 March 2010—USFWS responds to Corps Alaska District stating that the Project is within the range of polar bears, and Spectacled and Steller's eiders.
- 19 March 2010—Project Manager, Corps Alaska District designates ExxonMobil as the non-federal representative to prepare the BA.
- 18 May 2010—A coordination meeting occurs between representatives of the Corps and USFWS to discuss ESA Section 7 consultation process and the content of the BA.
- 5 January 2012—ESA Section 7 consultation is initiated with the submittal of the BA to USFWS.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SEALIFT BARGE ROUTE
COASTAL BARGE ROUTE
SEA ICE ROAD
TUNDRA ICE ROAD
NORTHSTAR UNIT
DEWLINE UNIT
PRUDHOE BAY UNIT
DUCK ISLAND UNIT
LIBERTY UNIT
BADAMI UNIT
ARCTIC FORTITUDE UNIT
Deadhorse
Beaufort Sea
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Newport Entrance
Challenge Entrance
Mary Sachs Entrance
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Kadleroshilik River
Shaviovik River
Kavik River
Staines River
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Barrow
Beaufort Sea
Kaktovik
Nuiqsut
Deadhorse
National Petroleum Reserve-Alaska
Arctic National Wildlife Refuge
TAPS
USA
Canada
Action Area
Approximate Coastal Barge Route
Approximate Sealift Barge Route
Approximate Ice Road Routes
Proposed Pipelines
Proposed Point Thomson Facilities and Roads
Existing Pipeline
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ExxonMobil
Point Thomson Project
ACTION AREA AND MAIN MARINE AND GROUND TRANSPORTATION CORRIDORS
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.1

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2.1 Location/Action Area

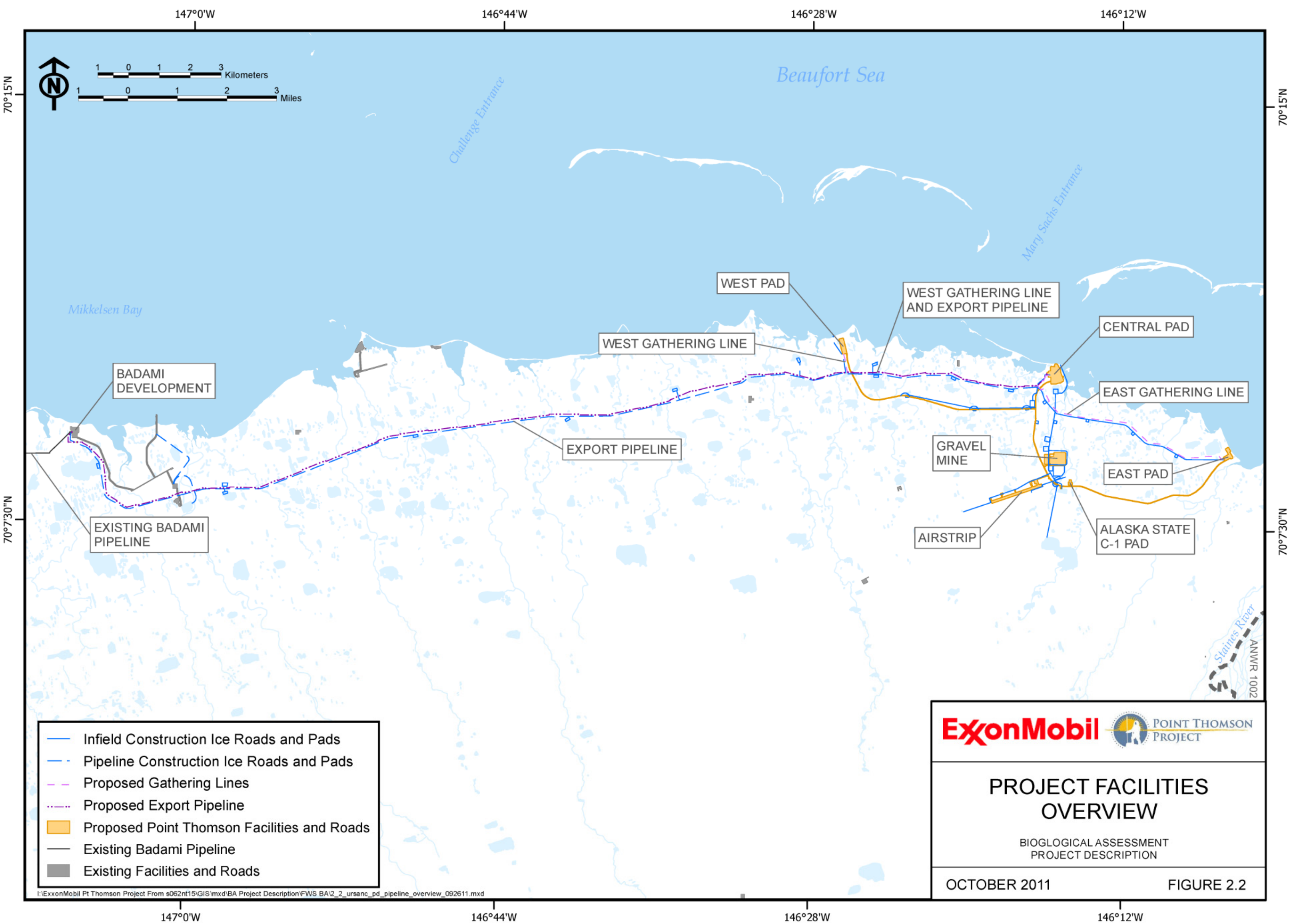
The Point Thomson Project Action Area will be located along the Beaufort Sea coast, on the eastern North Slope of Alaska in an area generally between the Staines River on the east and Prudhoe Bay on the west, and from 10 km (6 mi) seaward side of the barrier islands to a point inland of the proposed airstrip, as shown in Figure 2.1.

The main Project facilities (Central Pad) will be located approximately 10 km (6 mi) west of the Staines River, and approximately 35 km (22 mi) east of the Badami Development. An export pipeline will extend 35 km (22 mi) west from the Central Pad to the Badami Development, occupying a narrow corridor 2–5 km (1–3 mi) inland (Figure 2.2). Seasonal ice roads, when constructed, will occur on or very near the sea ice near the coastline and/or across the tundra between Point Thomson and the Endicott Development road with occasional short inland spurs to water source lakes (Figure 2.3).

The Action Area was defined to encompass the direct and indirect effects of the Project. Broadly, the Action Area includes the area affected by proposed gravel roads and pads, facilities, pipelines, and seasonal ice roads, as well as areas potentially affected directly and indirectly by air and sea transportation and marine spills (Figure 2.1). The Action Area extends from vessel docking facilities at West Dock in Prudhoe Bay, where coastal barges will depart for Point Thomson, and includes the portion of the sealift barge routes in the Beaufort Sea outside of the barrier islands extending from approximately Prudhoe Bay to Point Thomson, as shown in Figure 2.1. The coastal barge route is generally inside the barrier islands, whereas the sealift routes are offshore marine corridors between ports outside of Alaska and the Project site. The sealift route will converge with the coastal barge shipping route inside the barrier islands between Prudhoe Bay and Point Thomson. The marine boundary of the Action Area includes an area approximately 10 km (6 mi) seaward of the barrier islands on the north to the Staines River in the east. The southern extent of the Action Area includes the area south of the proposed Point Thomson airstrip to Deadhorse. The eastern boundary of the Action Area extends east of the project facilities to Brownlow Point. The Action Area was expanded to include at least a 1.6-km (1 mi) buffer around transportation routes and facilities (for example West Dock in Prudhoe Bay) to encompass potential route changes or variation, as well as to encompass potential disturbance effects on wildlife such as polar bears.

2.2 Project Overview

The proposed Project will initiate development and commercial hydrocarbon production from the Thomson Sand reservoir. The Thomson Sand 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.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Beaufort Sea
Challenge Entrance
Mary Sachs Entrance
Mikkelsen Bay
WEST PAD
WEST GATHERING LINE AND EXPORT PIPELINE
CENTRAL PAD
WEST GATHERING LINE
EAST GATHERING LINE
BADAMI DEVELOPMENT
EXPORT PIPELINE
GRAVEL MINE
EAST PAD
AIRSTRIP
ALASKA STATE C-1 PAD
EXISTING BADAMI PIPELINE
Staines River
ANWR 1002
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 Badami Pipeline
Existing Facilities and Roads
ExxonMobil
POINT THOMSON PROJECT
PROJECT FACILITIES OVERVIEW
BIOGLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.2

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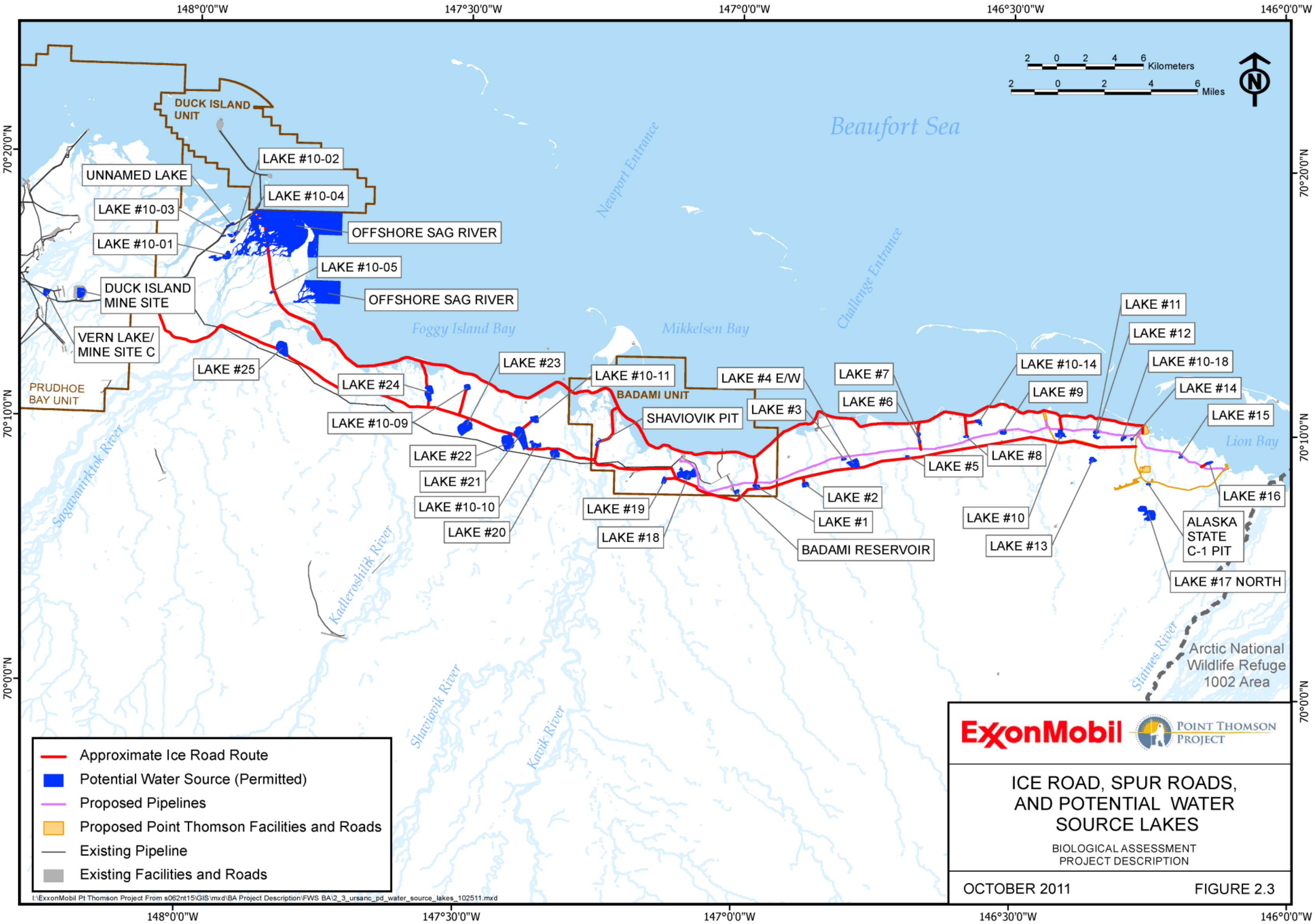
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70°0'0"N
Kilometers
Miles
Beaufort Sea
DUCK ISLAND UNIT
LAKE #10-02
UNNAMED LAKE
LAKE #10-04
LAKE #10-03
OFFSHORE SAG RIVER
LAKE #10-01
LAKE #10-05
DUCK ISLAND MINE SITE
OFFSHORE SAG RIVER
VERN LAKE/ MINE SITE C
Foggy Island Bay
Mikkelsen Bay
Newport Entrance
Challenge Entrance
LAKE #11
LAKE #12
LAKE #10-14
LAKE #10-18
LAKE #25
LAKE #23
LAKE #10-11
LAKE #4 E/W
LAKE #7
LAKE #9
LAKE #14
PRUDHOE BAY UNIT
LAKE #24
BADAMI UNIT
LAKE #6
LAKE #15
LAKE #10-09
SHAVIOVIK PIT
LAKE #3
Lion Bay
LAKE #22
LAKE #8
LAKE #5
LAKE #21
LAKE #2
LAKE #16
LAKE #10-10
LAKE #19
LAKE #1
LAKE #10
ALASKA STATE C-1 PIT
LAKE #20
LAKE #18
BADAMI RESERVOIR
LAKE #13
LAKE #17 NORTH
Sagavanirktok River
Kadleroshilik River
Shaviovik River
Kavik River
Staines River
Arctic National Wildlife Refuge 1002 Area
Approximate Ice Road Route
Potential Water Source (Permitted)
Proposed Pipelines
Proposed Point Thomson Facilities and Roads
Existing Pipeline
Existing Facilities and Roads
ExxonMobil
POINT THOMSON PROJECT
ICE ROAD, SPUR ROADS, AND POTENTIAL WATER SOURCE LAKES
BIOLOGICAL ASSESSMENT PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.3

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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 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 (LRDD). 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 LRDD 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 5.7 million standard cubic meters per day (mmscmd) (200 million standard cubic feet per day [mmscfd]) of natural gas for recovery of approximately 10,000 barrels per day (bpd) 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 3-phase stream (gas, water, and hydrocarbon liquids) produced from the wells will be separated, and the hydrocarbon liquids will be recovered and stabilized to meet pipeline tariff specifications from the Export Pipeline to the Trans Alaska Pipeline System (TAPS) 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 facility. 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; grind and inject module; 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 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 and emergency response activities. No gravel road between Point Thomson and other Alaska 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.
- Single season winter ice roads and pads used for construction, operations and other activities, as needed.

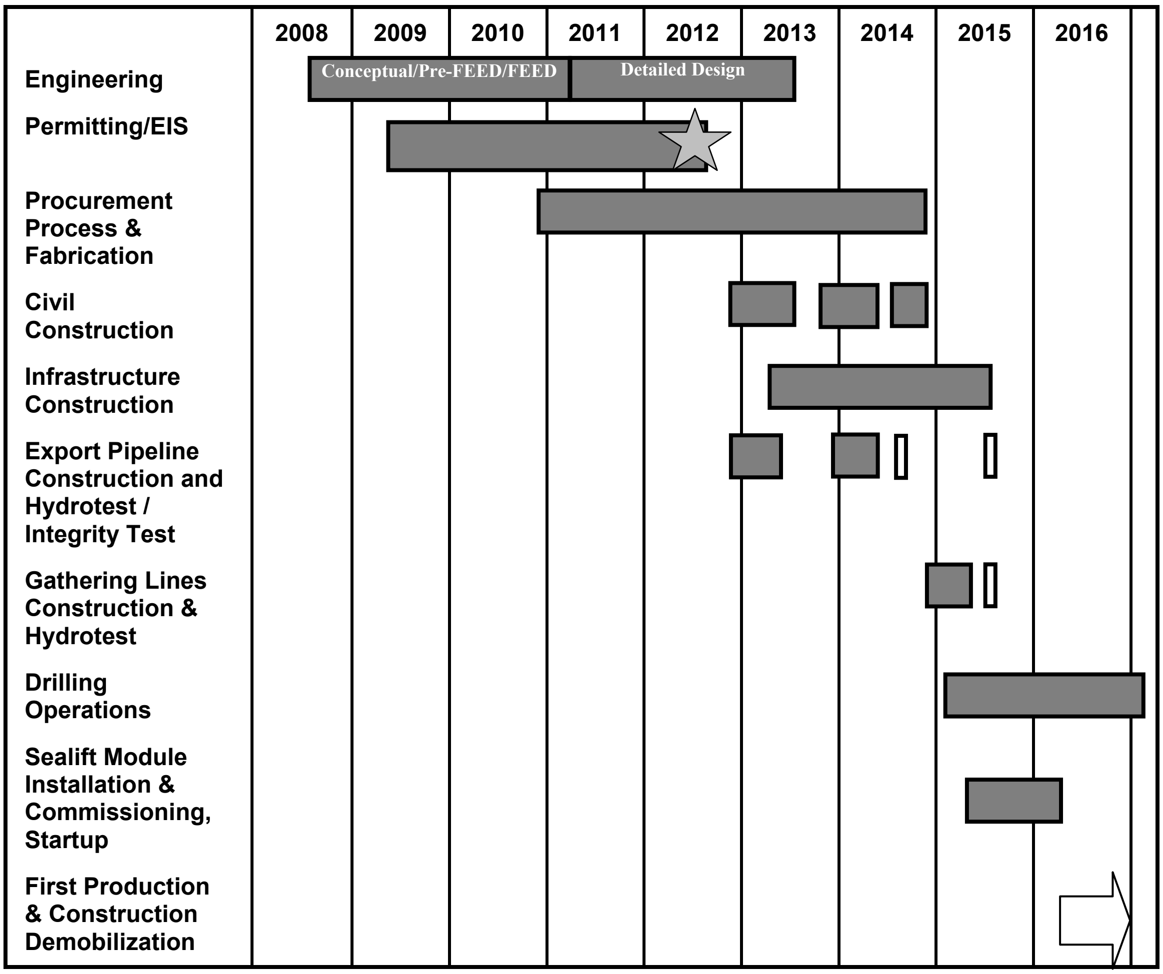
From the CPF facilities, stabilized hydrocarbon liquids will be transported through the approximately 35-km (22-mi) long Export Pipeline to existing common carrier pipelines for delivery to the TAPS. The Export Pipeline will be supported on approximately 2,200 Vertical Support Members (VSMs) from the CPF to the Badami Sales Oil Pipeline connection. Other infrastructure associated with the Export Pipeline includes two small gravel pads at Badami: an Auxiliary Pad to provide space to install a leak detection metering skid and a small 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 project permits. The actual timing of some Project components may vary to accommodate execution plan contingencies.

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 integrity assessment or hydrotesting occurring during the summers of 2014 and 2015.
Gathering Lines Construction and Hydrtotest	4^{th} Q 2014 – 2^{nd} 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 Project 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.
Production, Construction Demobilization, and onging operations	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 pads, which will require Alaska Department of Natural Resources and North Slope Borough approvals.
2. In the first winter season (2012–13), the gravel access road from the mine site to the airstrip and Central Pad will be fully installed. A gravel base approximately two 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.

This biological assessment will analyze project elements beginning with gravel construction in December 2012 through the operations phase of the project beginning in 2016.

2.4 Access/Transportation

The Project will be a remote operating facility, located approximately 80 km (50 mi) east of Prudhoe Bay and the existing Alaska North Slope road infrastructure. Various modes of traffic (marine, ground, and air) will be used. During the open water season, barges and other vessels will be used to transport equipment and supplies. During winter, seasonal ice roads will be constructed, as needed, to support construction and operations activities. Ice roads will be required to support construction of gravel roads, pads, and airstrip; pipeline construction; delivery of early infrastructure facilities; and transport of personnel, fuel, truckable modules, equipment, and materials to Point Thomson. Ice roads will also be required in subsequent years to support additional drilling and field operations. Aircraft will be used year-round for personnel, materials, and emergency support, as well as routine surveillance and pipeline inspections.

Another important consideration in the Project's logistics and transportation strategy is the plan to construct process facility and camp modules offsite, which will then be transported to Point Thomson. Direct offloading of large sealift modules at Point Thomson is planned, with smaller modules being trucked to the Alaska North Slope on State highways to Deadhorse and then transported to Point Thomson via ice roads. The larger sealift modules will be delivered via ocean barges during the summer open water season and will be offloaded at Point Thomson. Table 2.2 provides estimates of logistical traffic by various transportation modes.

Table 2.2 Projected Roundtrips to Point Thomson by Mode and Phase.

Transportation Activity	Construction (total for phase)	Drilling (total for phase)	Operations (annual)
Land Transport (ice road)	4,510	5,200—6,250	0
Barge	170 coastal 10 sealift	20—100	15
Fixed-wing Aircraft	990	400	545
Helicopter	900	0	4

2.4.1 Marine Transportation

Marine access enables transport of equipment and materials to Point Thomson when ice roads are not available, or when heavy loads are not able to be transported by aircraft. In the summer, barge and boat transport will be used by the Project, as required, between dockheads outside Alaska, at Prudhoe Bay, and the marine facilities at Point Thomson. Two forms of barging will be used to access Point Thomson: coastal barges and oceangoing (sealift) barges.

Coastal barging will provide a means for transporting material, equipment, and supplies, and for the removal of wastes and excess equipment. Alaska North Slope-based coastal barges will be the primary vessels deployed for this purpose.

Previous drilling activity at Point Thomson was supported by over-the-beach (coastal) barge access during the open water season. This type of direct beach access limits the loads that can be delivered but will continue until the Service Pier (see Section 2.5.7 below) is constructed at the Central Pad. The Service Pier will allow use of larger and/or more fully-loaded coastal barges.

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 (Figure 2.1).

The total anticipated number of round trip costal barge trips during construction and construction demobilization (2013–2016) is 170 (Table 2.2). This number will drop to between 20 and 100 annually for drilling, and 15 per year during operations (2017 and beyond). Most of these barge trips will be using

deck barges to transport equipment, materials and supplies. Some barge runs will involve transporting fuel, either via tanker trucks on deck barges or in fuel barges.

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 modules from locations outside of Alaska generally using standard 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). The 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. Ocean barges that are approximately 8 meters (m)

(25 feet [ft]) deep, 32 m (105 ft) wide, and 122 m (400 ft) long will be used for sealift of large modules and heavy equipment to the Point Thomson site.

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 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 ocean 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).

Self Propelled Module Transporters (SPMTs) will be used to offload the modules from the barges and transport them to the Central Pad, to be set directly on their respective foundations. The grounded barges will be re-floated and demobilized from the area after modules and other large cargo have been offloaded.

2.4.2 Ground Transportation

Ground transportation will use a system of onshore (tundra) and offshore (sea) ice roads during construction (see Section 2.5.13), and a relatively short network of gravel (all season) infield roads that will link the various elements of the Project during drilling and operations (see Section 2.5.2). Off road tundra travel may also be required during construction and operations. Tundra travel will involve use of approved tundra travel vehicles. The type and volume of ground traffic will depend on the activities and the extent of infrastructure in place.

2.4.3 Air Transportation

Aircraft will be used on a year-round basis to transport equipment, materials, supplies, and personnel, as well as for emergency support. The gravel airstrip will be located approximately 5 km (3 mi) inland. It will be sized to handle large cargo planes.

Until the airstrip is constructed and commissioned, air traffic will be restricted to helicopters. After the gravel airstrip is commissioned, fixed-wing aircraft will be the normal method of deployment and rotation of personnel, as well as emergency medical evacuation. Helicopter and fixed-wing aircraft will be required to support on-site activities; the number of flights will depend on the activities and the extent of infrastructure in place.

Early in the construction period (through 2014), 1–2 C-130 flights may be used to transport or resupply materials and equipment. This type of aircraft will not be used on a regular basis, but only when materials and equipment cannot be moved by other means in a timely manner.

Fixed-wing cargo and passenger aircraft, typically Beechcraft 1900, Casas, Dash 8/SAAB 340, Twin Otter turbo-prop or DC-6 aircraft, and helicopters will transport normal operational materials, equipment, supplies, groceries, and personnel between Deadhorse and Point Thomson. Up to 2–3 flights per day will occur through all phases of construction, depending on the manpower and resupply requirements.

Air traffic routes between Deadhorse and the Point Thomson airstrip will generally maintain a normal operational altitude of 457 m (1,500 ft) and follow a route inland of the coast where practical unless deviations are required for safety or operation requirements.

2.5 Project Facilities

The Project includes the installation of gravel roads and pads, wells, process and utility facilities, camps, pipelines, marine offloading facilities (Service Pier and Sealift Bulkhead), an airstrip, a gravel mine, and other civil works. Figure 2.2 provides a map showing the location of the well pads, and the related pipelines and infrastructure (roads, airstrip, gravel mine, etc.). Other project facilities include ice roads and pads, and utilities for water supply, electrical generation, and communications. Figure 2.3 provides locations of the ice roads and water supply sources. The area covered by gravel structures is shown in Table 2.3. The total footprint of all gravel structures is 117 ha (289 ac), which includes 9.0 ha (22 ac) of existing gravel pads. Project facilities are described in more detail below.

Table 2.3 Point Thomson Project footprint coverage and road lengths.

Structure	Area (ha)			Length (km)
	Pads	Access Roads	Total Area	Access Roads
Central Pad [a]	22.67	8.08	30.75	4.29
East Pad [a]	6.31	10.33	16.64	5.66
West Pad	7.66	13.51	21.17	7.18
Service Pier for Coastal Barges	0.02		0.02	
Alaska State C-1 Pad [a]	1.65	0.15	1.80	0.05
Water Source Pad	0.28	0.07	0.35	0.03
Airstrip/Helipad/Navaid Pad	18.36	0.68	19.04	0.60
Boat Launch	0.04		0.04	
Badami Pads	0.17		0.17	
Gravel Mine	20.06	1.33	21.39	0.71
Gravel Storage Pad	5.21		5.21	
Dredged Material Pile	0.38		0.38	
Vertical Support Members (VSMs)	0.02		0.02	
TOTAL	**82.82**	**34.15**	**116.97**	**18.52**

Key:
[a] Gravel footprints for Central, East, and Alaska State C-1 pads include portions of existing gravel from prior exploration activity: Central Pad = 5.36 ha, East Pad = 1.94 ha, and Alaska State C-1 Pad = 1.65 ha.

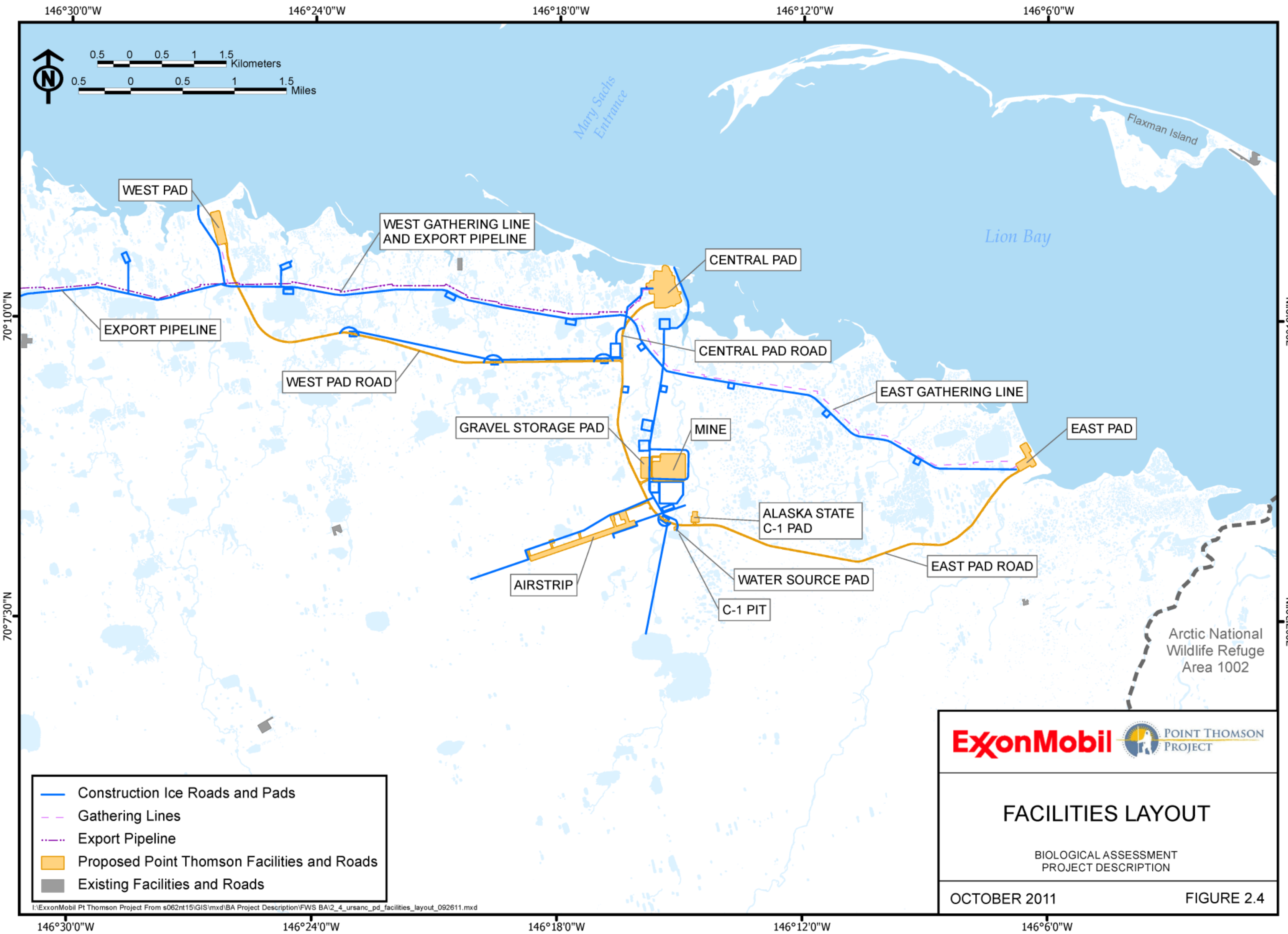
Gravel structures will be constructed primarily in the winter using standard North Slope equipment and methods. Gravel placement for some structures will also occur during the summer but no direct placement of gravel on tundra during the summer is planned.

2.5.1 Construction Camps

The Point Thomson Project will use temporary construction camps to house workers in the field. These camps may be both in Deadhorse and the Point Thomson area. In Deadhorse, other than a small camp addition to ExxonMobil's existing Deadhorse facility where practicable, the project will utilize existing camps that are providing support to various companies. The Point Thomson camps will be dedicated to construction of the Point Thomson Project. These camps will be placed on either single season ice pads or gravel pads. It is envisioned there will be a peak between 500 and 600 beds during the Project construction period. The number of beds, utilities specifics, and timing of mobilization/demobilization will be defined as detailed design and execution advances and as construction contracts are let.

2.5.2 Infield Access Roads

Approximately 18.4 km (11.4 mi) of in-field gravel roads will be constructed to connect Project pads, airstrip, gravel mine, and freshwater supply source(s) to the Central Pad (Figure 2.4, Table 2.3). The infield gravel roads will cross nine small tundra streams, with bridges or culverts being installed at these crossings. Bridges will be constructed during the first two winter construction seasons. With the exception


146°30'0"W
146°24'0"W
146°18'0"W
146°12'0"W
146°6'0"W
70°10'0"N
70°7'30"N
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
WEST PAD ROAD
EAST GATHERING LINE
EAST PAD
GRAVEL STORAGE PAD
MINE
ALASKA STATE C-1 PAD
EAST PAD ROAD
WATER SOURCE PAD
AIRSTRIP
C-1 PIT
Arctic National Wildlife Refuge Area 1002
Construction Ice Roads and Pads
Gathering Lines
Export Pipeline
Proposed Point Thomson Facilities and Roads
Existing Facilities and Roads
ExxonMobil
POINT THOMSON PROJECT
FACILITIES LAYOUT
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.4

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of two culverts designed for fish passage which will be installed during low flow conditions in late summer, culvert installation is planned to follow road construction during the winter, with seasoned gravel. Bridges will consist of pipe piling supports with sheet piling abutments and precast concrete decks.

2.5.3 Central Pad

The approximately 22.7 ha (56-ac) Central Pad (Figure 2.5, Table 2.3) incorporates the entire existing PTU-3 exploration pad site to reduce the amount of new gravel pad area. The two existing development wells are located on the Central Pad. The Central Pad will also be the location of the Class I disposal well and the CPF, which will include the main process and utility modules, associated support and infrastructure facilities, and high- and low-pressure flares and auxiliary equipment. Also on Central Pad will be the camp and camp utility modules; diesel and methanol storage tanks; a cold storage area with associated pipe racks, cable racks, warehouse, and storage equipment and staging areas; a grind and inject module; and a communications facility.

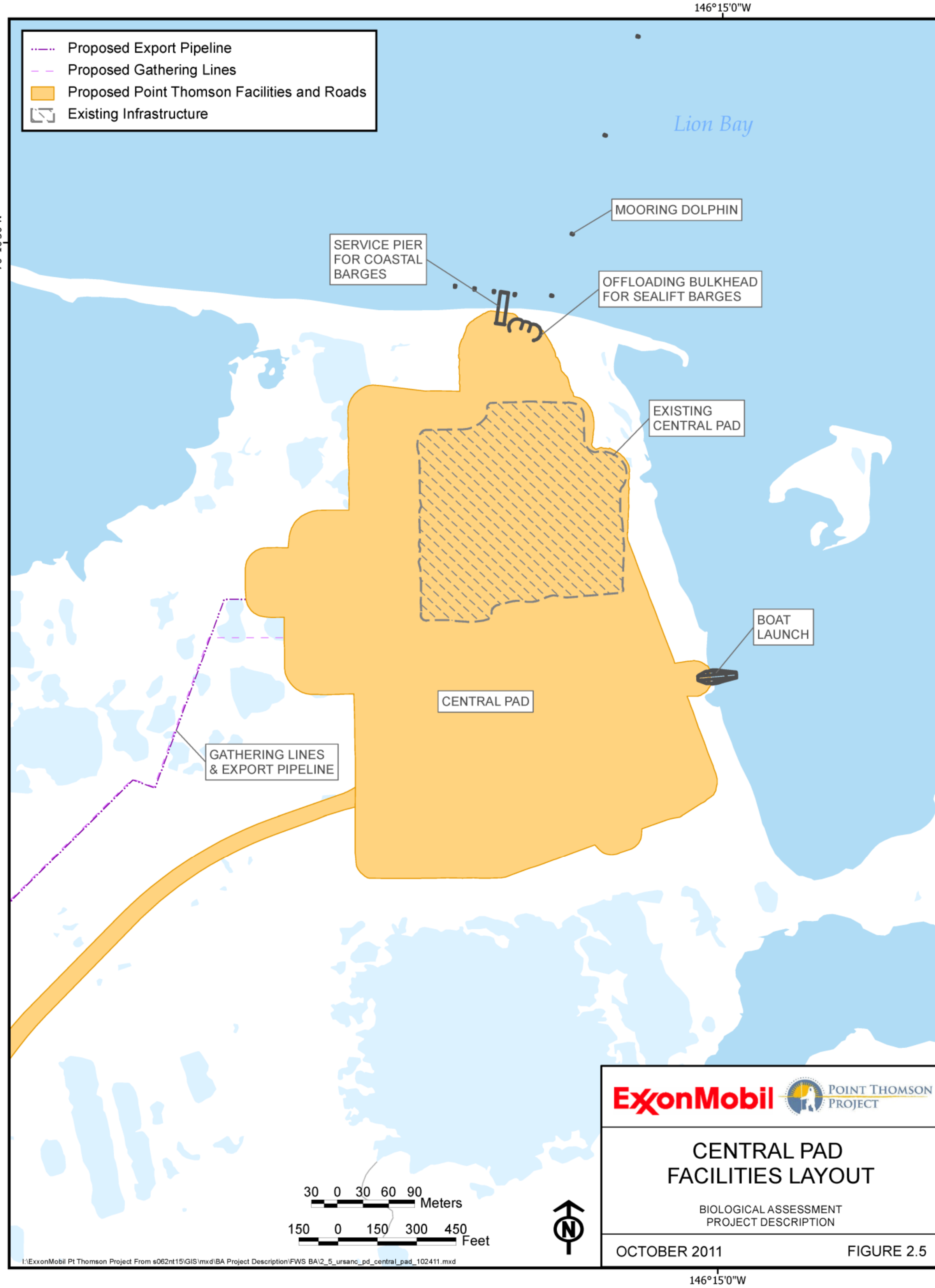
A flare system will be used to safely burn natural gas that occasionally needs to be released when pipelines and facilities are depressurized for maintenance, during a process upset, or in an emergency situation. High-pressure (HP) and low-pressure (LP) system flares will be combined into a single flare stack just west of the main Central Pad. The HP flare tip will not exceed a height of 46 m (150 ft) above ground surface and the LP flare tip will not exceed a height of 23 m (75 ft) above ground surface.

2.5.4 East and West Pads

The East and West pads will each be located approximately 6.3 and 6.9 km (3.9 and 4.3 mi) respectively from the Central Pad (Figure 2.4). The East Pad will be approximately 6.3 ha (15.6 ac) in size and has been located to make use of the existing North Staines River State No.1 gravel pad (1.9 ha [4.8 ac]) to reduce the overall gravel requirement (Table 2.3). The western boundary of the 1002 Area of the Arctic Refuge is located about 3 km (2 mi) east of the proposed East Pad and approximately 10 km (6 mi) east of the proposed Central Pad. The Wilderness Area of the Arctic Refuge is approximately 50 km (30 mi) from both the Central and East Pads. Light emanating from the facilities will be controlled by design. The West Pad will be a new gravel pad approximately 7.7 ha (18.9 ac) in size.

2.5.5 Airstrip

A year-round gravel airstrip will be constructed south of the Central Pad, approximately 5 km (3 mi) from the coast (Figure 2.4). The airstrip's dimensions will be approximately 1,707 m (5,600 ft) long by 61 m (200 ft) wide, with an access road, apron, helipad, and ancillary navigation aid pads (total area of 18.4 ha [45.4 ac], Table 2.3). After the gravel runway has been installed, navigational aids, approach lighting, and control buildings will be installed. The area for approach lights will require an ice road to be constructed prior to pile installation. This ice road will also be used for installation of the power cable and lights. Power cables will be trenched beside the gravel access road to the airport, and then run through a conduit strung along sleepers to service the runway lights. A temporary helipad will be located at the Central Pad and used until the helipad at the gravel airstrip is operational.


146°15'0"W
Proposed Export Pipeline
Proposed Gathering Lines
Proposed Point Thomson Facilities and Roads
Existing Infrastructure
Lion Bay
MOORING DOLPHIN
SERVICE PIER FOR COASTAL BARGES
OFFLOADING BULKHEAD FOR SEALIFT BARGES
EXISTING CENTRAL PAD
BOAT LAUNCH
CENTRAL PAD
GATHERING LINES & EXPORT PIPELINE
70°10'30"N
30 0 30 60 90 Meters
150 0 150 300 450 Feet
ExxonMobil
POINT THOMSON PROJECT
CENTRAL PAD FACILITIES LAYOUT
BIOLOGICAL ASSESSMENT PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.5

2.5.6 Other Pads

Several small gravel pads will be constructed to support project activities. The area covered by these pads is presented in Table 2.3.

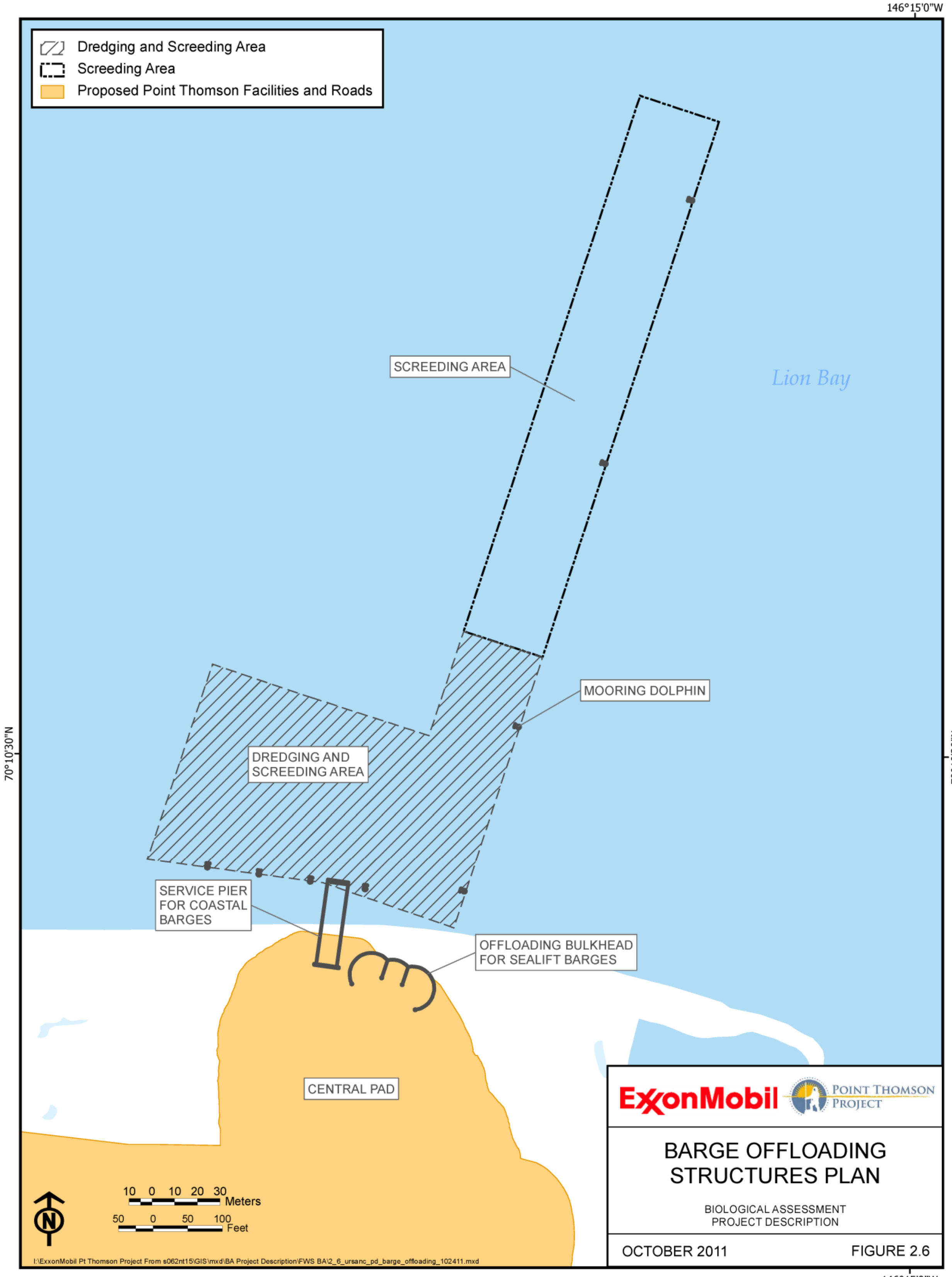
2.5.7 Marine Facilities

Three marine facilities are associated with the Central Pad. These are a Boat Launch, Sealift Bulkhead, and Service Pier as shown in Figure 2.6.

The boat launch will be located on the east side of the Central Pad. The gravel/concrete panel ramp will be approximately 7.3 m (24 ft) wide and extend approximately 50 m (165 ft) from the Central Pad and then into the bay to approximately 1.1 m (3.5 ft) below the Mean Lower Low Water (MLLW) level. The boat launch will consist of a 33-m-long (108-ft) gravel ramp with 7.3-m-wide and 17.3-m-long (24-ft-wide and 57-ft-long) concrete planks 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.

Loaded ocean-going sealift barges require several feet of draft and cannot directly access the beach. For landing and securing the larger ocean sealift barges, an onshore (above mean high water) Sealift Bulkhead with four offshore mooring dolphins will be constructed adjacent to and offshore of the Central Pad. 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. 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 construction using standard North Slope methods. These will be cut off 1.5 m (5 ft) below the mudline or removed during the construction phase after all facility modules are transported to the Central Pad.

A Service Pier for offloading coastal barges will be constructed adjacent to the Sealift Bulkhead (Figures 2.5 and 2.6). The Service Pier will allow more fully loaded coastal barges (up to 726 tonnes [800 tons]) to access the site than the previously used over-the-beach-access method, which will reduce the number of seasonal resupply barge trips. The docking facility will consist of a 36-m-long by 9-m-wide (120-ft by 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 sea floor through the ice in the winter in a line perpendicular to the pier.


146°15'0"W
Dredging and Screeding Area
Screeding Area
Proposed Point Thomson Facilities and Roads
SCREEDING AREA
Lion Bay
MOORING DOLPHIN
DREDGING AND SCREEDING AREA
70°10'30"N
SERVICE PIER FOR COASTAL BARGES
OFFLOADING BULKHEAD FOR SEALIFT BARGES
CENTRAL PAD
10 0 10 20 30 Meters
50 0 50 100 Feet
ExxonMobil
POINT THOMSON PROJECT
BARGE OFFLOADING STRUCTURES PLAN
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.6

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 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.

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. 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 m^2 (154,000 ft^2) and starts at a location approximately 12–18 m (40–60 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 feet).

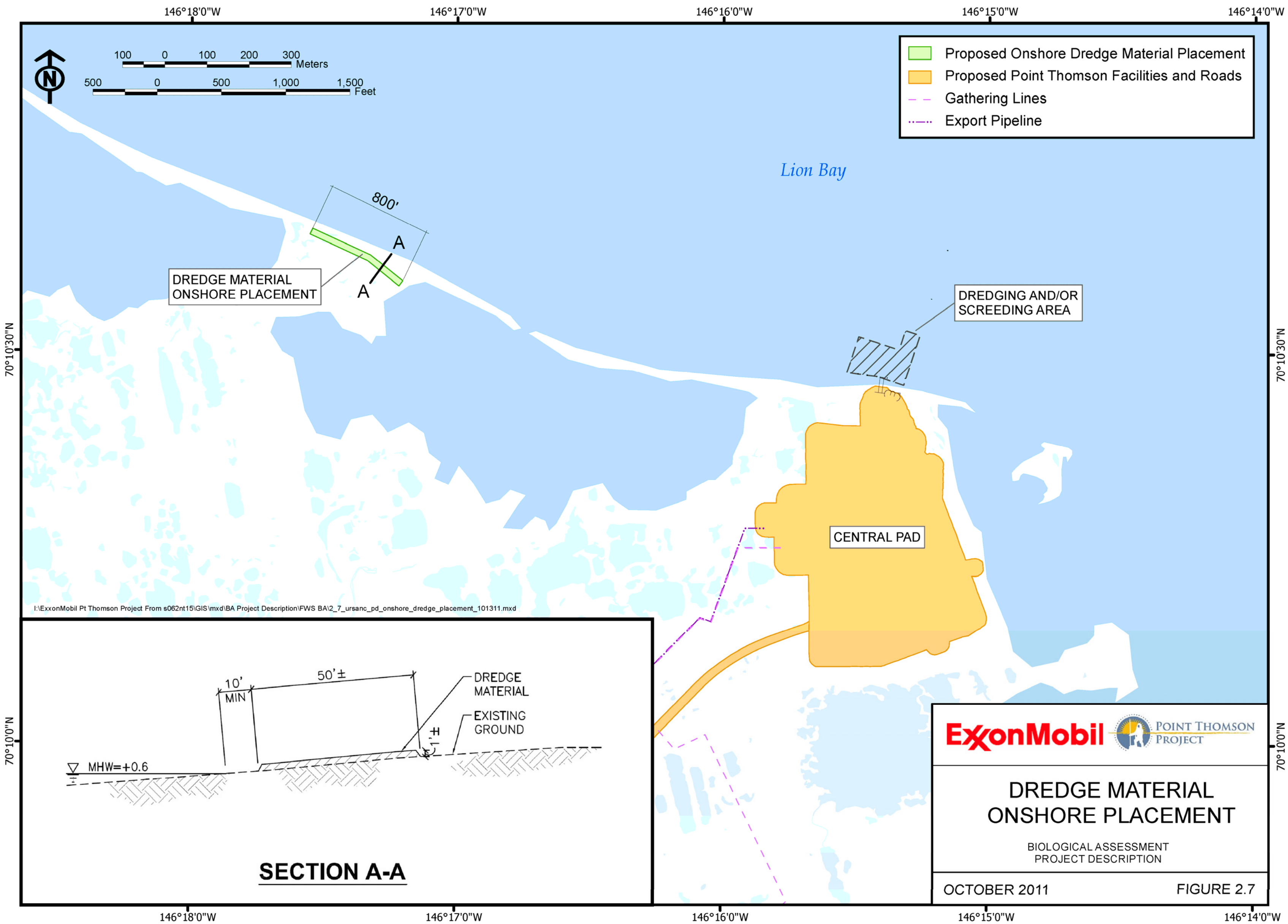
Not all of the ice in the designated dredge area can be removed at the same time. Therefore, dredging and screeding will be conducted sequentially in different areas. As a result, in order to achieve the needed seabed profile, some of the dredged material may need to be temporarily placed in an onshore 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 material. 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 612 m^3 (800 yd^3).

The seabed material removed during dredging will be placed along nearby shoreline above mean high water. The disposal area is estimated to be approximately 0.38 ha (0.9 ac) in size with the proposed disposal location along a stretch of beach approximately 1.2 km (0.75 mi) west of the area dredged (Figure 2.7). Coastal studies indicate that this site is far enough away from the barge offloading facilities that the dredged area would not be refilled from this deposited material. The actual disposal location used may vary based on dredging season and volume, but approval will be sought from the appropriate regulatory agencies prior to placement of spoils onshore.

2.5.8 Gravel Mine

The primary gravel source for the Project will be a new gravel mine located approximately 3 km (2 mi) south of the Central Pad and just north and east of the airstrip (Figure 2.4). An estimated 1,720,248 m^3 (2,250,000 yd^3) of gravel and 802,783 m^3 (1,050,000 yd^3) of organic and inorganic overburden will be removed from the approximately 20 ha (49.6-ac) mine site.


146°18'0"W
146°17'0"W
146°16'0"W
146°15'0"W
146°14'0"W
100 0 100 200 300 Meters
500 0 500 1,000 1,500 Feet
Proposed Onshore Dredge Material Placement
Proposed Point Thomson Facilities and Roads
Gathering Lines
Export Pipeline
Lion Bay
800'
A
A
DREDGE MATERIAL ONSHORE PLACEMENT
DREDGING AND/OR SCREEDING AREA
CENTRAL PAD
70°10'30"N
70°10'0"N
10' MIN
50'±
DREDGE MATERIAL
EXISTING GROUND
MHW=+0.6
SECTION A-A
ExxonMobil
POINT THOMSON PROJECT
DREDGE MATERIAL ONSHORE PLACEMENT
BIOLOGICAL ASSESSMENT PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.7

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Gravel mining is planned to occur over a two-year period. Overburden will be placed on two single-season ice pads during each year of mining (one for organic overburden and one for inorganic overburden storage). The organic overburden ice pad will occupy approximately 2.2 ha (5.4 ac) and the inorganic overburden ice pad will be 11.6 ha (28.7 ac). At the conclusion of the mining for each year, the overburden will be placed back into the mine pit and the ice pad will be allowed to melt during the summer season. Approximately 152,911 m^3 (200,000 yd^3) of gravel will be stockpiled for future maintenance needs on an approximately 5.2-ha (12.9 ac) gravel storage pad adjacent to the mine site and accessible by the gravel mine access road. As gravel is consumed over the years, the vacated area may be used for storage and staging of equipment and materials.

Mining operations will primarily occur during the winter and will include blasting and mechanical excavation. If summer mining is required following winter mining activities, mechanical equipment (e.g., trimmer, dozer) will be used for gravel extraction activities in the mine footprint. No blasting will occur during summer mining. No direct placement of gravel on tundra during the summer is planned.

The Project mine site rehabilitation plan is to place overburden back into the excavated area, creating stabilized sidewalls and a mosaic of wet and moist habitat conditions. The excavated area will be allowed to fill with snowmelt and spring runoff from the surrounding area and is expected to take from 5–10 years to fill with water. Once the mine site naturally fills with water, it will provide shallow water habitat for birds and deep-water habitat for fish. The flooded mine site could also serve as a potential back-up water source for the Project.

2.5.9 Water Supply

Freshwater for ice roads and pads will be supplied from approved water sources located between Endicott and the Project site (Figure 2.3). Typically, access to water sources (other than those accessible by gravel road) is initially via tundra travel approved vehicles until ice roads are constructed to provide access. The Alaska State C-1 pit will be the primary water source for the Project operations. As noted above, a small gravel pad will be constructed for year-round access to that water source. The new gravel mine will be rehabilitated to serve primarily as freshwater habitat, but could also be used as a back-up water supply without materially impacting its primary function of supporting waterfowl. Water rights will be obtained for long-term operational water supply needs. Freshwater will be transported by truck.

2.5.10 Communications

Communications services will be supported by tower structures at various Project locations. Permanent towers will be free-standing with no guy wires. The CPF main communication tower located on the Central Pad is approximately 6–8 m (20–25 ft) square at the base tapering to 2–3 m (8–10 ft) at the top. With all appurtenances this tower will not be higher than 61 m (200 ft) above the pad surface.

Four lattice towers used for communications, lighting, navigational aids, and speaker mounting will be erected at the airstrip. These towers will range in height between 11 and 17 m (35 and 55 ft) above the ground. The typical tower will have heavy steel tube legs built with an equilateral triangle design with zigzag cross bracing and typically constructed in multiples of 3-m (10-ft) sections.

A temporary telecommunications tower is planned to be installed at the Central Pad in support of early construction of ice roads and other activities. This tower is scheduled to be installed in December 2012 and removed from service in March–April 2013 after the permanent telecommunications tower is commissioned for service. The temporary tower will be a 23 m (75 ft) lattice tower supported by stacked pre-cast concrete anchors at the base and two sets of three guy wires each at approximately mid-span and the 15.2 m (50 ft) level (or the top of the tower). The guy wires will be equipped with striped, high visibility guards spaced evenly on all guy wires.

2.5.11 Electrical Power Facilities

Drilling activities will typically be supplied with electrical power from the drilling rig diesel fuel-powered generators. Temporary diesel fuel-powered electrical generators will provide power for construction and operations infrastructure and life support. Once gas is available, four gas-fired turbine generators will be used to meet peak power requirements. Power feeds to the East Pad, West Pad, airstrip, and mine/water reservoir will be provided using power cables from the CPF module. A power cable will be attached to the gathering line vertical support members (VSMs) going to the East and West pads. Power cables going to other facilities (e.g., airstrip and Alaska State C-1 water supply reservoir) will be buried in a trench approximately 5 m (15 ft) from the toe of the road connecting the Central Pad to the airstrip and water source. No overhead power lines are planned or expected.

2.5.12 Pipelines

The infield gathering lines and the Export Pipeline will be constructed during the winter from tundra ice roads, with small ice pads located along the ice road for materials storage and staging. All pipelines will be placed on VSMs sized to maintain a minimum 2.1 m (7 ft) height between the bottom of the pipe (including any cables or wind vibration dampeners, if required), and the tundra surface. Pipe sections will be staged along the route and welded together before their placement on the VSMs using typical North Slope construction methods.

Line lengths are approximately 7.7 km (4.8 mi) each for both the East Pad and West Pad gathering lines and 35 km (22 mi) for the Export Pipeline, although the Export Pipeline and West Pad gathering line will follow the same corridor and be placed on common VSMs for about 6.2 km (4 mi).

Please note that while the Export Pipeline is integral to and necessary for completion of the Project, the Export Pipeline as a common carrier pipeline will be regulated separately from the Project under applicable State and federal law, and will be owned and operated by PTE Pipeline LLC, a wholly owned subsidiary of ExxonMobil Pipeline Company.

2.5.13 Ice Roads and Pads

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 2.3). The ice road between Point Thomson and Endicott could either be on the sea ice or tundra (each 75.6 km [47 mi] long), depending upon weather, operational requirements, and other factors. 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 (O&M) activities.

Prior to constructing ice roads, ExxonMobil, working with the USFWS, will survey ice road routes and the proposed pipeline routes using Forward-looking Infrared (FLIR) imaging technology for the purpose of detecting polar bear dens. Detection efforts will also use known locations of radio- or satellite-collared bears, U.S. Geological Survey (USGS) denning habitat maps, and ground truthing as necessary. As specified in the Letters of Authorization, ExxonMobil will observe a 1.6-km (1-mi) operational exclusion zone around known polar bear dens during the denning season (November-April, or until the female and cubs leave the area) unless the USFWS allows otherwise. Should previously unknown occupied dens be discovered within 1.6 km (1 mi) of activities, work in the immediate area will cease and the USFWS contacted for guidance. This may result in shutting down ice road traffic or rerouting ice roads to avoid dens.

Ancillary facilities (e.g., light plants, generators, and guard shacks) may be located along ice roads and on ice pads. Typical North Slope construction equipment and methods using snow, freshwater, and milled ice chips will be used for ice road and pad construction. Snow fences may be required to gather snow. Spur ice roads will be constructed to connect the ice roads and pads to water sources.

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 break-up.

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. Bypasses will be constructed, if required, to avoid bear dens. Ice-road activities will be coordinated with the Alaska Department of Natural Resources (ADNR), Alaska Department of Fish and Game (ADFG), and USFWS. Ice road activity can begin as early as November, depending on weather conditions and permitting status.

Sea ice roads may be up to approximately 23 m (75 ft) wide for large equipment access and safety. Sea-ice roads 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.

Tundra ice roads will also provide a work surface for construction of gravel infrastructure (pads, roads, and airstrip), and both gathering and export pipelines (Figures 2.2 and 2.4). Approximately 72 km (45 mi) of infield and pipeline ice roads (11–15 m [35–50 ft] wide) will be used for construction.

Tundra ice roads will cross most streams at locations that naturally freeze to bottom. In some locations, reinforcement to form a snow or ice bridge will be required. Additional reinforcement (e.g., rig mats) may also be required in some locations. Stream crossings will be breached or slotted, as required, to avoid flooding during breakup.

Seasonal ice pads will be primarily required to support construction work. These will include approximately 0.01–0.12-km² (2–3-ac) ice storage/staging pads along the ice roads for bridge and pipeline construction, ice pad extensions required to support construction activities on the Central Pad, and 13.8 ha

(34 ac) of ice pads adjacent to the gravel mine for the temporary storage of organic and inorganic overburden removed from the mine. Total coverage of seasonal ice pads will be 46.8 ha (116 ac).

2.6 Operations and Maintenance

To ensure the safety and integrity of roads, pads, and the airstrip, routine inspection and maintenance will be required. Road and pad maintenance will be performed, as needed, using typical North Slope construction equipment. Care will be taken not to damage the adjacent tundra, particularly during snow removal operations. Snow fences may be installed to reduce snow drifting onto roads, pads, and airstrips. Culverts will be inspected periodically as part of routine operation, and debris removed as required. ExxonMobil will pay particular attention during spring breakup to maintain normal hydraulic activity. Small quantities of gravel may be added periodically to maintain a level surface.

During winter months, snow removal activities will be conducted on an ongoing basis using equipment, such as front-end loaders and motor graders. Snow on pads will be visually inspected for contamination before removal. Contaminated snow will be collected and stored in a designated area for proper disposal. Contaminated snow may be allowed to melt, or a snow-melter will be used, and contaminated melt-water will be injected, where allowed, into the Class I disposal well. Uncontaminated snow will be pushed onto surrounding tundra and/or placed on the sea ice, where it will be allowed to melt. Pad clearing activities will be conducted in a manner that avoids gravel and debris entrainment in snow moved off the pad**.** Snow storage and disposal will be undertaken in a manner to avoid the creation of potential hiding places for polar bears.

Fuel and hazardous substances will be stored and handled in accordance with applicable regulations and permit stipulations. Storage and transfer facilities will be designed with appropriate liners and secondary containment systems. These areas will be kept free of debris, including excess accumulated rainwater and snow accumulation during winter season. Accidental discharge will be prevented or reduced by implementing strict procedures, personnel training, and secondary containment requirement, following the appropriate Best Management Practices (BMPs) of the North Slope operations outlined in the: *Alaska Safety Handbook; the North Slope Field Environmental Handbook;* and the Project's Oil Discharge Prevention and Contingency Plan (ODPCP), Spill Prevention Control and Countermeasure (SPCC) Plans, Facility Response Plans (FRP), and Stormwater Pollution Prevention Plan (SWPPP).

Pipelines may be accessed by using Rolligons (or similar tundra travel equipment) when tundra travel is allowed, or from ice roads built during the winter to access a specific location. Access can also be achieved by helicopter. Integrity monitoring of the pipelines will allow inspection through the use of in-line inspection tools. Visual inspection of the pipelines and surrounding area will typically be performed on a weekly basis via aerial surveillance unless precluded by safety or weather conditions.

2.7 Workforce Estimate

The Project workforce will vary during the drilling, construction, and operations phases. The construction workforce is expected to peak at approximately 500 people when ice road construction, pipeline construction, and civil construction works are occurring at the same time. Due to the diverse types of work being conducted at multiple locations, the workforce will be billeted at several sites at the Project. During periods of drilling activity, drilling related employment is estimated to be 150–180 personnel. The Project will require an operations workforce of approximately 80 people. Additional workers will be required during special work programs (e.g., planned and emergency maintenance operations).

2.8 Environmental Protection And Mitigation

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

2.8.1 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 Plan of Operations, Alaska Department of Environmental Conservation (ADEC)-approved ODPCP and Environmental Protection Agency (EPA)-required SPCC Plans, and FRP for various project activities.

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

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 spill 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. There is also an aggressive Drips and Drops program to find, clean up 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. Snow machines 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 near-shore 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 all aspects of 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 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, ADNR, Alaska Oil and Gas Conservation Commission (AOGCC), and 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.

2.8.2 Fuel Transfers and Storage

Fuel transportation, storage, and use will be in accordance with applicable federal, state and NSB requirements.

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 UOP 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 of the Code of Federal Regulations [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. To the extent practicable, fuel storage tanks will be placed at least 30 m (100 ft) from water bodies. This isn't practical in some cases, such as pumps and light plants at water sources, or where numerous small lakes and ponds are in close proximity to the location. In these cases, waivers from this requirement will be sought.

Tanks with capacities of 38,000 l (10,000 gallons [gal]) 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.

2.8.3 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:

- Drilling mud recycling/reuse to the maximum extent possible, and spent drilling muds and cuttings will be injected into an onsite or offsite 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 Alaska Pollutant Discharge Elimination System (APDES) and/or National Pollution Discharge Elimination System (NPDES) permits. Discharges to the tundra and surface waters (fresh water 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 Alaska North Slope locations, or transferred to other facilities in Alaska or the Lower-48 states for treatment, disposal, or recycling. All hazardous waste must be sent to authorized off-site disposal facilities. These wastes will be consolidated and stored onsite in designated accumulation areas prior to transport. Hauling waste offsite is seasonally limited. During the open-water season, waste hauling from the Project 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.

2.8.4 Mitigation

The following mitigation procedures are designed to minimize potential adverse impacts of the Project on federally listed and candidate species; the procedures are described in detail in applicable subject areas of the attached Point Thomson Project Environmental Mitigation Report. Many of the mitigation measures described in the Point Thomson Project Environmental Mitigation Report that are not specific to listed and candidate species will nevertheless mitigate potential impacts to those species. Specific mitigation is not being proposed for Pacific walrus because they are not expected to occur in the area.

2.8.4.1 Eiders and Loons

Proposed development concerns associated with eiders and loons (and all birds), include habitat impacts, changes in behavior due to disturbance and activities, indirect effects from increases in predators, direct impacts such as vehicle and tower collision, and contamination from spills.

Summary

Key mitigation measures for birds will include:

- Implementing operational controls to minimize nesting opportunities for predatory birds and denning opportunities for predatory mammals.
- Minimizing attraction of predatory birds and mammals to food and wastes at facilities.
- Designing facilities to minimize potential for bird strikes, including structures and lighting.
- Rehabilitating the gravel mine to enhance habitat for waterfowl.

- Reducing disturbance to birds by completing most construction activities during winter and controlling vehicle and aircraft traffic.
- Minimizing overall vegetation and habitat loss by use of existing gravel pads, minimal footprint size, and roadless connection to Prudhoe Bay and Alaska Highway system.
- Implementing spill prevention and response programs, as described in Appendix C.

Mitigation Measures

Operational controls to minimize nesting and denning opportunities to prevent population increases of predatory species (e.g., ravens and arctic foxes). will include: blocking off nooks and crannies with fabric/netting or other bird nest deterrent, using scare devices to deter the birds when they land in places likely to be nesting sites, and removing nests as the birds try to construct them (before they have a chance to lay eggs). Foxes will be deterred from denning by elimination of open containers, culverts, pipes, and other potential shelters at ground level.

Food wastes will be strictly controlled in covered dumpsters and then incinerated. Sewage sludge will be incinerated or stored in tanks for shipment.

Several measures will be implemented to reduce bird strikes. These include:

- Careful design considerations were given to facility lighting (e.g., light hoods to reduce outward-radiating light) that minimizes the potential for disorienting migrating birds, which is one cause of bird strikes.
- Buildings and stack heights will be the minimum needed to perform their functions, with consideration for associated footprint. The flares will be free standing (no guy wires).
- The primary Central Pad communications tower will be free standing (no guy wires). The tower will be lighted according to Federal Aviation Agency (FAA) requirements.
- Other communications towers (e.g., at the airstrip or other pads) will avoid the use of guy wires and will be attached to camps or other larger structures when possible.
- Power lines and fiber-optic cables will either be buried or placed on the pipeline VSMs.

The Gravel Mine Rehabilitation Plan includes placing overburden back into the pit, creating shallow water areas and shorelines to provide an irregular appearance, and allowing the pit to fill naturally with water to create additional freshwater habitat for birds. The reclaimed pit will be a backup water source for Project purposes.

Exclusive of the Alaska-State C-1 pit, which will be used as a primary water source, water removal from freshwater lakes used by nesting waterfowl will be limited during the summer to minimize the potential for reducing the amount or quality of nesting and brood-rearing habitat through diminished water levels.

Gravel placement on the tundra will primarily occur during the winter. Should site preparation and/or construction activities occur during the summer on the tundra prior to July 31 (by which time most Arctic nesting birds have hatched) the areas in the vicinity of these field activities will be searched for nesting birds by qualified biologists prior to the start of work. If an active nest of a migratory bird is found (even after July 31), the appropriate USFWS Field Office will be contacted for instructions on how to avoid or mitigate the potential loss of the active nest. Vehicle and aircraft disturbance to birds will be reduced by controlling vehicle speed and aircraft altitude and flight routes. Vehicle speeds will be limited to 35 mph and aircraft will fly at 457 m (1,500 ft) above ground level and follow a route inland of the coast to avoid the most likely breeding areas except when required for operational or safety reasons.

Habitat loss to gravel coverage will be reduced by using ice roads, barges, and aircraft to transport personnel and materials from Prudhoe Bay to Point Thomson, thus avoiding the need for an all-season road connecting to Prudhoe Bay. Existing gravel (8.96 ha [22.1 ac]) comprises about 7.7% of the final gravel footprint, which reduces the amount of gravel required and reduces new impacts to wildlife habitat and wetlands from Project construction. Use of temporary ice pads for storage and minimized pad footprint size will keep the habitat affected by gravel coverage to a relatively small total area (116.97 ha [289.0 ac]).

Spills will be prevented and cleaned up as described above in Section 2.8 and Appendix C.

2.8.4.2 Polar Bears

Polar bears frequently come ashore and can be encountered by Project personnel at any time of the year. Project activities that potentially could affect polar bears include construction activities such as ice-road construction and operation, installation of barge facilities, and grounding barges for offloading. Additionally, spills potentially could affect polar bears, depending on the types, sizes, and locations of the spills.

Summary

Mitigation measures specific to polar bears will include:

- Implementing spill prevention and response programs, as described in Appendix C.
- Implementing and building upon the successful experience of procedures developed during the 2008-2011 drilling program (including, but not limited to, measures noted below).
- Obtaining Letters of Authorization (LOAs) from the USFWS for "incidental and intentional take by harassment" of polar bears, under existing Incidental Take Regulations (ITRs; 76 FR 47010).
- Updating and implementing the Project's Polar Bear and Wildlife Interaction Plan (Appendix A).
- Conducting FLIR surveys annually for potential maternal polar bear dens along ice-road routes.
- Implementing procedures and communications protocols for wildlife encounters.
- Rerouting an ice road if an active polar bear den is discovered within 1.6 km (1 mi) of the ice-road route or taking other actions approved by the USFWS.
- Closing an ice road if a maternal polar bear den is observed during the den emergence period (early March to mid-April), in consultation with the USFWS.
- Conducting ice-road closure drills to practice the ice-road closure protocol.
- Watching for polar bears using bear monitors [and deterring polar bears from Project activities, as necessary, using USFWS-approved deterrent methods].
- Employing operational controls (e.g., road and air traffic restrictions).
- Ensuring Project workers attend training programs, such as "Arctic Pass," which cover polar bear and wildlife awareness.
- Communicating with the workforce on polar bear issues through Environmental Bulletins, posters, safety meeting discussions, etc.
- Developing project design and operational features to avoid or discourage wildlife encounters and to protect wildlife and human safety (e.g., building walkways, doors, lighting, snow management, and traffic control).

Mitigation Measures

The mitigation measures described for terrestrial mammals and for bowhead whales and seals in the Point Thomson Environmental Mitigation Report will also apply to polar bears. Other key mitigation measures incorporated to avoid or minimize impacts on polar bears are discussed below, by Project component.

Ice Roads

The primary potential impact to polar bears from ice roads would be disturbance of female bears during and immediately after the denning period. Polar bear den locations vary from year to year. Therefore, it is not possible to predict with certainty where a den might be found. ExxonMobil's approach has been to detect dens and then to take proactive measures to avoid disturbing them, as is stipulated under the ITRs.

The first step in den detection will be to conduct one or more aerial surveys, in cooperation with the USFWS, using a forward-looking infrared (FLIR) camera before or shortly after ice road construction commences. If the FLIR survey finds a heat signature that may indicate an active den, then additional ground-level FLIR surveys, or other suitable actions, may be taken to confirm whether a den exists. Ice roads and other activities will avoid active dens by 1.6 km (1 mi), unless otherwise authorized by the USFWS.

While ice roads are active, security measures and ice-road rules will be implemented to avoid and minimize interactions with polar bears and other wildlife. For example, operators are required to report wildlife sightings immediately to the nearest security checkpoint. If such a sighting is a polar bear, then the USFWS will be notified and appropriate actions taken, which may include shutting down the road down. Ice-road closure protocols are included in the Polar Bear and Wildlife Interaction Plan (Appendix A). These protocols will be practiced in annual ice-road closure drills.

During the 2008–2011 drilling program, ExxonMobil prepared and implemented a state of the art polar bear and wildlife interaction plan. This plan incorporated the considerable experience of other North Slope operators, added significant improvements, and set new standards in mitigating impacts to polar bears in routing and operating the ice road from the Endicott spur to Point Thomson. Key elements and successes of the program include:

- Training and education
- Site design and operations

- Deterrence and hazing protocols
- Reporting requirements
- Ice road protocols
- Ice road closure drills
- HD helicopter surveys

The USFWS recognized the success of ice road closure practices. These operational procedures and controls will continue to be incorporated in ExxonMobil's Polar Bear and Wildlife Interaction Plan to ensure the workforce understands mitigation measures and can implement them.

Project Construction, Drilling, and Operations

During construction, drilling, and operations, bear monitors at the Central Pad will watch for polar bears and other wildlife to detect approaching animals as early as possible so that appropriate protective measures can be taken. Bear monitors will be used at other construction sites, as needed. No action other than monitoring is required in most cases. All polar bear observations will be reported to USFWS within 24 hours of the first sighting. Bear monitors will be trained in USFWS approved training courses and will employ accepted deterrence methods, as needed, to keep polar bears away from humans and Project activities. Clear communication protocols have been established and have proven effective for managing bear encounters. Every worker will be required to notify the bear monitor, security, or supervisors whenever they see a bear or sign of a bear (e.g., bear tracks or scat). A bear-specific alarm will alert workers when a bear is in the vicinity and they need to seek safety inside. Other bear warnings may be used, such as radios, intercoms, and lights and placards at exit doors. Hazardous materials and waste, particularly food, garbage, and sewage, will be stored in bear-resistant containers. Personnel will be strictly prohibited from feeding wildlife.

3.0 DESCRIPTION OF THE SPECIES AND THEIR HABITATS

Three species currently listed as threatened under the ESA may occur seasonally in the vicinity of the Point Thomson Project: an ice-dependent carnivorous mammal—the polar bear—and two primarily arctic-breeding sea ducks—Spectacled and Steller's eiders. Two other species—the Pacific walrus and Yellow-billed Loon—are candidate species (proposed, but not yet listed under the ESA). Critical habitat has been designated for only one species, the polar bear, in the Action Area. The Pacific walrus occurs primarily in shallow, continental shelf waters of the Bering and Chukchi seas, with small numbers occurring in the Beaufort Sea, and only during the summer (Garlich-Miller et al. 2011). The Beaufort Sea is beyond the normal range of the Pacific walrus and the likelihood of encountering walruses in the Action Area appears to be low (USFWS 2011a). This species is not discussed further in this BA because the Action Area is outside the normal range for the Pacific walrus.

Polar bears can occur in the marine and coastal zones of the Action Area during all seasons, but their presence varies seasonally with ice conditions and food availability. Spectacled Eiders occur in the Point Thomson Project vicinity during the summer breeding season somewhat less than annually and always at low densities; breeding primarily occurs west of the Project. Steller's Eiders have not been sighted during surveys in recent years, but likely were occasional visitors in the past. Yellow-billed Loons occur in low numbers regularly in the nearshore marine waters in the Point Thomson vicinity, but there is no evidence of Yellow-billed Loon breeding in the Project Area. A summary of the existing environmental information for each species is presented below, including historical and current distribution, population status and trends, and life history and habitat use.

3.1 Polar Bear

3.1.1 Species Status

Polar bears are managed by the USFWS and are protected under two federal laws and several international agreements. The polar bear was designated a protected species under the Marine Mammal Protection Act (MMPA) of 1972, as amended and reauthorized (PL 92-522 and 103-238; 16 USC §§1361–1423h). The U.S. is one of five arctic nations that signed the *Agreement on the Conservation of Polar Bears and Their Habitat* in Oslo, Norway, in November 1973. The polar bear was listed in 1975 as an Appendix II species under the *Convention on International Trade in Endangered Species of Wild Flora and Fauna* (CITES).

In response to a petition in February 2005 to list the species under the ESA, the USFWS undertook a status review (Schliebe et al. 2006) and issued a proposed rule to list the polar bear as a threatened species on 9 January 2007 (72 FR 1064). The final rule listing the polar bear as a threatened species under the ESA was published on 15 May 2008 (73 FR 28212) and became effective the same day. The ESA listing automatically resulted in the designation of polar bear population stocks as strategic stocks under the MMPA. In a special rule developed under the terms of ESA Section 4(d) and published on 16 December 2008 (effective 15 January 2009; 73 FR 76249), the Secretary of the Interior retained the regulatory requirements of the MMPA and CITES as the primary conservation provisions for the polar bear, while noting that the ESA Section 7 consultation requirements apply for human activities potentially affecting the species.

In reaching its listing decision, USFWS analyzed five factors potentially affecting the polar bear, as required by ESA Section 4(a): (1) present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) adequacy of existing regulatory mechanisms; and (5) other manmade or natural factors affecting its existence, such as contaminants, human interactions, industrial development, and tourism (Schliebe et al. 2006). As is discussed in more detail below (Section 4.1), the ESA listing decision was based principally on the first of these factors, focusing on the threat to polar bear habitat posed by the current trend of rapidly diminishing sea-ice cover and thickness in the Arctic Ocean, primarily during summer (73 FR 28212; Durner et al. 2009). The continuing loss of sea-ice habitat was judged to put polar bears at risk of becoming endangered throughout their range in the foreseeable future, meeting the criterion established by the ESA for designating a threatened species.

Human activities that can affect polar bears are regulated by the USFWS under both the MMPA and ESA, with the regulations developed under the former law being applied in the current permitting process regarding incidental take (under the MMPA, "take" means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill"). Government agencies charged with approving permits for a development project must consult with USFWS under Section 7 of the ESA regarding the potential effects of the project on polar bears and designated critical habitat. The principal mechanism for regulating human activities is the review and approval of Incidental Take Regulations (ITRs), which are established under Section 101(a)(5) of the MMPA for 5-year periods to regulate the nonlethal, incidental, unintentional taking of small numbers of polar bears. Take is permitted under the ITRs provided that it results in negligible impacts on the species and does not have an unmitigable adverse impact on the availability of the species for subsistence use by Alaska Natives. Activities related to oil and gas exploration and development in the Beaufort Sea region of northern Alaska currently are subject to an ITR rulemaking in effect from 3 August 2011 through 3 August 2016 (76 FR 47010).

3.1.2 Critical Habitat

When the polar bear was listed as a threatened species, the USFWS deferred designation of critical habitat until more information was available. A subsequent lawsuit filed by environmental organizations resulted in a court-ordered settlement in October 2008 that required USFWS to issue a final rule on critical habitat by 30 June 2010. On 29 October 2009, the USFWS published a proposed rule (74 FR 56058) to designate critical habitat for polar bears in Alaska, with a comment period ending 28 December 2009. With court approval, the USFWS later published a revised proposal on 5 May 2010 (75 FR 24545) that reopened the comment period until 6 July 2010 and extended the due date for the final rulemaking to 23 November 2010. The revised proposal corrected the area of the proposed sea-ice habitat unit to remove waters not under U.S. jurisdiction, thereby reducing the total area proposed for all three habitat units by approximately 6.7% from 519,403 km² (200,541 mi²) to 484,764 km² (187,168 mi²). The final rule designating critical habitat was published on 7 December 2010 and became effective on 6 January 2011, reducing the total area slightly further to 484,734 km² (187,157 mi²) (75 FR 76086).

Three primary constituent elements (PCEs) of critical habitat were recognized by the USFWS:

- Sea-ice habitat in waters 300 m (984 ft) or less in depth over the continental shelf of the U.S., used for feeding, breeding, denning, and movements;
- Terrestrial denning habitat with specific topographic characteristics (bluff or bank height and slope) suitable for capturing and retaining snow drifts of sufficient depth to sustain maternal dens through the winter; and
- Barrier-island habitat, including all barrier islands and associated coastal spits, used for denning, refuge from human disturbance, and movements along the coast for access to denning and feeding habitats.

These three PCEs constituted the basis for designating three corresponding units of critical habitat (depicted for the Action Area in Figure 3.1):

- *Unit 1: Sea-ice Habitat*, comprising approximately 464,924 km² (179,508 mi²) of U.S. territorial waters extending from the mean high-tide line seaward over the continental shelf to the 300-m depth contour, but limited in the Chukchi Sea by the Exclusive Economic Zone and the

International Date Line, and in the Bering Sea by the southern extent of the Chukchi Sea population stock (described below), as indicated by radio-telemetry data;

- *Unit 2: Terrestrial Denning Habitat*, comprising an estimated 14,652 km² (5,657 mi²) of land along the northern coast of Alaska, containing the maternal denning habitat characteristics described by Durner et al. (2001) and an estimated 95% of all known historical terrestrial dens, within 32 km (20 mi) of the coast between the U.S./Canada border on the east and the Kavik River on the west, and within 8 km (5 mi) of the coast from the Kavik River west to Point Barrow;
- *Unit 3: Barrier Island Habitat*, comprising an estimated 10,576 km² (4,083 mi²) of barrier islands and associated mainland spits, along with the water, ice, and terrestrial habitat within 1.6 km (1 mi) of those features ("no-disturbance zone").

The final designation of critical habitat excluded existing manmade structures and the land on which they were located on the effective date of the final rule (6 January 2011). In addition, seven specific areas, totaling approximately 74.2 km² (28.6 mi²), were excluded, consisting of the communities of Barrow and Kaktovik (57 km², or 22 mi²) and five U.S. Air Force radar sites—Point Barrow, Point Lonely, Oliktok Point, Bullen Point, and Barter Island (17.2 km², or 6.6 mi²). The radar sites at Point Barrow and Barter Island are included within the Barrow and Kaktovik exclusion areas, respectively.

3.1.3 Distribution and Population Status

Polar bears have a circumpolar distribution in the Northern Hemisphere, primarily around the rim of the Polar Basin and into the seasonally ice-covered regions of contiguous seas. In Alaska, they occur most commonly within 320 km (200 mi) of the coast of the Arctic Ocean (Amstrup and DeMaster 1988). Twenty relatively discrete subpopulations of polar bears have been identified throughout the species range, which are estimated to total 20,000–25,000 animals rangewide (Schliebe et al. 2006, Amstrup et al. 2007, Obbard et al. 2010). These subpopulations vary from several hundred to several thousand animals each (Stirling 2002, Schliebe et al. 2006, Obbard et al. 2010). Bears from three subpopulations (stocks) occur in U.S. waters off Alaska: (1) the Northern Beaufort Sea (NBS) stock, which occurs primarily in northwestern Canada, (2) the Southern Beaufort Sea (SBS) stock, which occupies the Beaufort Sea off the northern coast of Alaska (including the Point Thomson Action Area), and (3) the Chukchi Sea (CS) stock, which occupies the Chukchi and Bering seas off northwestern Alaska (Bethke et al. 1996, Amstrup 2003a, Amstrup et al. 2004a, Schliebe et al. 2006, Obbard et al. 2010).

The subpopulation ranges of polar bears have been grouped into four ecoregions (Convergent, Divergent, Archipelago, and Seasonal Ice), based on the distribution and characteristics of sea ice and corresponding population movements (Amstrup et al. 2007). The SBS stock occupies the Divergent ecoregion, where sea ice forms annually but is exported to other ecoregions or else melts and retreats to the central portion

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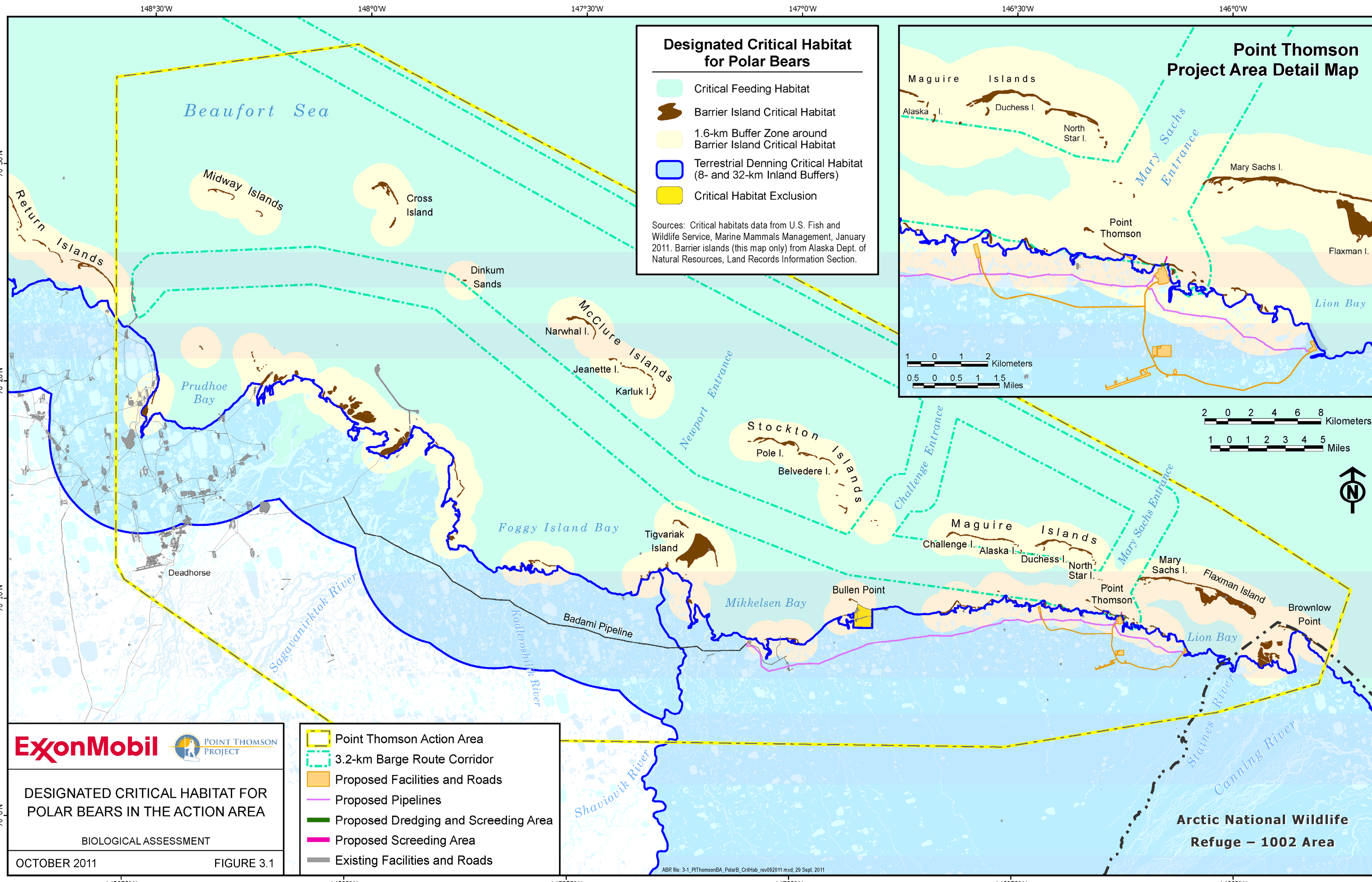
Designated Critical Habitat for Polar Bears
Critical Feeding Habitat
Barrier Island Critical Habitat
1.6-km Buffer Zone around Barrier Island Critical Habitat
Terrestrial Denning Critical Habitat (8- and 32-km Inland Buffers)
Critical Habitat Exclusion
Sources: Critical habitats data from U.S. Fish and Wildlife Service, Marine Mammals Management, January 2011. Barrier islands (this map only) from Alaska Dept. of Natural Resources, Land Records Information Section.
Point Thomson Project Area Detail Map
Beaufort Sea
Midway Islands
Return Islands
Cross Island
Dinkum Sands
McClure Islands
Narwhal I.
Jeanette I.
Karluk I.
Prudhoe Bay
Newport Entrance
Stockton Islands
Pole I.
Belvedere I.
Challenge Entrance
Maguire Islands
Challenge I.
Alaska I.
Duchess I.
North Star I.
Mary Sachs Entrance
Mary Sachs I.
Flaxman Island
Flaxman I.
Point Thomson
Lion Bay
Brownlow Point
Foggy Island Bay
Tigvariak Island
Mikkelsen Bay
Bullen Point
Deadhorse
Sagavanirktok River
Kadleroshilik River
Badami Pipeline
Shaviovik River
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
Kilometers
Miles
ExxonMobil
POINT THOMSON PROJECT
DESIGNATED CRITICAL HABITAT FOR POLAR BEARS IN THE ACTION AREA
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.1
Point Thomson Action Area
3.2-km Barge Route Corridor
Proposed Facilities and Roads
Proposed Pipelines
Proposed Dredging and Screeding Area
Proposed Screeding Area
Existing Facilities and Roads

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of the Polar Basin; polar bears in this ecoregion either move with the retreating ice or abandon it to spend the summer on land (Durner et al. 2009).

The SBS stock ranges over an area of more than 906,500 km² (350,000 mi²), extending from the vicinity of Cape Bathurst, NWT, on the east to Icy Cape and Point Hope on the Chukchi Sea coast in Alaska on the west, and seaward about 300 km (185 mi) from the coast (Amstrup 1995, 2000, 2002; Bethke et al. 1996; Brower et al. 2002; Schliebe et al. 2006). There are some indications that the range of the SBS stock may have contracted in recent years (USFWS 2010). The core activity area of the SBS stock encompasses a considerably smaller region from Herschel Island, Yukon, to Point Barrow, Alaska, and seaward about 135 km (85 mi) (Amstrup 1995, 2000). The Action Area is located within the core activity area of the SBS.

The SBS and CS stocks overlap considerably in the northeastern Chukchi and southwestern Beaufort seas (Amstrup et al. 2004a, 2005; Schliebe et al. 2006; USFWS 2010). While not as extensive as the overlap with the CS stock, the amount of overlap of the SBS stock with the NBS stock in the eastern Beaufort Sea is substantial (Amstrup et al. 2004a, 2005; Schliebe et al. 2006). Genetic studies have found insignificant differentiation among the NBS, SBS, and CS stocks, indicating consistent genetic exchange among these stocks despite considerable fidelity to range areas by individual collared bears and suggesting that they may represent a single breeding population (Cronin et al. 2006). Nevertheless, they are managed as separate stocks on the basis of the demographic and movement data that demonstrate range fidelity. Judging from radio-telemetry data collected during 1985–2003, the section of coastline in which the Point Thomson Project is located is used almost exclusively by the SBS stock (Figure 6 in Amstrup et al. 2004a).

The SBS stock was estimated at 1,526 animals (95% CI = 1,211–1,841) in 2006 (Regehr et al. 2006); the most recent SBS stock assessment used that figure to estimate a minimum population size of 1,397 animals for management purposes (Allen and Angliss 2011). The 2006 estimate represented the mean of three annual estimates from the period 2004–2006, which did not differ significantly (Regehr et al. 2006). The 2006 estimate was lower than the first estimate of the SBS stock, which was 1,778 animals during the period 1972–1983 (Amstrup et al. 1986). The population increased during the 1980s and is thought to have remained stable during the 1990s (Schliebe and Evans 2002, Allen and Angliss 2011). The minimum population size in 2002 was calculated as 1,973 animals, based on an estimate of up to 2,272 animals in the SBS population in 2001 (Schliebe and Evans 2002, USFWS 2010). However, because the methods used to derive these various estimates differed somewhat and because the confidence intervals around the estimates overlap, they cannot be considered statistically different (Regehr et al. 2006). The best information currently available, however, suggests that the SBS population is now declining (Obbard et al. 2010, Allen and Angliss 2011).

Although analysis of recent population trends did not show a statistically significant decline during the period 2001–2006, annual survival rates of cubs of the year and recruitment of yearlings were lower and body size of subadult bears and adult females declined from earlier periods; these factors suggest reduced nutritional status and a declining population (Regehr et al. 2006; Rode et al. 2007, 2010). Such declines have been linked previously in the polar bear population of western Hudson Bay, Canada (Stirling et al. 1999, Stirling and Parkinson 2006), where similar declines in body condition, size, and cub survival were noted in the years before a significant decline in population was observed (Regehr et al. 2006; Obbard et al. 2007; Rode et al. 2007, 2010).

During the 20th century, polar bear populations in Alaska rebounded after two periods of excessive hunting. The SBS population increased substantially from its most recent historic low in about 1972 (Amstrup 1995, 2002). That low resulted from about 20 years of guided sport-hunting, which employed small airplanes to cover large areas of sea ice in search of bears (Amstrup 1995). A previous historic low may have occurred around 1910–1920 (J. J. Burns, Sr., personal communication), resulting from a prolonged period of extensive vessel-based commerce that included Yankee whalers, coastal traders, sojourners, explorers, scientists, and subsistence hunters (Leffingwell 1919, Bockstoce 1986, Amstrup 2000). Coastal traders actively hunted and bartered for polar bear skins during periods when fur prices were high (J. J. Burns, Sr., personal communication). Commercial whaling essentially ended in 1914 (Bockstoce 1986, Bockstoce and Burns 1993) and small-vessel coastal trading declined during the 1920s and ended in the early 1930s.

3.1.4 Reproduction and Survival

Polar bears are large, long-lived carnivores that reach reproductive maturity relatively late in life and have relatively few young, an extended period of maternal care, and comparatively high survival rates, especially after attaining maturity (Amstrup 2003a). Amstrup (2000, 2003a) and Stirling (2002) provided synoptic accounts of the reproductive cycle, from which the following information is summarized. The onset of sexual maturity (first breeding) may occur as early as 4.5 years of age, but most females of the SBS population probably achieve sexual maturity at about 5.5 years of age (Schliebe et al. 2006). Mating occurs primarily from March to late May or early June, when both sexes are active on the sea ice. Males are about twice the size of females and there is intense competition among males for estrous females.

Polar bears are polygamous; a male will remain with a receptive female only for a short time and then seek another female. During the breeding season, males actively seek females by following their tracks on the sea-ice. Adult males and non-pregnant females are active all year, excavating dens only as temporary shelter during severe weather.

Some pregnant females of the SBS population construct and enter natal dens in October, but most do so in mid–late November (Amstrup and Gardner 1994). Birth occurs in maternal dens, typically in late December or early January. The newborn cubs are highly undeveloped, weighing about 0.5 kg (1.1 pound). Mothers and cubs emerge from natal dens in late March or April, when the cubs are 3–4 months old and weigh up to 10–12 kg (22–26 pounds) (Lentfer and Hensel 1980, Amstrup and Gardner 1994, Smith et al. 2007). They remain near the den for up to two weeks (Smith et al. 2007) as the cubs become acclimated to outside temperatures. Females that den on land then move onto the sea ice to hunt. Cubs usually stay with their mothers until they are 1.5 to 2.5 years old, although some may remain into their third or fourth year (Stirling et al. 1975). Females breed again at about the same time they separate from their young; thus the breeding interval of females that successfully wean cubs is three years or longer.

The most common litter size is two, followed by one; although infrequent, triplets are not rare. Females in their prime years, ages 8–18, have the largest litters and the heaviest cubs. In populations that are not overexploited, such as the SBS, females live to the mid 20s, with maximum longevity in the late 20s and early 30s. Males live to their early 20s and occasionally to the late 20s (Amstrup 2000, 2003a; Stirling 2002).

The long duration of research on the SBS population—more than 40 years—provided data during a period of changing climatic and sea-ice regimes and expanding industrial development on the North Slope. Amstrup (1995, 2000) noted subtle differences in several population parameters between phases when the population was declining (1967–1974) and when it was increasing (1981–1992). During the years of decline (1967–1974), the number of young per female in the population as a whole was about 0.4, there was a greater frequency of more than one yearling with females, the reproductive interval of 3.4 years was shorter, and the age structure of the population was younger. During years when the population was increasing (1981–1992), there were fewer young per female (<0.38), fewer litters with more than one yearling, the reproductive interval had increased to 3.7 years, and there was a higher proportion of older animals. These differences suggested density-dependent changes and were interpreted as signs that the population was approaching or reaching carrying capacity (Amstrup 1995, 2000).

Recent research has focused on changes in population status and survival as a consequence of diminishing habitat. The reported survival of SBS cubs in the 1980s and early 1990s was 65% and that of yearlings was 86%; survival of adult females was 96% (Amstrup 1995). Regehr et al. (2006) found that, despite higher production of cubs, cub survival over summer was significantly lower in the period 1990–2006 than in the period 1967–1989; cub survival in the later period (1990–2006) was estimated at 43% and adult survival (all ages of both sexes older than cubs) was estimated at 92%. Further analysis of a short-term data set suggested that survival of adult females decreased from 96–99% in 2001–2003 to 73–79% in 2004–2005 (Regehr et al. 2007, 2010). Demographic modeling based on data collected during 2001–2006 projected that population growth would occur in years with extensive sea-ice cover and that declines would occur in years with low ice coverage, primarily as a result of decreased female survival (Hunter et al. 2010).

3.1.5 Habitat Use

Although they are classified as marine mammals and are strong swimmers, polar bears rely principally on the availability of sea-ice habitats to provide a substrate on which to roam, hunt, breed, den, and rest. They use island and coastal mainland habitats as well as sea ice, but Amstrup (2003a) noted that only 975 (7%) of 14,622 weekly locations of polar bears equipped with satellite collars during 1985–2001 were on land, and most of those were for denning females. Some polar bears also occur on or transit the multi-year ice at very high latitudes (Stirling 2002). Preferred habitats are located in the active seasonal ice zone that overlies the continental shelf and associated islands and in areas of heavy offshore pack ice (Stirling 1988; Durner et al. 2004, 2009). Adult males usually remain there, rarely coming ashore (Amstrup and DeMaster 1988). Habitat use changes seasonally with the formation, advance, movement, retreat, and melt of sea ice (Amstrup et al. 2000; Ferguson et al. 2000; Durner et al. 2004, 2009; Schliebe et al. 2008). During winter and spring, polar bears tend to concentrate in areas of ice with pressure ridges, at floe edges, and on drifting seasonal ice at least 20 cm (8 inches) thick (Stirling et al. 1975, 1981; Schliebe et al. 2006); the greatest densities occur in the latter two categories, presumably because those habitats offer bears greater access to seals. The use of shallow-water areas is greatest in winter, in areas of active ice with shear zones and leads (Durner et al. 2004). The use of landfast ice increases in spring during the pupping season of ringed seals. Multiyear ice is selected in late summer and early autumn as the pack ice retreats to its minimal extent (Ferguson et al. 2000, Durner et al. 2004). Prey availability may not be the only factor affecting habitat selection, as females with young may retreat to the safety of areas with less prey but greater stability in ice cover (Mauritzen et al. 2003).

Polar bear distribution is influenced primarily by prey abundance on seasonal ice (Smith 1980). The primary prey of polar bears in the Beaufort Sea is the ringed seal (*Pusa hispida*). Bears capture seals by waiting for them at breathing holes and at the edges of leads or cracks in the ice. They also stalk seals resting on top of the ice and catch young seals by breaking into pupping chambers in snow on top of the ice in the spring. To a lesser extent, bears also prey on bearded seals (*Erignathus barbatus*), Pacific walrus, and beluga whales (*Delphinapterus leucas*), and feed on carrion, including whale, walrus, and seal carcasses found along the coast (Amstrup 2003a, Schliebe et al. 2006). They occasionally eat small mammals, bird eggs, and vegetation when other food is not available. Polar bears are extremely curious and opportunistic hunters and may approach human developments in search of food.

3.1.5.1 Maternal Denning

The Beaufort Sea is an area of widespread, low-density denning in comparison with known denning concentration areas in other parts of the species range (Amstrup 2003b, Schliebe et al. 2006). The main area of terrestrial denning for the SBS stock is located along the coast between Point Barrow and Barter Island, including the barrier islands and a coastal strip extending up to 40 km (25 mi) inland (75 FR 76086, Allen and Angliss 2011).

Pregnant polar bears excavate maternal dens in compacted snow drifts adjacent to coastal banks (barrier islands and mainland bluffs), river or stream banks, and other areas with at least 1.3 m (4.3 ft) of vertical topographic relief and steep slopes (mean 40°, range 15.5–50°) (Amstrup and DeMaster 1988; Durner et al. 2001, 2003, 2006). Dens often are located at the edge of stable sea ice on the shoreward side of barrier islands. In particular, Flaxman, Pingok, Cross, Cottle, and Thetis islands are known to support maternal dens along the central Beaufort Sea coast. Onshore, most maternal dens are located in drifts along coastline bluffs and, to a lesser extent, along river or stream banks, but a few have been found along lakeshores and even at the edge of an abandoned gravel pad (Durner et al. 2003). The common characteristic among suitable denning habitats is the presence of topographic features of sufficient height and slope to catch blowing snow and form persistent drifts in early winter.

Using a combination of methods, USGS biologists characterized and mapped landscape features (bank-habitat segments) considered to provide suitable maternal denning habitat along the Alaska Beaufort Sea coast between the Colville River and the border with Canada (Durner et al. 2001, 2003, 2006). They delineated and quantified potential habitat using remote sensing, aerial-photo interpretation, and ground-truthing, correctly classifying about 90% of the potential habitats mapped. In two separate analyses, they mapped 1,782 km (1,107 mi) (11.4 km² [4.4 mi²], or 0.18%) of potential habitat in a 6,335 km² (2,446 mi²) study area between the Colville and Tamayariak rivers (Durner et al. 2001) and 3,621 km (2,250 mi) (23.2 km² [9.0 mi^2], or 0.29%) in a 7,994-km² (3,086-mi^2) study area of the coastal plain within Arctic Refuge(Durner et al. 2006) (Table 3.1).

Table 3.1 Extent of potential terrestrial denning habitat for polar bears, as mapped by USGS, in 1.6-km buffer zones surrounding proposed infrastructure and in the entire Action Area for the proposed Point Thomson Project.

Area	No. of Bank-habitat Segments	Total Length of Bank-habitat Segments (km)	Bank-habitat Area [a] (km^2)	Land Area [b] (km²)	Total Area [c] (km²)
Sea ice road option [d]	193	66.7	0.43	235.4	381.7
Tundra ice road option [d]	286	106.9	0.69	316.9	350.5
Action Area	1,178	566.9	3.66	1,422.7	4,136.4

Key:
[a] Assuming an average width of 6.4 m per mapped segment of bank habitat (Durner et al. 2001).
[b] Mainland and islands combined, excluding marine waters.
[c] Mainland, islands, and marine waters combined.
[d] Buffer radius of 1.6 km around all ice and gravel roads and pads, within which den surveys must be conducted before construction.

Until the latter part of the 20th century, most maternal dens were found largely by ground-based observers in mainland or landfast-ice habitats, so it generally was thought that most denning occurred on land, even though local environmental knowledge of Native hunters recognized that maternal dens also occurred on drifting ice (USFWS 1995; Kalxdorff 1997; J. J. Burns, Sr., personal communication). Lentfer (1975) challenged the predominant view of terrestrial denning when he confirmed that denning occurred, to an unknown extent, on drifting ice. That discovery led to an important reconsideration of the extent of potential denning habitat. Subsequent radio-telemetry studies provided quantitative data about maternal denning in all habitats and confirmed that a high proportion of dens occurred on drifting pack ice, often far from shore.

Of 90 dens located during 1981–1991 in the Beaufort Sea region, 48 (53.3%) were on drifting pack ice, 38 (42.2%) were on land, including barrier islands, and 4 (4.5%) were on landfast ice (Amstrup and Gardner 1994). Dens on land occurred mainly in a narrow band along the coast, although one was 61 km (38 mi) inland. Amstrup (2003b) summarized similar information on 186 maternal dens located in his Beaufort Sea study area between Point Hope, Alaska, and the Mackenzie River in northwestern Canada (167° to 137° West longitude) from spring 1982 to 2003 (including some of the same dens reported on by Amstrup and Gardner 1994). Of those 186 dens, 90 (48.4%) were on drifting ice and 96 (51.6%) were on land or landfast ice. The most recent analysis of den locations used by collared bears reported notable shifts in the distribution of maternal dens in northern Alaska (Fischbach et al 2007). That study compared 124 den locations used by 85 radio-collared bears of the SBS stock between an early period (1985–1994) and a later period (1997–2004). The analysis documented a landward and eastward shift in maternal denning, including the area between the Sagavanirktok and Canning rivers, in which the Point Thomson Project is located. The proportion of dens located on drifting pack ice decreased from 62.3% in the early period to 37.1% in the later period, and proportionately fewer dens on pack ice occurred in the western Beaufort Sea in the later period.

In all of the studies described above, the proportion of dens located on land increased through time; a similar increase in denning on land by the adjacent NBS population in Canada also has been noted (Stirling and Andriashek 1992). The increasing proportion of bears denning on land in the Beaufort Sea region initially was attributed to the restriction of hunting after 1972 (Stirling and Andriashek 1992, Amstrup and Gardner 1994), but, more recently, the landward and eastward shift in denning by SBS bears has been related to reductions in stable sea-ice cover and delays in autumn freeze-up (Fischbach et al. 2007). Because of their greater proximity to settlements, industrial sites, and coastal areas of human activity, dens on land and landfast ice are presumed to be more vulnerable to human-induced disturbance.

Female polar bears do not show fidelity to specific den locations, but they tend to den on the same type of substrate (pack ice or land) from year to year and may return to the same general area to den (Amstrup and Gardner 1994, Amstrup 2003a, Schliebe et al. 2006, Fischbach et al. 2007). Fischbach et al. (2007) noted that more females shifted from sea ice to land in both time periods he studied and that females in the later period showed greater fidelity to land as a denning substrate.

Considering dens on all substrates, Amstrup and Gardner (1994) concluded that denning and cub births in the Beaufort Sea region were sufficient to account for the estimated size of the SBS population at that time: approximately 140 dens per year in a population estimated at 1,500 to 1,800 animals. By comparison, the USFWS estimated that approximately 240 females in this population den annually (75 FR 76099). Cub production did not differ between females using dens on pack ice and those denning on land or landfast ice, although the risk of cub loss was considered greater for dens on the drifting pack ice (Amstrup and Gardner 1994).

3.1.6 Movements

Polar bears of the SBS stock range over large areas during the year, with total annual movements ranging from 1,406 to 6,203 km (874 to 3,854 mi) and covering annual activity areas of 7,264 to 596,800 km² (2,805 to 230,436 mi²) (Amstrup et al. 2000). Monthly movements ranged from 79 to 420 km (49 to 261 mi) over areas of 88 to 9,760 km² (34 to 3,768 mi²), with the largest total monthly movements occurring during early winter and the smallest in early spring. Females with cubs move less and cover smaller areas than do other sex and age classes. Movements appear to be increasing as sea-ice cover continues to diminish, however. From 1979 to 2006, female polar bears moving from the pack ice to denning areas onshore experienced an average increase in travel distance of >6 km (>3.7 mi) per year (>168 km [>104 mi] over 28 years) (Bergen et al. 2007). Increased frequency of long-distance swimming by radio-collared bears (Durner et al. 2011), observations of swimming bears and dead bears in open water (Monnett and Gleason 2006, Schliebe et al. 2006), intraspecific predation and cannibalism (Amstrup et al. 2006a), and unusual predation attempts (Derocher et al. 2000, Brook and Richardson 2002, Stirling et al. 2008) all indicate increasing difficulty dealing with ecological changes resulting from declining sea-ice cover.

Some polar bears begin to appear on the mainland and barrier islands in August, during the open-water period. However, by the time of minimal ice extent in mid–late September, the pack ice can be very far from shore (Miller et al. 2006, Schliebe et al. 2008). Schliebe et al. (2008) found a significant positive relationship between the number of bears observed on coastal surveys in fall and the distance from the shore to the pack ice. As seasonal ice forms and pack ice spreads southward in the late fall and winter, other bears move with it, appearing along the Beaufort Sea coast (Lentfer 1972, Amstrup et al. 2000). Some polar bears may remain on pack ice all year if there is continuous access to prey (Stirling 2002). Polar bears typically use land only during late summer, autumn, and the maternal denning season in winter; besides denning females, females with cubs and subadult males occasionally come ashore. Beach-cast carrion can provide particularly important food sources for subadults and sows with cubs (USFWS 1995, Miller et al. 2006). Except for pregnant females that remain to den, bears begin to leave the coast when sea ice develops, usually by late October (Schliebe et al. 2001, Kalxdorff et al. 2002), although they remain relatively near shore in winter compared with late summer and fall, when ice is farthest from shore (Amstrup et al. 2000). Females with young cubs may hunt in areas of landfast ice after den emergence.

It has been known for a long time, as stated by several Alaska Native informants (in USFWS 1995), that polar bears become increasingly abundant on the mainland and barrier islands during the open-water season in late summer and the fall whaling season. Aerial surveys for marine mammals along the coast and offshore in the Beaufort Sea have provided numerous sightings of polar bears. For instance, numerous incidental sightings have been recorded as part of the federal Bowhead Whale Aerial Survey Program (BWASP) (e.g., Figure 3-28 in ExxonMobil Corp. 2009) and are available in that program's database (http://www.alaska.boemre.gov/ess/bwasp/ xbwasp.htm). Most relevant for this discussion are the extensive radio-telemetry data set maintained by USGS since 1985, which was used by Amstrup et al. (2006b) to estimate the seasonal presence of polar bears and risk of spills during the fall open-water season (Figure 3.2), and the data set from aerial surveys of polar bears by USFWS along the Beaufort Sea coast between Point Barrow and the Canadian border in the fall (September–October 2000–2005 and 2007, and August–October 2008–2009) (Figure 3.3). Analysis of the latter data set (provided for this BA by T. Evans, USFWS, personal communication) produced an average of 64 bears per survey (range 16–125) over all years; adjustment for survey effort produced an average of 5.0 bears per 100 km (62 mi) (range 1.4–12.1 bears). On average, approximately 4% of the bears in the SBS stock (maximum 8%; based on the 2006 estimate of 1,526 animals; Regehr et al. 2006) were observed on land per survey

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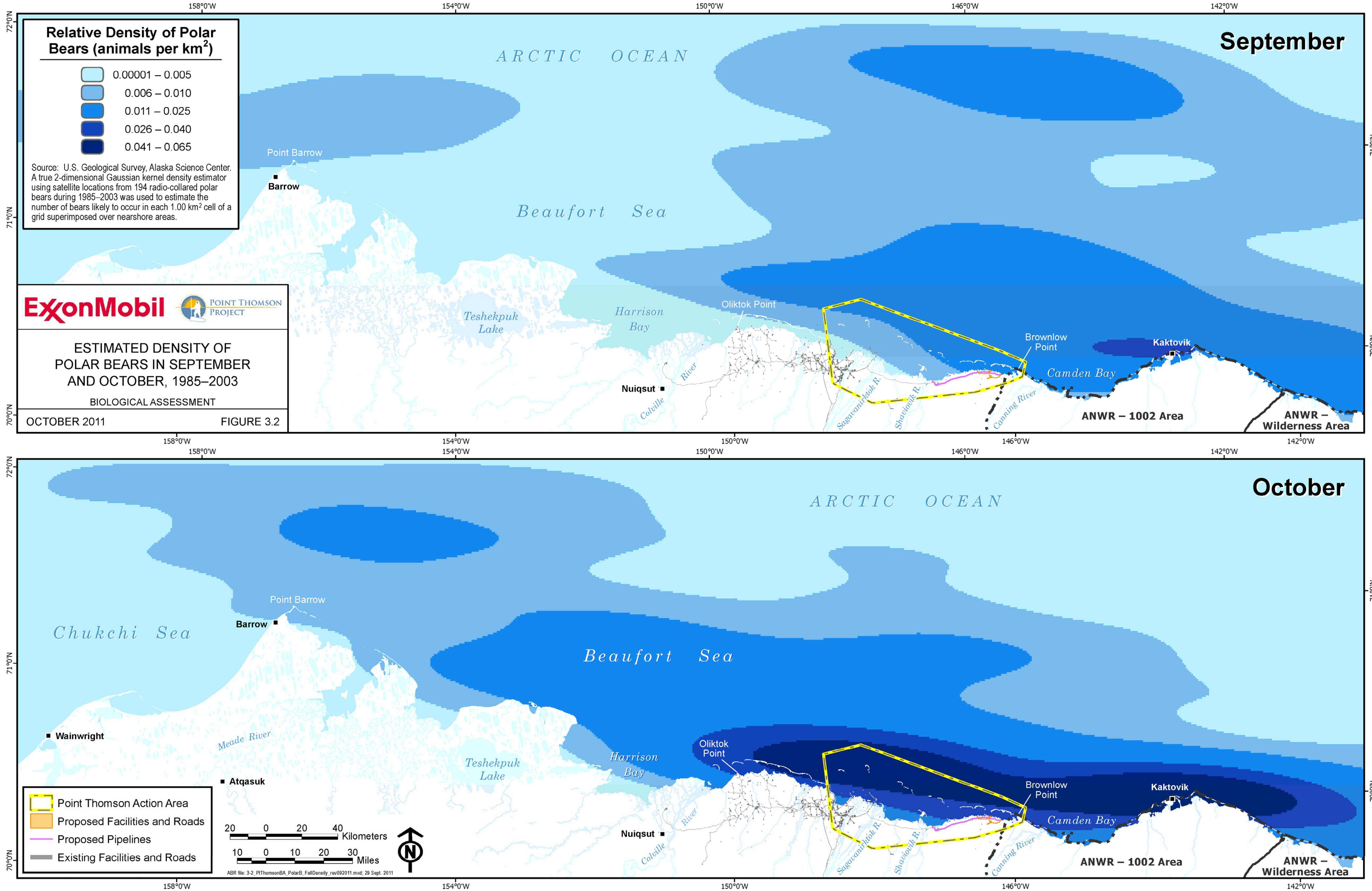
Relative Density of Polar Bears (animals per km^2)
0.00001 – 0.005
0.006 – 0.010
0.011 – 0.025
0.026 – 0.040
0.041 – 0.065
Source: U.S. Geological Survey, Alaska Science Center. A true 2-dimensional Gaussian kernel density estimator using satellite locations from 194 radio-collared polar bears during 1985–2003 was used to estimate the number of bears likely to occur in each 1.00 km^2 cell of a grid superimposed over nearshore areas.
ExxonMobil
POINT THOMSON PROJECT
ESTIMATED DENSITY OF POLAR BEARS IN SEPTEMBER AND OCTOBER, 1985–2003
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.2
September
October
ARCTIC OCEAN
Beaufort Sea
Chukchi Sea
Point Barrow
Barrow
Wainwright
Atqasuk
Meade River
Teshekpuk Lake
Harrison Bay
Oliktok Point
Nuiqsut
Colville River
Sagavanirktok R.
Shaviovik R.
Canning River
Brownlow Point
Camden Bay
Kaktovik
ANWR – 1002 Area
ANWR – Wilderness Area
158°0'W
154°0'W
150°0'W
146°0'W
142°0'W
72°0'N
71°0'N
70°0'N
Point Thomson Action Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
20 0 20 40 Kilometers
10 0 10 20 30 Miles
N

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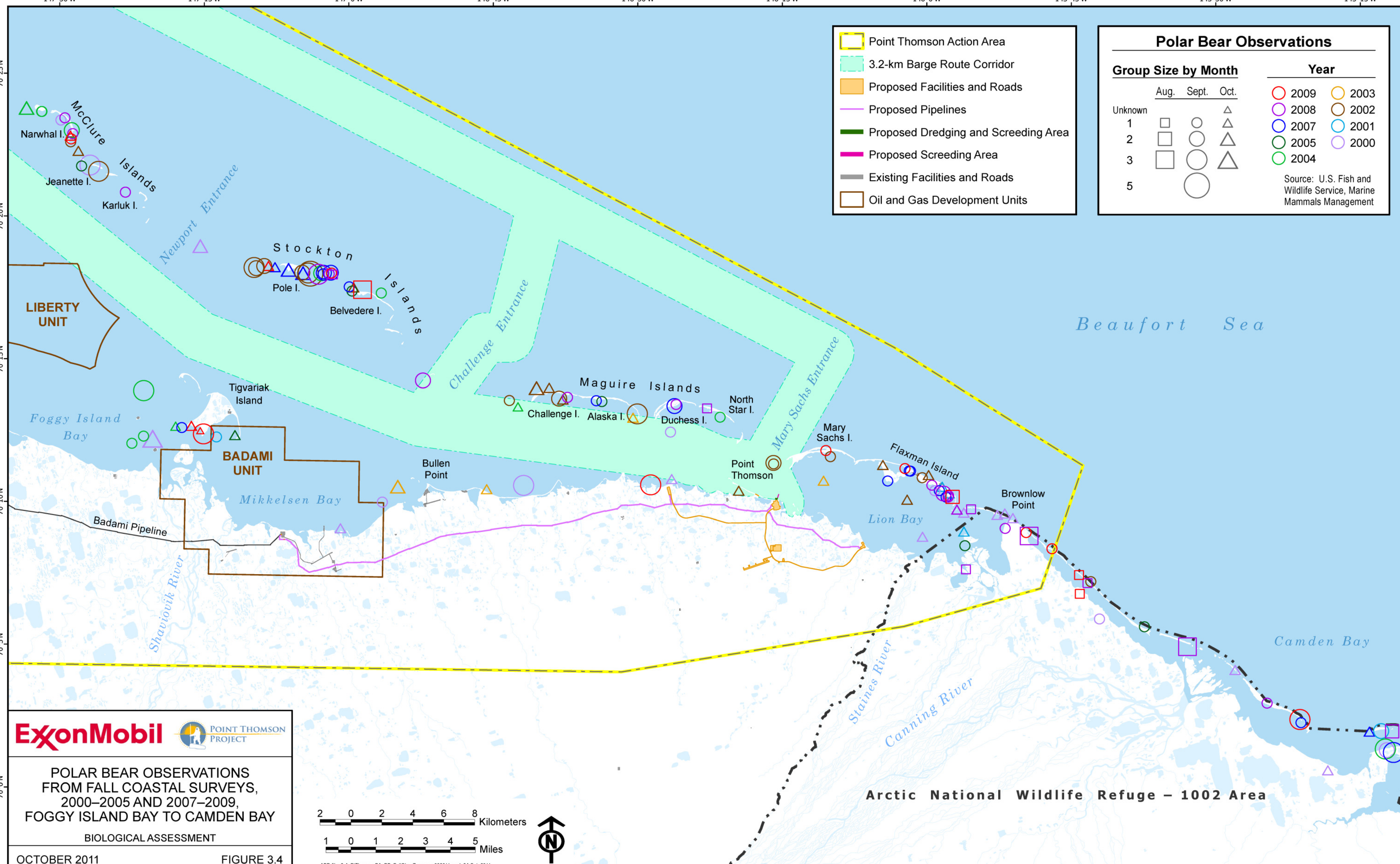

POLAR BEAR OBSERVATIONS FROM FALL COASTAL SURVEYS, 2000–2005 AND 2007–2009, FOGGY ISLAND BAY TO CAMDEN BAY

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(Schliebe et al.2008). Most sightings (82%) were recorded on barrier islands, with 11% on the mainland and 6% on landfast ice (74 FR 56068). Peak numbers generally occurred in late September–early October (USFWS 1995; Schliebe et al. 2001, 2008; Kalxdorff et al. 2002). Most individual polar bears that move through the Point Thomson area probably do so in the fall, when bears are present along the entire Beaufort Sea coast from Point Barrow to the Canada border.

Polar bears congregate in fall on barrier islands (Figures 3.3 and 3.4) because of food availability, especially bowhead whale carcasses remaining from subsistence hunts on Cross and Barter islands, and favorable environmental conditions (Miller et al. 2006, Schliebe et al. 2008). For instance, an aggregation of 28 bears was observed in November 1996 near a carcass on Cross Island and another 11 were observed within 3.2 km (2 mi) of a carcass on Barter Island (Kalxdorff 1998). Such concentrations have become commonplace and bear numbers have increased in autumn in certain locations (Miller et al. 2006, Schliebe et al. 2008). The greatest concentrations now occur at Barter Island, Cross Island, and Point Barrow, where bears are attracted to and feed on bone piles of harvested bowhead whales taken during the autumn subsistence hunt (Miller et al. 2006, Schliebe et al. 2008). The Point Thomson area is located between Cross and Barter islands, used by whalers from Nuiqsut and Kaktovik, respectively, but there is little indication of bear movement between those sites (Miller et al. 2006). These occurrences are classic cases of attraction to predictable food sources, resulting in modification of activity patterns during the ice-free season, increased tolerance of (perhaps habituation to) the structures, noises, and activities associated with nearby communities, and thus increased risk of bear/human conflicts.

3.1.7 Management and Human Harvest

Polar bears live in geographic areas under the jurisdiction of five nations—Russia, Norway, Denmark, Canada, and the United States—and also in international waters where jurisdiction is not clearly defined. Representatives of these five nations developed the international *Agreement on the Conservation of Polar Bears and Their Habitat* in November 1973, which was ratified in 1976 (USFWS 1995, Schliebe et al. 2006). It allowed bears to be harvested only in areas where they were taken by traditional means in the past and it prohibited the use of aircraft and large motorized vessels in polar bear hunting. The agreement created a high-seas polar bear sanctuary but did not prohibit hunting from the ground using traditional methods.

The three polar bear stocks that occur in Alaska are shared with Canada (SBS and NBS stocks) and with Russia (CS stock). Bears from the SBS stock are hunted in both northern Alaska and northwestern Canada. In 1988, the North Slope Borough Department of Wildlife Management (representing Alaska

Natives) and the Inuvialuit Game Council (representing Canadian First Nations) signed a user-to-user accord between indigenous peoples of Canada and Alaska to provide for coordinated management of the Beaufort Sea stocks. According to the *Polar Bear Management Agreement for the Southern Beaufort Sea* (Brower et al. 2002), the recommended annual harvest quota (the recording year being July 1 to June 30) was 76 from 1988/1989 to 1993/1994, 77 from 1994/1995 to 1996/1997, and 80 in 1997/1998. The harvest quota for the SBS stock remained at 80 bears until July 2010 (Obbard et al. 2010), when it was reduced to 70 bears, of which 35 were allocated to Alaskan subsistence hunters (USFWS 2011a, 2011b; 76 FR 47021). In addition to annual hunting quotas, the management agreement provided for the establishment of specified hunting seasons, protection of bears constructing or occupying dens, and protection of females with cubs of the year or yearlings. Other conservation measures in the agreement related to methods and means of hunting, data acquisition and exchange, and annual meetings.

During the 10-year period from 1988/1989 to 1997/1998, Alaskan and Canadian hunters combined took an average of 58 bears per year (range = 36–90) from the SBS population. The combined mean annual harvest decreased to 54 bears for during the four reporting years from 1 July 2003 to 30 June 2007 (Allen and Angliss 2011). In Alaska, the long-term mean annual harvest for the SBS stock was reportedly 35 bears during 1980–2008 (DeBruyn et al. 2010) and 33 bears during 1980–2007 (Allen and Angliss 2011). The mean annual Alaska harvest declined from 39 bears during 1 July 2000–30 June 2004 to 32 bears during 1 July 2004–30 June 2008 (DeBruyn et al. 2010). Recent declines in the Alaska harvest notwithstanding, the harvest rate exceeds the "potential biological removal" (PBR; defined under the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population) for the SBS stock, which is 22 bears per year, based on the most recent population estimate in 2006 (Allen and Angliss 2011). For this reason, adjustments in the allowable harvest level may become necessary (Schliebe et al. 2006) and concern has been expressed that the current harvest may not be sustainable, given the likelihood of a declining population (Obbard et al. 2010).

3.2 Spectacled Eider

3.2.1 Species Status

The Spectacled Eider is managed by the USFWS under the Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712), as amended, and the ESA. The Spectacled Eider was petitioned for listing under the ESA on 10 December 1990 after undergoing severe declines in abundance, particularly on the Yukon-Kuskokwim Delta (YKD) in western Alaska (Kertell 1991, Stehn et al. 1993). In 1993, Spectacled Eiders were listed by the USFWS as a threatened species without designating critical habitat (58 FR 27474–27480). After a review of old and new data, critical habitat was designated for Spectacled Eiders in 2001 (66 FR 9146–9185). The only area listed as critical habitat in northern Alaska is Ledyard Bay in the Chukchi Sea; all other areas of critical habitat are in western Alaska and the only terrestrial critical habitat is on the YKD. The causes of the decline in western Alaska are unknown, but poisoning from spent lead shot, reductions in benthic marine prey, subsistence harvest, predation on breeding grounds, and research-related disturbance are possible factors (66 FR 9146-9185). An analysis of weather and ice in the Bering Sea wintering area for the species concluded that extreme ice and wind could affect yearly variation in breeding activity on the YKD, but no single factor explained long-term declines (Petersen and Douglas 2004). In northern Alaska, where Point Thomson is located, the long-term trend for the population is stable or slightly declining, so there likely are differences in the type or severity of factors operating in western and northern Alaska populations.

3.2.2 Species Distribution and Life History

The Spectacled Eider is a medium-sized sea duck that breeds primarily on coastal tundra in Siberia and northern Alaska and winters in the Bering Sea. Spectacled Eiders nest in three areas: on the arctic coast of Siberia, in western Alaska on the YKD, and along the Beaufort Sea coast from Point Barrow to Demarcation Point (Gabrielson and Lincoln 1959, Dau and Kistchinski 1977, Bellrose 1980). Spectacled Eiders are uncommon nesters (i.e., they occur regularly but are not found in all suitable habitats) on Alaska's ACP, and tend to concentrate on large river deltas (Johnson and Herter 1989). Nearly all Spectacled Eiders on Alaska's ACP breed between Icy Cape and the Shaviovik River at Bullen Point (66 FR 9146–9185). They are relatively common breeders in northern portions of the National Petroleum Reserve–Alaska (NPRA), but uncommon in the foothills and at Storkersen Point, near Prudhoe Bay (Derksen et al. 1981). Spectacled Eiders from all three breeding areas winter in the Bering Sea near St. Lawrence Island (Petersen et al. 2000).

Relatively few data are available on spring migration routes across the ACP, although an overland route has been proposed (Myres 1958, TERA 1999a). Recent satellite telemetry on returning Spectacled Eiders suggests they migrate along the Chukchi and Beaufort Sea coasts (Sexson et al. 2011). Spectacled Eiders arrive on the ACP of northern Alaska in late May or early June (Warnock and Troy 1992, Anderson and Cooper 1994, Johnson 1995, Johnson et al. 1996, USFWS 1996). Observations during the pre-nesting period suggest that habitats containing open water early in the season are important to Spectacled Eiders (Anderson and Cooper 1994). Nesting begins in mid-June and eggs start hatching in early–mid July; males disperse from the area by late June (Warnock and Troy 1992, Anderson and Cooper 1994, Johnson et al. 2008). The date of the first nest on the Colville River delta has ranged from 8 to 24 June in different years (Simpson et al. 1982, North et al. 1984, Nickles et al. 1987, Gerhardt et al. 1988). Spectacled Eider hens on the Colville River delta and NE NPRA laid clutches of 1–7 eggs (mean = 4.0 eggs, SE = 0.12, n = 96 nests; C. Johnson, ABR Inc., personal communication). Hens have high incubation constancy, spending from 90% (Flint and Grand 1999) to 94–99% (Johnson et al. 2006, 2007, 2008) of the day on the nest. Incubation lasts 22 to 24 days (Dau 1974, Flint and Grand 1999). After the female begins incubating, male Spectacled Eiders leave their mates and nesting areas (Gabrielson and Lincoln 1959, Kistchinski and Flint 1974, TERA 1995a). The primary cause of nest failure on the Colville River delta is predation by arctic fox (*Vulpes lagopus*), Parasitic Jaeger (*Stercorarius parasiticus*), and Glaucous Gull (*Larus hyperboreus*) (Johnson et al. 2006, 2007, 2008), but red foxes (*Vulpes vulpes*), Long-tailed Jaegers (*Stercorarius longicaudus*), and Common Ravens (*Corvus corax*) also prey on eider eggs, although they are less common in that area. Predation of ducklings has been attributed to avian predators (Petersen et al. 2000). The effect of predation on overall production has not been quantified, but hatching success improved in one study area with predator removal (Grand and Flint 1997). Telemetry studies of Spectacled Eiders at Prudhoe Bay indicate that, after males depart the breeding grounds in late June, some spend several weeks in the Beaufort Sea while most undertake a molt migration overland to the Chukchi Sea (Ledyard Bay) off Alaska, off the arctic coast (Indigirka/Kolyma River) of Russia, or along the Chukotsk Peninsula (Mechigemenan [Mechig-menskiy] Bay) in Russia (Petersen et al. 1999a, TERA 2003). A fourth molting area, East Norton Sound, in western Alaska, does not appear to be used by Spectacled Eiders from the North Slope. Female eiders, which depart more asynchronously than males depending on whether they nested successfully and reared broods, may spend several weeks in the Beaufort Sea before moving to molting areas (TERA 2003).

From molting areas, Spectacled Eiders begin moving in October to wintering areas in the Bering Sea, where the entire world population appears to winter in restricted openings in the ice pack south of St. Lawrence Island (Larned et al. 1995, Larned and Tiplady 1997, Petersen et al. 1999a). The total wintering population of eiders in these small, open-water areas in the ice (polynyas) has been estimated at >330,000 birds from photographs of 18 flocks in 1997 (Larned and Tiplady 1997).

Spectacled Eiders feed on benthic invertebrates (primarily clams) while at sea (Petersen et al. 1998). On their breeding grounds, they take insects, insect larvae, seeds, and other plant material (Dau 1974, Kistchinski and Flint 1974).

3.2.3 Population Status

Prior to 1990, when Spectacled Eiders were proposed for listing, few studies on the ACP of Alaska were focused solely on this species, although general information on distribution and abundance had been collected during early bird studies conducted in the region (Bergman et al. 1977, Derksen et al. 1981, Rothe et al. 1983). In 1990, a regional review for the ACP was prepared to determine if existing data showed a decreasing eider population, but few long-term studies were available to assess population trends (North 1990). Beginning in 1991, both extensive and intensive studies on Spectacled Eiders have been conducted on the ACP. Many of these studies have focused on determining population trends by using aerial surveys during early to mid June to determine breeding numbers.

Population decline in the Spectacled Eider was first reported in western Alaska where populations on the YKD declined by more than 96% from historical levels (50,000 pairs; Stehn et al. 1993). Historical records of Spectacled Eider abundance on the ACP are unavailable, but the USFWS estimated the breeding population was 5,525 in 2009 (95% CI = 3,663–7,387; Larned et al. 2010). Recent estimates suggest that the ACP now supports the main breeding population of Spectacled Eiders in Alaska (USFWS 1996, Larned et al. 2009). Data from the nesting population in the Prudhoe Bay area suggested that it might have declined by as much as 80 percent between 1981 and 1992 (Warnock and Troy 1992, TERA 1993). However, since 1992 the breeding population across the entire ACP has been relatively stable with mean population growth rates not significantly different from equilibrium, as of 2008 (n = 16 years; Larned et al. 2009). With an additional year of data in 2009, the population of Spectacled Eiders on the North Slope exhibited a slight but significant decline of 1.5% (Larned et al. 2010). Depending on the period of years evaluated, the Spectacled Eider population on the North Slope appears to be stable or marginally declining.

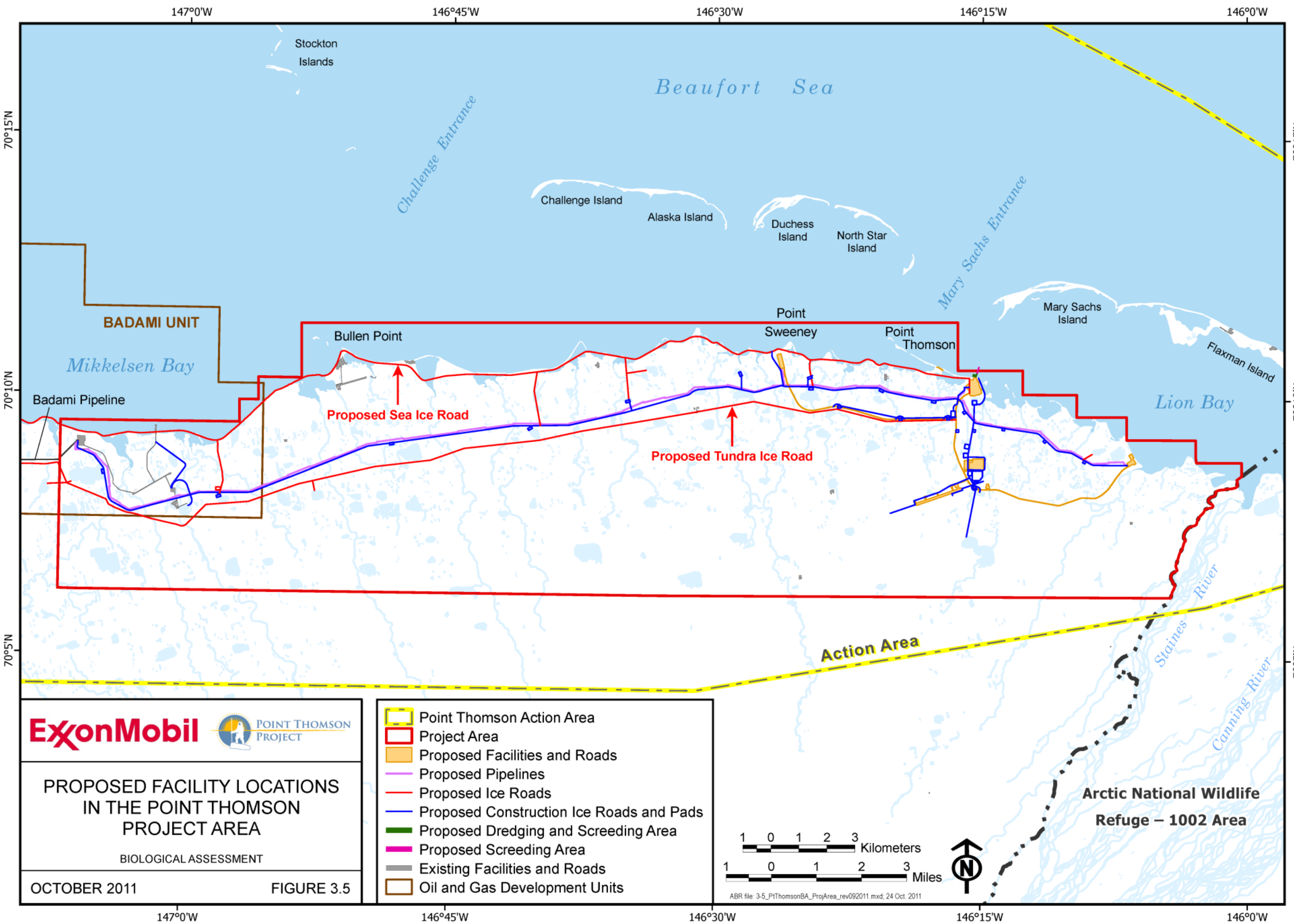
3.2.4 Critical Habitat

Although critical habitat was proposed for Spectacled Eiders on the ACP (65 FR 6114), the final ruling did not delineate specific areas for critical habitat, other than areas in the YKD, Norton Sound, Bering Sea, and Ledyard Bay (66 FR 9146–9185). Critical habitat was not designated on the ACP because habitat for this part of the species range, particularly nesting habitat, was not considered to be limiting.

3.2.5 Habitat Use

Spectacled Eiders tend to nest on islands, peninsulas, shorelines, hummocks in wet meadows, and on polygon rims (Kistchinski and Flint 1974, Dau 1976, Anderson et al. 1999, Johnson 1995). Wet, aquatic, and halophytic habitats are selected by Spectacled Eiders during breeding. In recent studies on the Colville River delta, pre-nesting Spectacled Eiders significantly preferred ($P \leq 0.05$) brackish water, salt marsh, salt-killed tundra, deep open water with islands or polygonized margins, shallow open water with islands or polygonized margins, deep polygon complex, and grass (*Arctophyla fulva*) marsh during 16 years of surveys (Johnson et al. 2010a). In the NPRA, pre-nesting Spectacled Eiders significantly preferred brackish water and the same two open water habitats preferred on the Colville River delta during eight years of surveys. Although there is less data on pre-nesting Spectacled Eiders in the Point Thomson area, 57% of 7 eider groups in 1994 used shallow fresh water lakes and 43% used fresh water lakes with emergents (Byrne et al. 1994). During nesting, Spectacled Eiders on the Colville River delta significantly preferred wet polygonal habitats (deep polygon complex and patterned wet meadow), but also used all the habitats preferred during pre-nesting (Johnson et al. 2008). Spectacled Eiders in the Kuparuk Oilfield nested primarily in non-patterned wet meadows within wetland complexes containing emergent grasses (*A. fulva*) and sedges (*Carex* spp.) (Anderson and Cooper 1994, Anderson et al. 2009). Spectacled Eiders in the Prudhoe Bay oilfield also nested principally in non-patterned wet meadows (Warnock and Troy 1992).

To quantify habitat use and habitat impacts in potential breeding areas in the Point Thomson vicinity, we define an area bounding the Project where direct and indirect effects from construction of new facilities could occur. The Point Thomson Project Area (Figure 3.5) is the portion of the Action Area (Figure 2.1) that includes the terrestrial zone of facilities and activities for the Project from East Pad to Badami and thus spans the areas of permanent habitat loss from Project activities. Marine and aircraft activity will be the primary sources of Project-related disturbance and change outside the Project Area in the larger Action Area.


Beaufort Sea
Stockton Islands
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
Mary Sachs Island
Flaxman Island
Lion Bay
BADAMI UNIT
Mikkelsen Bay
Badami Pipeline
Bullen Point
Point Sweeney
Point Thomson
Proposed Sea Ice Road
Proposed Tundra Ice Road
Action Area
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
147°0'W
146°45'W
146°30'W
146°15'W
146°0'W
70°15'N
70°10'N
70°5'N
ExxonMobil
POINT THOMSON PROJECT
PROPOSED FACILITY LOCATIONS IN THE POINT THOMSON PROJECT AREA
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.5
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Proposed Ice Roads
Proposed Construction Ice Roads and Pads
Proposed Dredging and Screeding Area
Proposed Screeding Area
Existing Facilities and Roads
Oil and Gas Development Units
Kilometers
Miles
N

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Potential breeding habitats for Spectacled Eiders probably occur within the Point Thomson Project Area. Aquatic and wet vegetation types in the Project Area (Figure 3.6, Table 3.2) are similar to some of the habitat types used by eiders in other locations described above. Although all the areas with permanent gravel, facilities, and pipelines have been mapped in Figure 3.6, mapping of the entire Project Area is incomplete. The available mapping displays vegetation classifications rather than waterfowl habitats (for example, water is one class, with no distinctions between saltwater, brackish lakes, or freshwater lakes) making it difficult to evaluate the quality and quantity of habitats available in the Project Area for breeding eiders. The mapped portion of the Project Area contains 54.3 km^2 (13,426 ac, 23% of the mapped area) of wet and saline tundra habitat types, some of which correspond with breeding habitats used elsewhere. An unknown proportion of the water (77.8 km^2 [19,216 ac], 33% of mapped area) could also be potential breeding habitat. However, because breeding habitats (freshwater deep and shallow lakes) are not distinguished from non-breeding habitats (salt water, rivers, and streams), it is difficult to estimate how much of the area in water is potential breeding habitat.

During brood-rearing, from mid-July to when the young fledge in early September (TERA 1995a), Spectacled Eiders use a variety of aquatic habitats on the ACP. For example, broods on the Colville River delta were observed in nine different habitats, but most broods were seen in three habitats: salt-killed tundra, aquatic sedge with deep polygons (later renamed deep polygon complex), and deep open water with islands or polygonized margins (Johnson et al. 2003a). Brood-rearing Spectacled Eiders in the Kuparuk, Milne Point, and Prudhoe Bay oil fields used primarily waterbodies with margins of emergent grasses and sedges, basin wetland complexes, and occasionally deep open lakes (Warnock and Troy 1992, Anderson and Cooper 1994, Troy 1994, TERA 1995a). These observations demonstrate that nesting and brood-rearing eiders are reliant on aquatic habitats, particularly coastal habitats when available. When young are capable of flight, Spectacled Eiders move to nearshore marine waters, and then depart the ACP, usually by mid-September, when freeze-up begins. After leaving the ACP, Spectacled Eiders move to molting areas along the western coast of Alaska (Ledyard Bay, Norton Sound) and the eastern coast of Russia (Mechigmenshiy Bay and near the Indigirka and Kolyma river deltas) (USFWS 1996). During winter, Spectacled Eiders use polynyas in the Bering Sea, usually south of St. Lawrence and St. Matthew islands (Petersen et al. 1999a).

3.3 Steller's Eider

3.3.1 Species Status

As with the Spectacled Eider, the Steller's Eider is managed by USFWS under the Migratory Bird Treaty Act of 1918 and the ESA. The Steller's Eider was petitioned for listing as a threatened or endangered species on 10 December 1990. In 1992, the USFWS found the listing of the Steller's Eider to be warranted but precluded from listing because of listing decisions for higher priority species (57 FR 19852). In 1993, the USFWS determined that the species warranted listing, but only for its Alaska breeding population. It was proposed for listing in 1994 (59 FR 35896) and was formally listed as a threatened species under the ESA in 1997 (62 FR 31748–31757). Steller's Eiders historically nested throughout much of western and northern coastal Alaska and in arctic Russia, but in recent decades their breeding range has contracted to the western ACP of Alaska and in arctic Russia (Kertell 1991, Quakenbush and Cochrane 1993, Flint and Herzog 1999, Quakenbush et al. 2002). The contraction of the breeding range in Alaska was the primary justification for the listing of Steller's Eiders as threatened (62 FR 31748–31757). Although the causes of the extirpation from western Alaska and eastern ACP are

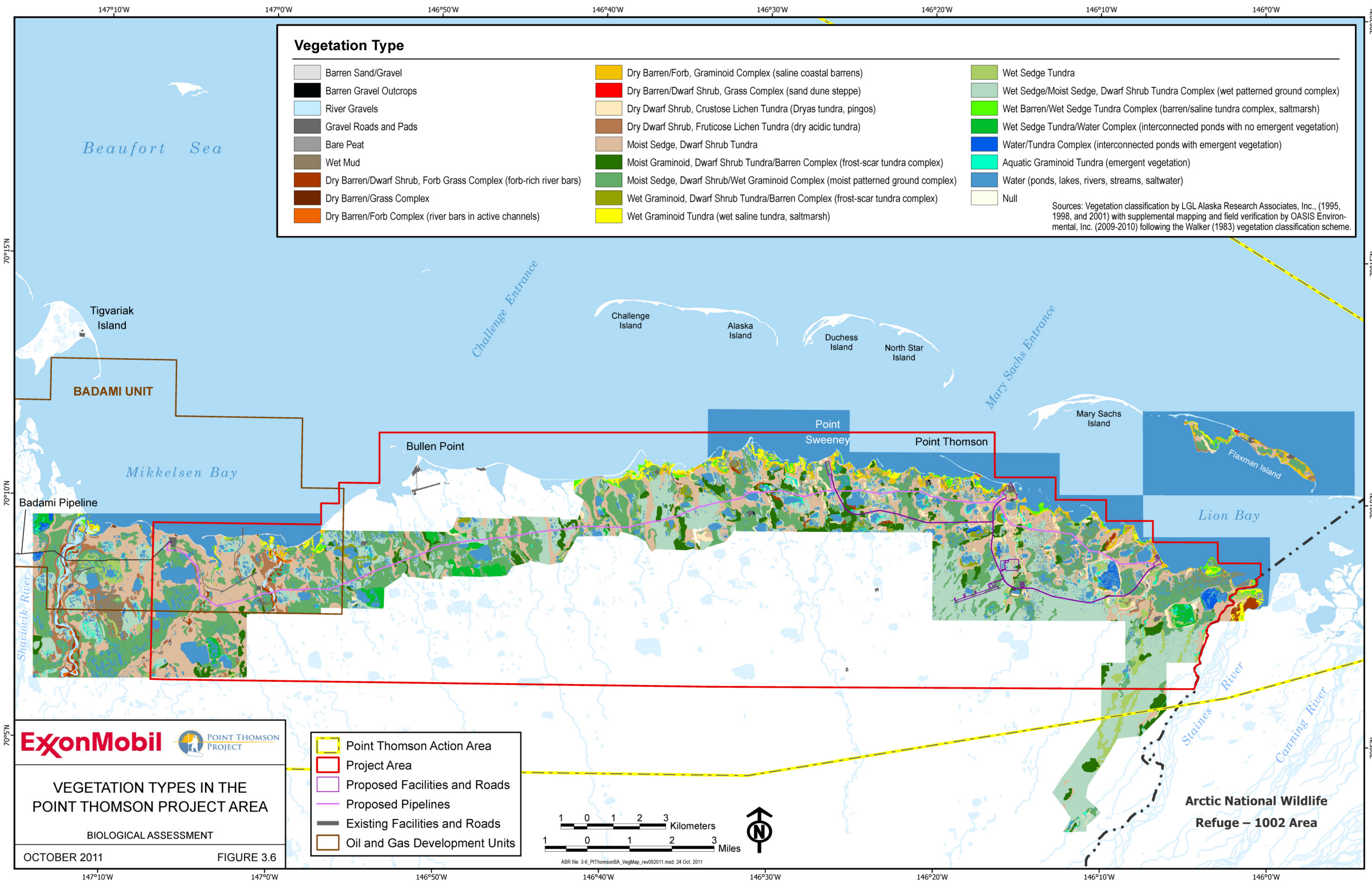
Vegetation Type
Barren Sand/Gravel
Barren Gravel Outcrops
River Gravels
Gravel Roads and Pads
Bare Peat
Wet Mud
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)
Dry Barren/Grass Complex
Dry Barren/Forb Complex (river bars in active channels)
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)
Dry Barren/Dwarf Shrub, Grass Complex (sand dune steppe)
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)
Dry Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra)
Moist Sedge, Dwarf Shrub Tundra
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)
Wet Graminoid Tundra (wet saline tundra, saltmarsh)
Wet Sedge Tundra
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)
Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh)
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation)
Water/Tundra Complex (interconnected ponds with emergent vegetation)
Aquatic Graminoid Tundra (emergent vegetation)
Water (ponds, lakes, rivers, streams, saltwater)
Null
Sources: Vegetation classification by LGL Alaska Research Associates, Inc., (1995, 1998, and 2001) with supplemental mapping and field verification by OASIS Environmental, Inc. (2009-2010) following the Walker (1983) vegetation classification scheme.
Beaufort Sea
Tigvariak Island
BADAMI UNIT
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
Mary Sachs Island
Point Sweeney
Point Thomson
Bullen Point
Mikkelsen Bay
Flaxman Island
Lion Bay
Badami Pipeline
Shaviovik River
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
Kilometers
Miles
ExxonMobil
Point Thomson Project
VEGETATION TYPES IN THE POINT THOMSON PROJECT AREA
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.6
147°10'W
147°0'W
146°50'W
146°40'W
146°30'W
146°20'W
146°10'W
146°0'W
70°20'N
70°15'N
70°10'N
70°5'N

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Table 3.2 Vegetation types mapped within the Point Thomson Project Area, Alaska. Data from ABR 2003 and LGL Alaska 1994–2001 (see Figure 3.6).

Vegetation Type	Area (ha)	% of Mapped Area
Barren Sand/Gravel	25.67	0.1
Barren Gravel Outcrops	1.95	<0.1
River Gravels	174.63	0.4
Gravel Roads and Pads	69.57	0.2
Bare Peat	11.65	<0.1
Wet Mud	265.14	0.6
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)	150.02	0.4
Dry Barren/Grass Complex	2.71	<0.1
Dry Barren/Forb Complex (river bars in active channels)	22.69	0.1
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)	268.67	0.6
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)	1.91	<0.1
Dry Barren/Dwarf Shrub, Grass Complex (sand-dune steppe)	294.24	0.7
Dry Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra)	359.80	0.9
Moist Sedge, Dwarf Shrub Tundra	3,974.29	9.5
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	743.87	1.8
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)	3,916.35	9.3
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	121.42	0.3
Wet Graminoid Tundra (wet saline tundra, saltmarsh)	248.84	0.6
Wet Sedge Tundra	598.69	1.4
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)	3,860.55	9.2
Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh)	119.99	0.3
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation)	278.53	0.7
Water/Tundra Complex (interconnected ponds with emergent vegetation)	83.64	0.2
Aquatic Graminoid Tundra (emergent vegetation)	120.47	0.3
Water (ponds, lakes, rivers, streams, saltwater)	7776.37	18.5
Unknown	2.65	<0.1
Mapped Area	23,494.33	100
Unmapped Area	18,509.37	

unknown, predation, ingestion of lead shot (in heavily hunted areas), and changes in the marine environment may have played roles in range reductions. The Russian populations are not currently listed as threatened or endangered.

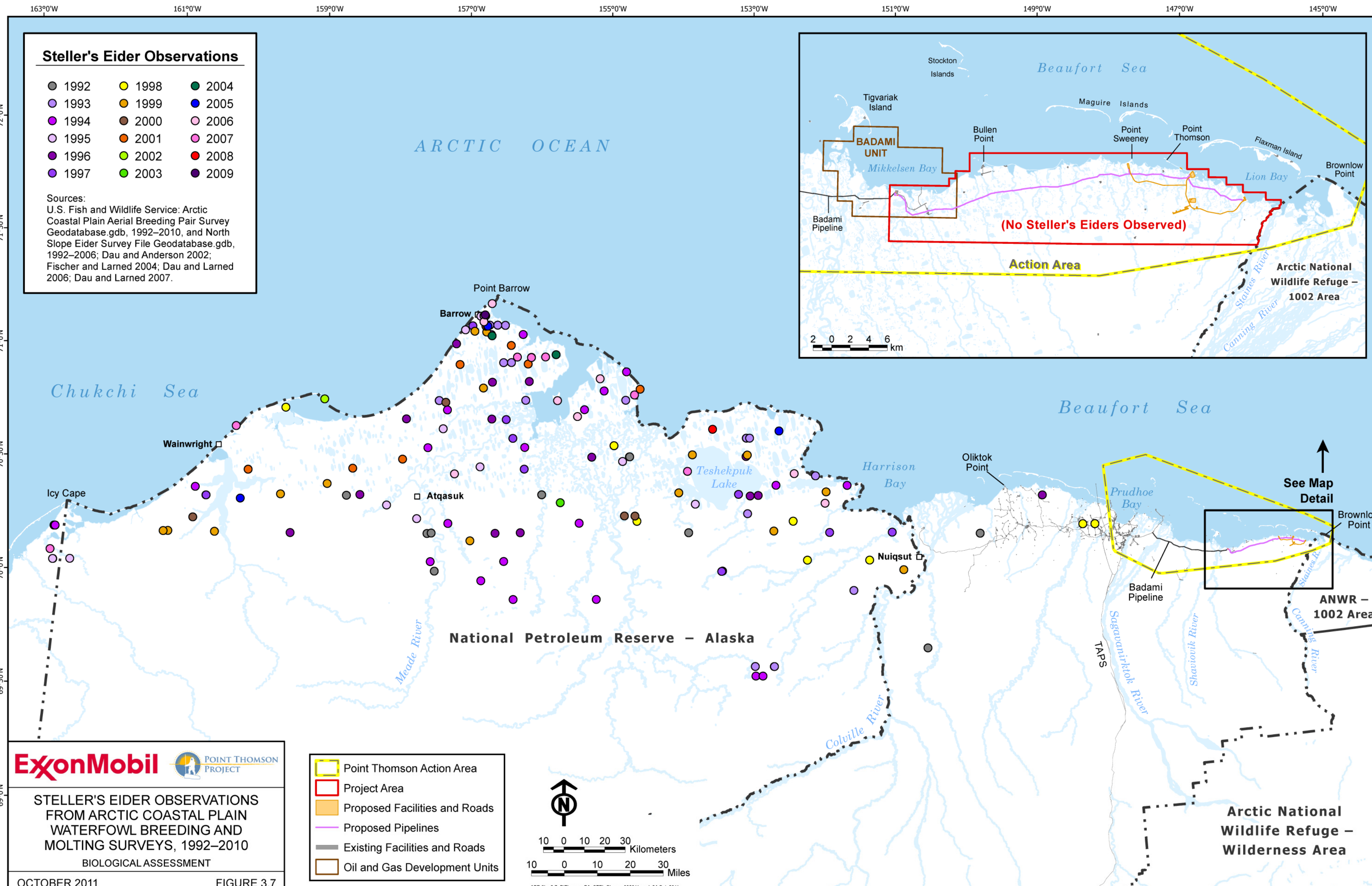
3.3.2 Species Distribution and Life History

Most of the world population of Steller's Eiders breed in arctic Russia and winter either in Europe (Russian-Atlantic population) or along the Alaska Peninsula (Pacific population) (Nygard et al. 1995, Quakenbush et al. 2002, USFWS 2002). A small segment of the world population of Steller's Eiders breeds in Alaska and winters along the Alaska Peninsula and possibly around Kodiak Island or in the Gulf of Alaska region (USFWS 2002). In Alaska, Steller's Eiders historically nested on the YKD and across most or all of the ACP (Kertell 1991, Quakenbush and Cochrane 1993, Quakenbush et al. 2002, USFWS 2002), but currently they nest primarily around Barrow with only a few remnant breeders on the YKD and scattered infrequent sightings across the remainder of the ACP (Figure 3.6, Day et al. 1995, Quakenbush et al. 1995, Flint and Herzog 1999, Quakenbush et al. 2002, USFWS 2002). Evidence of breeding by Steller's Eiders on the ACP east of Barrow has been reported only three times in recent years: single broods were seen inland along the Colville River in 1987 (T. Swem, USFWS, personal communication), near Prudhoe Bay in 1993 (Quakenbush et al. 2002), and near the upper Chipp River, approximately 80 km inland from the Dease Inlet/Admiralty Bay area in 1997 (King and Dau 1997). Other observations of Steller's Eiders east of Barrow are rare, although they have been observed occasionally in Prudhoe Bay (Quakenbush et al. 2002), the Kuparuk Oilfield in 1995, 2000, 2001, and 2007 (Anderson et al. 2008), NPRA in 2001 (Burgess et al. 2002, Noel et al. 2002c), and on the Colville River delta in 1995, 2001, and 2007 (J. Bart, Boise State University, personal communication; Johnson et al. 2011).

Another indication of the nesting distribution on the ACP is the concentration of pre-nesting Steller's Eiders near Barrow on the ACP survey (Figure 3.7). The current breeding range on the ACP probably extends from near Point Lay in the west to the vicinity of the Colville River delta in the east (Day et al. 1995; Quakenbush et al. 1995, 2002). Non-breeding and post-breeding birds use the nearshore zone of the northeastern Chukchi Sea and large lakes around Barrow for molting and summering, and a few occasionally occur as far east as the U.S.–Canada border (Quakenbush et al. 2002). Given that the Point Thomson Project Area is well to the east of the current range for Steller's Eiders, and the species has not been observed on aerial surveys of marine (Noel et al. 1999, 2000, 2002a, b; Petersen et al. 1999b; Flint et al.2001; Fischer et al. 2002; Fischer and Larned 2004) or terrestrial environments (Figure 3.7; USFWS

Geodatabase 1992–2010) in the Project Area, this species probably is an extremely rare visitor to this portion of the Beaufort Sea coast.

Steller's Eiders arrive in the Barrow area in late May–early June and their abundance in the breeding area is annually variable (Obritschkewitsch and Martin 2002a, b; Quakenbush et al. 2004; Rojek and Martin 2003; Rojek 2005, 2006, 2007, 2008). Snow cover appears to affect timing of nesting as females initiate nesting soon after tundra habitats become snow free in early–mid June (Obritschkewitsch and Martin 2002a, Quakenbush et al. 2004). Eggs generally hatch during mid–late July (Obritschkewitsch et al. 2001, USFWS 2002, Quakenbush et al. 2004, Rojek 2008). Steller's Eiders do not breed every year in the Barrow area (Quakenbush et al. 2002, 2004). Whether breeding occurs in any particular year near Barrow may be related to lemming abundance and the breeding activity of lemming predators, such as Pomarine Jaegers (*Stercorarius pomarinus*) and Snowy Owls (*Bubo scandiacus*), which possibly deter other predators away from nesting eiders (Quakenbush and Suydam 1999; Quakenbush et al. 2004; Rojek 2006, 2007, 2008). Steller's Eiders tend to forgo nesting in the Barrow area when lemmings are scarce and Pomarine Jaegers and Snowy Owls fail to breed. Steller's Eiders have nested at Barrow in only 10 of 17 years since 1991 (Rojek 2008). After hatch, female Steller's Eiders move their young to tundra ponds to feed on plants and invertebrates until fledging approximately 40 days later. After breeding, most of the Russian-Pacific population, and probably the Alaska breeding population of Steller's Eiders move to nearshore habitats along the Alaska Peninsula, primarily Izembek and Nelson lagoons, where they undergo a flightless molt for about three weeks (Jones 1965, Petersen 1980). Some eiders remain in these molting areas through the winter, but many move to wintering areas on the south side of the Alaska Peninsula, along the Aleutian chain, around Kodiak Island, and into Cook Inlet (USFWS 2002). Spring migration to the breeding grounds begins in April.


Steller's Eider Observations
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Sources:
U.S. Fish and Wildlife Service: Arctic Coastal Plain Aerial Breeding Pair Survey Geodatabase.gdb, 1992–2010, and North Slope Eider Survey File Geodatabase.gdb, 1992–2006; Dau and Anderson 2002; Fischer and Larned 2004; Dau and Larned 2006; Dau and Larned 2007.
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Wainwright
Icy Cape
Atqasuk
Teshekpuk Lake
Harrison Bay
Oliktok Point
Prudhoe Bay
Nuiqsut
See Map Detail
Brownlow Point
Badami Pipeline
ANWR – 1002 Area
TAPS
Meade River
Colville River
Sagavanirktok River
Shaviovik River
Canning River
National Petroleum Reserve – Alaska
Arctic National Wildlife Refuge – Wilderness Area
Stockton Islands
Tigvariak Island
Maguire Islands
Bullen Point
Point Sweeney
Point Thomson
Flaxman Island
BADAMI UNIT
Mikkelsen Bay
Lion Bay
(No Steller's Eiders Observed)
Action Area
Arctic National Wildlife Refuge – 1002 Area
Staines River
km
ExxonMobil
POINT THOMSON PROJECT
STELLER'S EIDER OBSERVATIONS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING AND MOLTING SURVEYS, 1992–2010
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.7
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
Kilometers
Miles

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3.3.3 Population Status

The population size of Steller's Eiders breeding on the ACP is difficult to approximate because of low numbers that are highly variable over a vast area. A 20-year mean population index from breeding pair surveys of the ACP in 1987–2006 is 780 Steller's Eiders (Mallek et al. 2007). Another set of ACP surveys conducted earlier in June primarily for Spectacled Eiders produced a mean population index of 161 Steller's Eiders from 18 years of surveys (Larned et al. 2010). Both estimates are probably biased low because neither incorporates correction factors for birds not detected during surveys. The recovery plan for Steller's Eiders estimated the breeding population on the ACP at "…hundreds or low thousands…" (USFWS 2002). Despite annual pre-breeding surveys of the ACP and more intensive sampling in the Barrow area (Ritchie and King 2001, 2004; Obritschkewitsch and Ritchie 2010), no meaningful trend can be estimated for Alaskan breeders because so few are seen (Larned et al. 2010). Steller's Eiders exhibited a 2.3% decline on spring staging surveys of migrating Steller's Eiders in southwest Alaska during 1992–2009, but have been essentially stable (0.7% decline) since 2002 (Larned and Bollinger 2009). These trends may not be particularly informative for Alaskan breeding birds, because the wintering areas in southwest Alaska contain unknown proportions of birds from both Russia and Alaska.

3.3.4 Critical Habitat

Critical habitat was designated for Steller's Eiders only in western Alaska near the YKD, Kuskokwim Shoals, Nelson Lagoon, Seal Islands, and Izembek Lagoon (66 FR 8850–8884). No critical habitat was designated on the ACP or in the Point Thomson Project Action Area. The primary constituent elements of critical habitat for Steller's Eiders identified in the original proposal were "…small ponds and shallow water habitats (particularly those with emergent vegetation); moist tundra within 100 m (326 ft) of permanent surface waters, including lakes, ponds, and pools; the associated aquatic invertebrate fauna; and adjacent nesting habitats" (65 FR 13262–13284). Although some of the constituent elements of Steller's Eider critical habitat occur in the Point Thomson Action Area (Figure 3.6), the available habitat has not been occupied in recent years and does not currently support breeding or non-breeding Steller's Eiders.

3.3.5 Habitat Use

Steller's Eiders spend most of the year in shallow coastal habitats, especially in the littoral zone and coastal lagoons where they feed on mollusks and other benthic invertebrates (Fredrickson 2001). They spend a short period in terrestrial habitats to nest and raise young.

The preferred habitats of Steller's Eiders near Barrow are waterbodies with pendant grass (*Arctophila fulva*) (Quakenbush et al. 2000, Obritschkewitsch et al. 2001). This habitat occupies less than 1% of the mapped portion of the Point Thomson Project Area (Figure 3.6, Table 3.2).

After breeding is completed, Steller's Eiders move to marine waters, where they molt and are completely flightless for three weeks (USFWS 2008a). Molting and wintering flocks of Steller's Eiders gather in protected lagoons and bays, feeding on mollusks and crustaceans in shallow water.

3.4 Yellow-Billed Loon

3.4.1 Species Status

The USFWS manages the Yellow-billed Loon primarily under the Migratory Bird Treaty Act and is considering management under the ESA. The Yellow-billed Loon was petitioned for listing as threatened or endangered under the ESA on 5 April 2004. A 90-day finding was issued in 2007 that initiated a status review (72 FR 31256). In 2006, the USFWS and other federal, state, and borough partners developed a conservation agreement to protect Yellow-billed Loon habitat and foster collaboration on monitoring, conducting research, and developing management guidelines. The strategies and objectives proposed in the conservation agreement may be incorporated into agency actions, such as management plans and mitigation requirements (USFWS 2006a). On 24 March 2009, the USFWS determined that listing the Yellow-billed Loon as a threatened or endangered species was warranted, but listing was precluded by other higher-priority listing actions (74 FR 12932–12968). Currently, the Yellow-billed Loon is classified as a candidate species under the ESA, which does not provide any statutory protection, but the UFSWS does encourage cooperation among state and federal agencies and industry to limit detrimental effects of activities on this species. The principal threats to Yellow-billed Loon population are factors reducing adult survival, although loss of recruitment is also of concern (USFWS 2006a). A status assessment for the species concluded the Yellow-billed Loon was vulnerable because of a combination of a low population size, low reproductive rate, and specific breeding habitat requirements (Earnst 2004). Direct mortality due to subsistence harvest and fisheries by-catch may be limiting the population and may cause it to decline (Schmutz 2009).

3.4.2 Species Distribution and Life History

The Yellow-billed Loon breeds on tundra lakes of North America and Eurasia, and winters along the north Pacific coast from Kamchatka to the Yellow Sea, from Kodiak to British Columbia, and on the Norwegian coast (North 1994, Earnst 2004). In Alaska, breeding occurs from Saint Lawrence Island and the Seward Peninsula north and east to the Canning River. The range is less studied in Canada, where breeding may occur from the Mackenzie River to Hudson Bay. Yellow-billed Loons are uncommon breeders on most of the ACP, but breeding is concentrated on large lakes near rivers and streams on the central ACP between the Meade and Colville rivers (Sjolander and Agren 1976, Johnson and Herter 1989, Earnst 2004, Earnst et al. 2005).

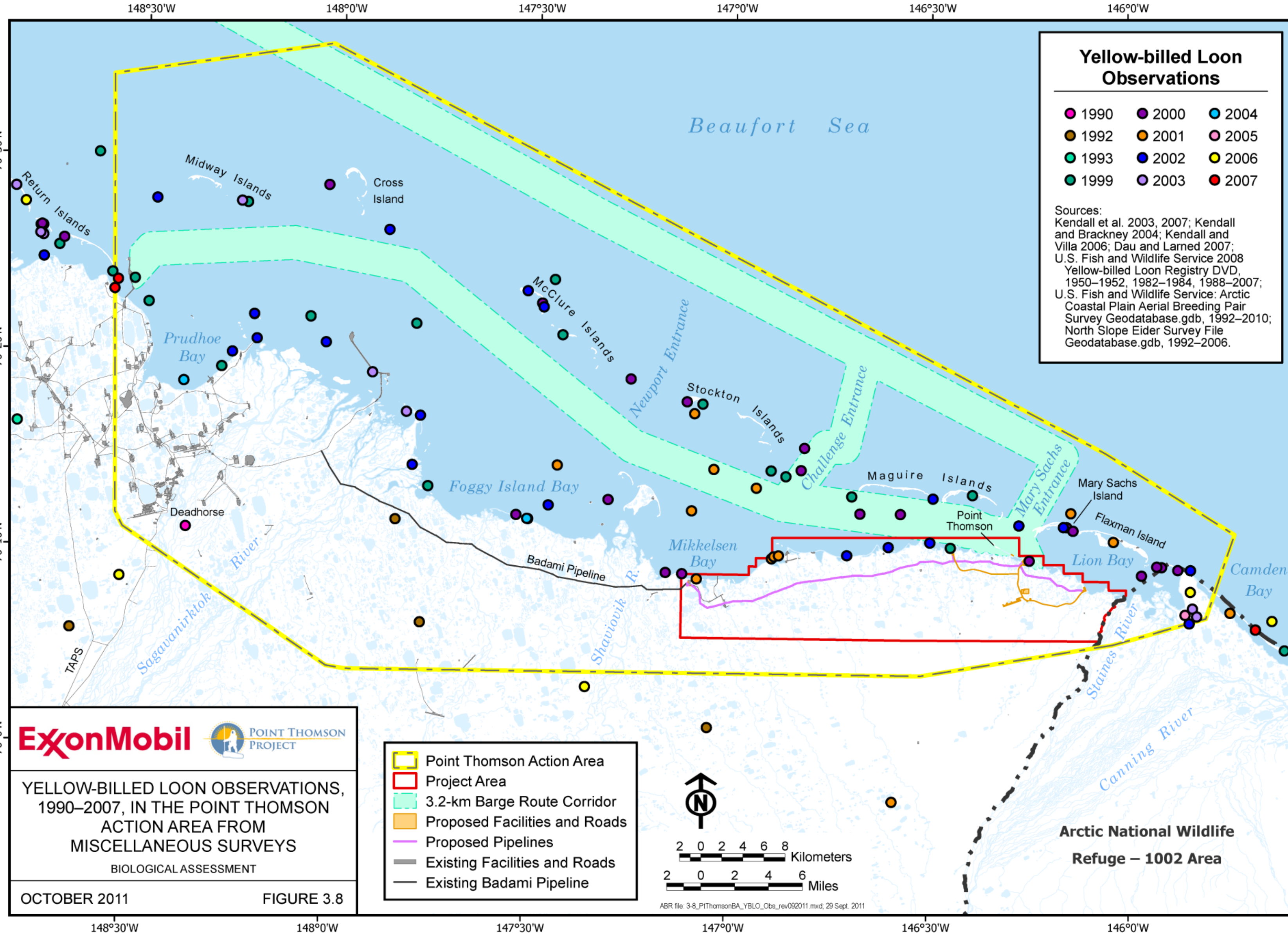
Yellow-billed Loons arrive on the breeding grounds on the ACP after the first spring meltwater accumulates on the river channels, usually during the last week of May (Rothe et al. 1983, Earnst 2004) and use openings in rivers, tapped lakes, and sea ice before nesting lakes are available in early June (North and Ryan 1988, Earnst 2004). Nest initiation begins during the first to last week of June, hatching occurs in early July to early August (Rothe et al. 1983, North 1986, Earnst 2004, Johnson et al. 2010a). Yellow-billed Loons typically lay clutches of two eggs and after hatch raise broods on the lakes where they nest or on adjacent lakes (North 1986, 1994; Johnson et al. 2010a).

3.4.3 Population Status

The most current population estimate of Yellow-billed Loons in northern Alaska is 3,369 birds and <1,000 nesting pairs, with most pairs occurring between the Meade and Colville rivers (Earnst 2004). Another 780 Yellow-billed Loons are thought to reside in western Alaska (Earnst 2004). The population trend from 18 years of surveys on the ACP is a positive annual growth rate of 2% (0.5–3.7%, 90% CI; Larned et al. 2010). The Point Thomson Project is about 145 km (90 mi) east of Alaska's easternmost concentration area for Yellow-billed Loons on the Colville River delta, and the Project is in a portion of the ACP where Yellow-billed Loons are scarce (Earnst 2004). No nests of Yellow-billed Loons have been documented in the Point Thomson Project Area, but several loons were seen in the early 1980s during fall staging (one bird) and migration (7 birds) by WCC and ABR (1983). Wright and Fancy (1980) also recorded Yellow-billed Loons at their two study plots near Point Gordon and Point Sweeny in 1980. More recently, Rodrigues (2002a, 2002b) recorded Yellow-billed Loons in the Point Thomson Project Area during ground-based breeding-bird studies, but no loons were seen on plots or found to be nesting. Similarly, Yellow-billed Loons were observed incidentally from field camps involved in ground-based nest searching on the Canning River delta to the east of Point Thomson (Figure 3.8), but no evidence of breeding was recorded (Martin and Moitoret 1981, Kendall et al. 2003, Kendall and Brackney 2004, Kendal and Villa 2006, Kendall at al. 2007).

In addition to the annual waterfowl surveys conducted across the ACP (Mallek et al. 2007, Larned et al. 2010), a large number of aerial surveys conducted from fixed-wing aircraft have provided extensive and intensive coverage of the marine environment using different sampling schemes in the Point Thomson vicinity. Marine surveys for Common Eiders and waterbirds during late June 1999–2009 (Dau and Taylor 2000a, 2000b; Dau and Anderson 2001, 2002; Dau and Larned 2004, 2006, 2007, 2008; Dau and Bollinger 2009) and molting waterfowl during 1999–2003 (Lynse et al. 2004) covered 100% of the nearshore water up to 1.6 km (1 mi) offshore of mainland and barrier islands from Point Barrow to Demarcation Bay. Separate waterbird surveys were conducted in June–August 1998, which sampled about 7% of the coastal zone to 60 km (37 mi) offshore from Cape Halkett to Stockton Island just east of Bullen Point (Petersen et al. 1999b). Later surveys expanded the survey extent east ward to Bullen Point in 1999, from Cape Halkett to Brownlow Point in 2000, and in 2001 sampled 30–60 km (19 –37 mi) offshore from Point Barrow to Demarcation Bay, near the border between Alaska and Canada (<4% coverage) (Fischer and Larned 2004). Noel et al. (1999, 2000, 2002a, b) conducted replicate surveys for molting waterfowl along four contiguous strip transects between Oliktok Point and Brownlow Point during July–September 1998–2001.

Despite the level of survey effort in the Beaufort Sea, low numbers of Yellow-billed Loons have been recorded annually between Oliktok and Brownlow points in late summer (Petersen et al. 1999b; Flint et al. 2001; Noel et al. 1999, 2000, 2002a, b; Fischer et al. 2002; Fischer and Larned 2004; Lynse et al. 2004). Where reported, Yellow-billed Loon densities were low (≤0.02 birds/km² [≤0.04 birds/mi²]; Noel et al. 1999, 2000, 2002a, b). Densities of Yellow-billed Loons were significantly higher in July than in June or August (Fischer and Larned 2004). Most Yellow-billed Loons in the Point Thomson area have been recorded in shallow nearshore waters (<10 m [33 ft]) between the barrier islands and the mainland with observations diminishing eastward towards Brownlow Point (Petersen et al. 1999b; Noel et al. 2002a, b; Fischer et al. 2002; Fischer and Larned 2004; Lynse et al. 2004), but three sightings of loons have been recorded onshore, south of the Project Area (Figure 3.8) during surveys for Tundra Swans (Stickney et al. 1993) and annual ACP breeding pair and eider surveys (Mallek et al 2002, Larned et al.2006). No Yellow-billed Loons were observed on three replicate lake-circling surveys conducted specifically for this species in the Point Thomson Project Area during late June to mid July 2010 (Johnson et al. 2010b). Yellow-billed Loons generally are not expected to nest on wetlands of the Point Thomson Project Area, because the easternmost breeding concentration in Alaska is on the Colville River delta, 145 km (90 mi) to the west (North 1994, Earnst 2004). The scarcity of Yellow-billed Loons in the terrestrial area of the Point Thomson Project Area is highlighted by the density-contour map from breeding waterfowl surveys of the ACP (Figures 3.9 and 3.10, adapted from Figure 5 in Larned et al. 2006 and USFWS Geodatabase


Yellow-billed Loon Observations
1990
1992
1993
1999
2000
2001
2002
2003
2004
2005
2006
2007
Sources:
Kendall et al. 2003, 2007; Kendall and Brackney 2004; Kendall and Villa 2006; Dau and Larned 2007;
U.S. Fish and Wildlife Service 2008 Yellow-billed Loon Registry DVD, 1950–1952, 1982–1984, 1988–2007;
U.S. Fish and Wildlife Service: Arctic Coastal Plain Aerial Breeding Pair Survey Geodatabase.gdb, 1992–2010;
North Slope Eider Survey File Geodatabase.gdb, 1992–2006.
Beaufort Sea
Midway Islands
Cross Island
Return Islands
McClure Islands
Newport Entrance
Stockton Islands
Challenge Entrance
Maguire Islands
Mary Sachs Entrance
Mary Sachs Island
Flaxman Island
Point Thomson
Prudhoe Bay
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Camden Bay
Deadhorse
Badami Pipeline
Sagavanirktok River
Shaviovik R.
Staines River
Canning River
TAPS
Arctic National Wildlife Refuge – 1002 Area
148°30'W
148°0'W
147°30'W
147°0'W
146°30'W
146°0'W
70°30'N
70°20'N
70°10'N
70°0'N
ExxonMobil
Point Thomson Project
YELLOW-BILLED LOON OBSERVATIONS, 1990–2007, IN THE POINT THOMSON ACTION AREA FROM MISCELLANEOUS SURVEYS
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.8
Point Thomson Action Area
Project Area
3.2-km Barge Route Corridor
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Existing Badami Pipeline
N
2 0 2 4 6 8 Kilometers
2 0 2 4 6 Miles
ABR file: 3-8_PtThomsonBA_YBLO_Obs_rev092011.mxd; 29 Sept. 2011

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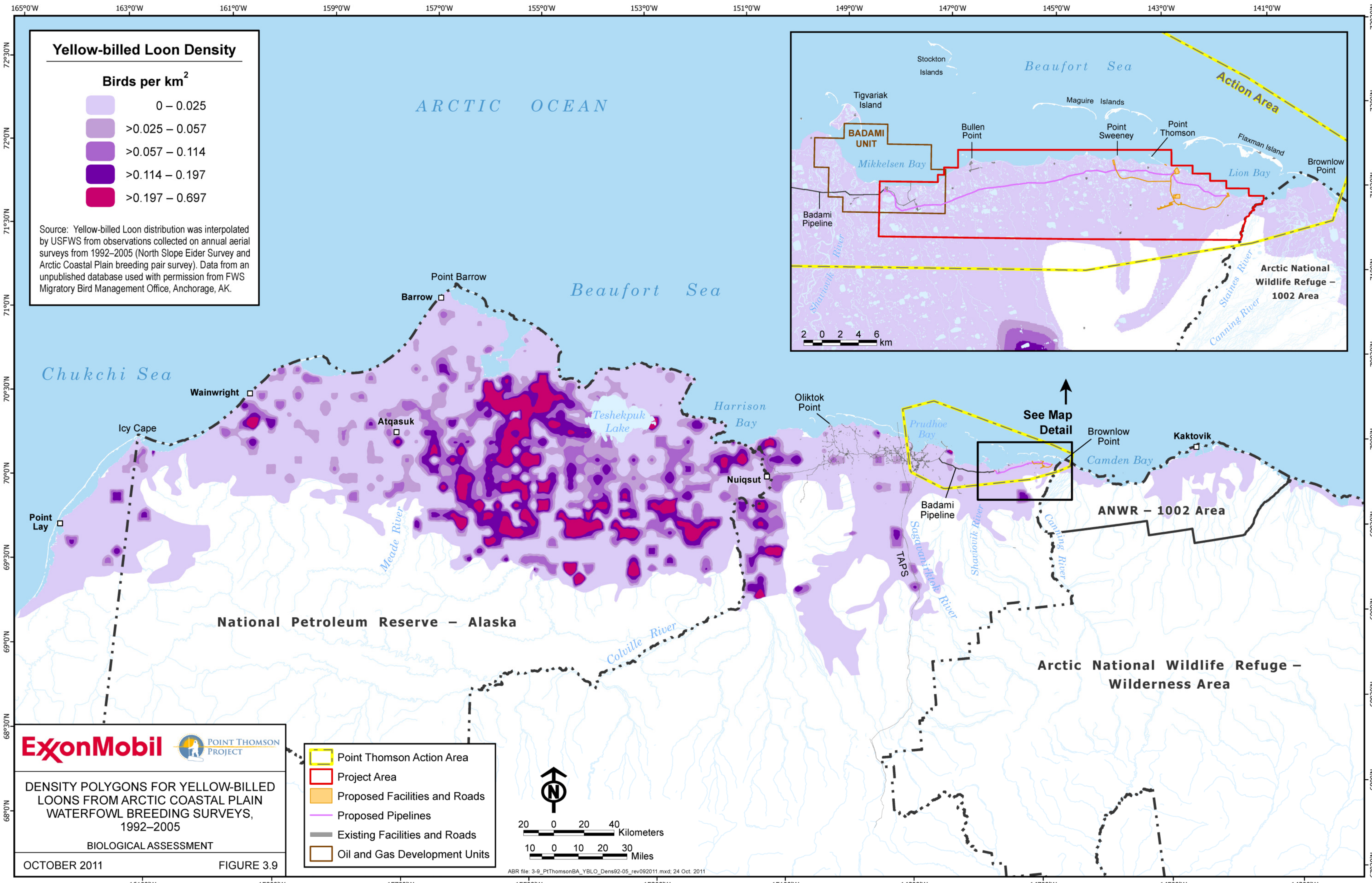
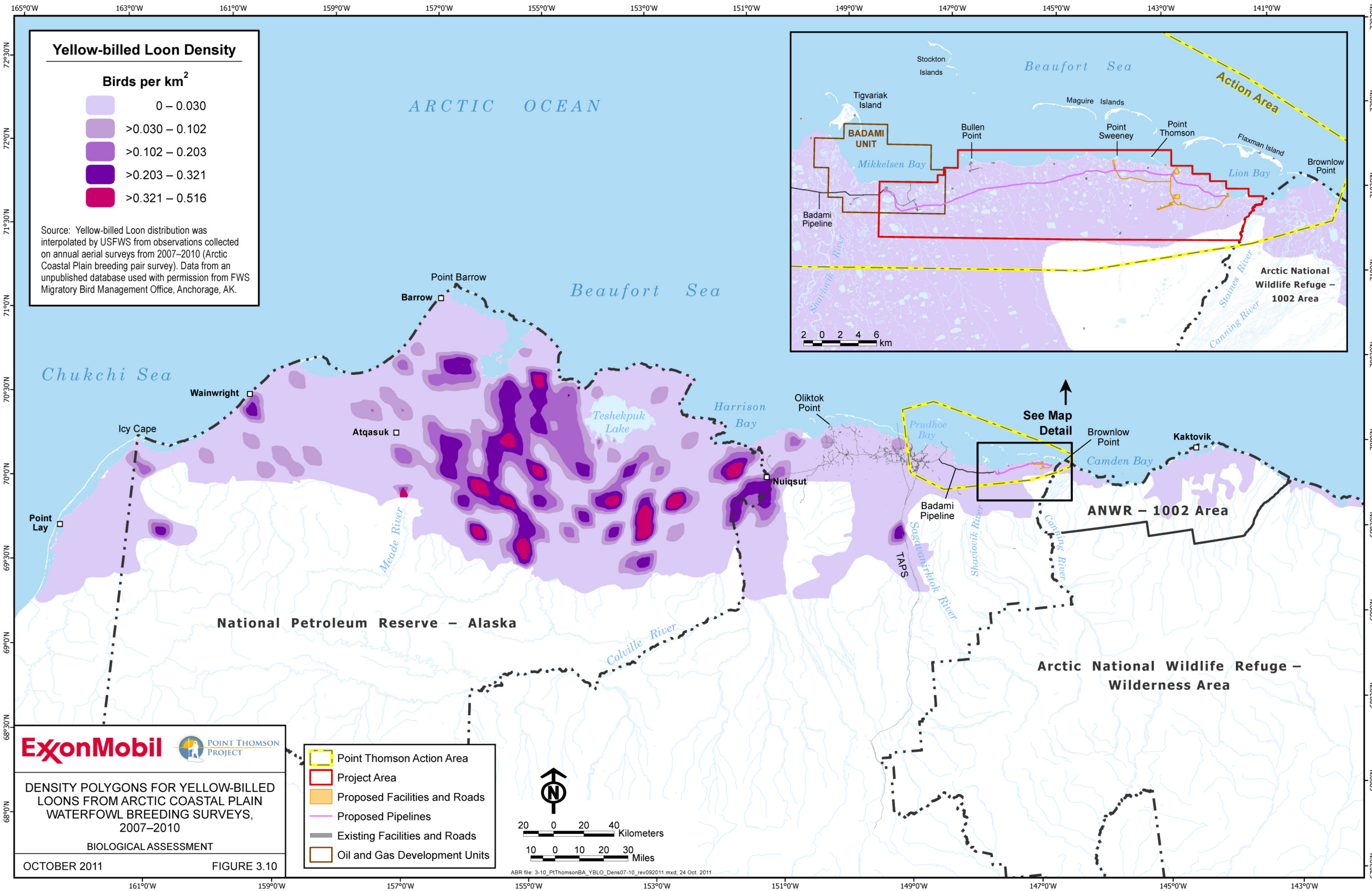

Yellow-billed Loon Density
Birds per km²
0 – 0.025
>0.025 – 0.057
>0.057 – 0.114
>0.114 – 0.197
>0.197 – 0.697
Source: Yellow-billed Loon distribution was interpolated by USFWS from observations collected on annual aerial surveys from 1992–2005 (North Slope Eider Survey and Arctic Coastal Plain breeding pair survey). Data from an unpublished database used with permission from FWS Migratory Bird Management Office, Anchorage, AK.
ARCTIC OCEAN
Beaufort Sea
Chukchi Sea
Point Barrow
Barrow
Wainwright
Icy Cape
Point Lay
Atqasuk
Teshekpuk Lake
Harrison Bay
Oliktok Point
Nuiqsut
Prudhoe Bay
Badami Pipeline
See Map Detail
Brownlow Point
Camden Bay
Kaktovik
ANWR – 1002 Area
National Petroleum Reserve – Alaska
Arctic National Wildlife Refuge – Wilderness Area
Colville River
Meade River
TAPS
Sagavanirktok River
Shaviovik River
Canning River
Stockton Islands
Tigvariak Island
BADAMI UNIT
Bullen Point
Maguire Islands
Point Sweeney
Point Thomson
Flaxman Island
Action Area
Mikkelsen Bay
Lion Bay
Badami Pipeline
Arctic National Wildlife Refuge – 1002 Area
Staines River
km
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
Kilometers
Miles
ExxonMobil
POINT THOMSON PROJECT
DENSITY POLYGONS FOR YELLOW-BILLED LOONS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING SURVEYS, 1992–2005
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.9


Yellow-billed Loon Density
Birds per km²
0 – 0.030
>0.030 – 0.102
>0.102 – 0.203
>0.203 – 0.321
>0.321 – 0.516
Source: Yellow-billed Loon distribution was interpolated by USFWS from observations collected on annual aerial surveys from 2007–2010 (Arctic Coastal Plain breeding pair survey). Data from an unpublished database used with permission from FWS Migratory Bird Management Office, Anchorage, AK.
ARCTIC OCEAN
Beaufort Sea
Chukchi Sea
Point Barrow
Barrow
Wainwright
Icy Cape
Atqasuk
Point Lay
Teshekpuk Lake
Harrison Bay
Oliktok Point
Nuiqsut
Prudhoe Bay
Badami Pipeline
TAPS
See Map Detail
Brownlow Point
Camden Bay
Kaktovik
ANWR – 1002 Area
Meade River
Colville River
Sagavanirktok River
Shaviovik River
Canning River
National Petroleum Reserve – Alaska
Arctic National Wildlife Refuge – Wilderness Area
Stockton Islands
Tigvariak Island
BADAMI UNIT
Mikkelsen Bay
Bullen Point
Maguire Islands
Point Sweeney
Point Thomson
Flaxman Island
Lion Bay
Action Area
Badami Pipeline
Staines River
Arctic National Wildlife Refuge – 1002 Area
2 0 2 4 6 km
ExxonMobil
POINT THOMSON PROJECT
DENSITY POLYGONS FOR YELLOW-BILLED LOONS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING SURVEYS, 2007–2010
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.10
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
20 0 20 40 Kilometers
10 0 10 20 30 Miles

1992–2010); the Point Thomson Project Area falls within the lowest density zones (0–0.030 birds/km² [0–0.078 birds/mi²]).

3.4.4 Critical Habitat

Critical habitat has not been proposed or designated for Yellow-billed Loons, because the species is proposed but not listed under the ESA. As a candidate species, it receives no protections under the ESA.

3.4.5 Habitat Use

Yellow-billed Loons arrive on the breeding lakes as moats of meltwater form around the edges of large, ice-covered lakes (North and Ryan 1988, Earnst 2004). Before breeding lakes are open, they use rivers and their channels, tapped lakes (lakes connected to rivers or channels), and openings in sea ice (Rothe et al. 1983, Earnst 2004). Nests are built on peninsulas, shorelines, islands, or in emergent vegetation, usually in or adjacent to large deep lakes (North and Ryan 1989). Broods usually are raised in the nesting lake, but occasionally young hatched on small or shallow lakes are moved to adjacent larger deep lakes (North 1986, Earnst 2004, Johnson et al. 2010a). On the Colville River delta, Yellow-billed Loons preferred deep open water with islands or polygonized margins, sedge marsh, and patterned wet meadow for nesting (Johnson et al. 2010a). During brood-rearing, they preferred two kinds of deep open water and tapped lakes with high-water connections. Similar preferences were observed in northeastern NPRA, affirming the importance of deep waterbodies to breeding Yellow-billed Loons (Earnst et al. 2006, Johnson et al. 2010a). In a landscape-scale study of habitat use during the breeding season, Yellow-billed Loons were more likely to occupy lakes that were large and deep, bordered by aquatic vegetation, had complex shorelines, and were connected to streams (Earnst et al. 2006). Waterbodies bordering nest sites are probably more important than the terrestrial habitats on which the nests actually are built (Johnson et al. 2003b), and the presence of fish in lakes within breeding territories appears to be critical to providing food to raise young (Earnst et al. 2006). Yellow-billed Loons forage and feed their young from lakes within their territories, and use lakes for escape habitat (North 1994, Johnson et al. 2003b, Earnst 2004). Although lakes and other waterbodies are present in the Point Thomson Project Area, the available vegetation mapping does not provide information that can be used to evaluate their potential as breeding habitat for Yellow-billed Loons (Figure 3.6). Visual inspection of available imagery and maps and assessment of aquatic habitat during loon surveys suggests that the type of lakes preferred by breeding Yellow-billed Loons—large, deep lakes and lakes connected to streams—are not common in the Point Thomson Project Area (A. Wildman, ABR, personal observation). The available habitat in the Point Thomson Project Area appears to be missing some of the elements of Yellow-billed Loon habitat used for breeding in other locations, and the Point Thomson Project is 145 km east of the easternmost concentration of breeding Yellow-billed Loons (on the Colville River delta); both factors explain the low density of Yellow-billed Loons and the absence of breeding in the Point Thomson Project Area.

4.0 ENVIRONMENTAL BASELINE

4.1 Polar Bear

4.1.1 Status in the Action Area

4.1.1.1 Habitat Use

The nature and dynamics of the seasonal ice cover play an important role in the ecology of arctic marine mammals (Burns 1970, Fay 1974, Burns et al. 1981). Different features of the dynamic ice cover either accommodate or exclude marine mammals, depending on the species and ice conditions. From the onset of marine freeze-up (October in Lion Bay) to the onset of melting (late May–June) and retreat from the coast (July–August), a sequence of different snow and ice conditions affects the local abundance of various marine mammals. Five general habitat types for marine mammals occur near Point Thomson: (1) the nearshore zone of the Beaufort Sea proper (north of the barrier islands); (2) a linear series of protective barrier islands; (3) an extensive shallow coastal lagoon inside the barrier islands; (4) two relatively wide and three narrow entrances to the lagoon; and (5) the mainland coast. Although polar bears may be encountered year-round in nearshore and coastal areas (Amstrup 1995, 2000, 2002; Schliebe and Evans 2002), they usually are absent from the Point Thomson area in spring and early summer. They use all five generalized habitats at some time during the year; however, use depends on the season and the presence or absence of sea ice, prey species, and beach-cast carrion.

Pregnant and subsequently post-parturient females can be present in dens, although not obvious, from late November through early April, most commonly on or close to the barrier islands (Amstrup 2002). Non-denning bears can be expected to roam through the area during those same months, although their preferred hunting habitat in winter and spring is farther offshore in areas of more active ice. Although polar bears can occur in the Action Area at any time of year, there are periods when the probability of their presence is low. The lowest probability of presence in the Action Area is spring and early summer (May to July), although that probability may increase in the future as more bears spend time on land in response to shrinking summer sea-ice cover (Schliebe et al. 2008).

The greatest proportion of a polar bear's total annual caloric intake occurs during spring and early summer when newly weaned ringed seal pups, on which they prey extensively, are very fat (Stirling 2002). Ringed seal abundance inside the barrier islands in the Point Thomson area is low, particularly after the sea ice melts in summer, so hunting conditions for ringed seals are poor there. Aerial surveys of ringed seals in the Alaska Beaufort Sea in late May and early June found the lowest densities of ringed seals in water depths of <5 m and >35 m (<16.4 ft and >115 ft); the greatest densities occurred along the edge of landfast ice in water 10–25 m (33–82 ft) deep (Moulton et al. 2002, Frost et al. 2004). The highest densities of ringed seals consistently occurred east of the Action Area, between Brownlow Point and Kaktovik (Frost et al. 2004).

Records of polar bear encounters at Point Thomson have been maintained during the recent drilling program under the terms of LOAs issued by USFWS and conditional-use permits from the North Slope Borough, and in keeping with the polar bear interaction plan required under the ITRs (Appendix A). Between 30 January 2009 and 28 October 2010, 53 sightings of 96 polar bears were recorded, comprising 23 females with 39 cubs plus 34 adults or subadults (no cubs) (Appendix B). After eliminating probable duplications from repeated observations of the same individuals, the total number of bears was more likely on the order of 65 animals (14 females with 26 cubs, plus 25 other bears) during the 21-month period. Sightings were recorded in the months of March (1 record), April (4), June (1), July (6), August (11), September (17), October (12), and November (1) (Appendix B); no sightings were recorded in the months of January, February, May, and December. Forty-two of the sighting records occurred at the Central Pad location at Point Thomson and three records involved two maternal dens that were discovered 100 m south of the sea ice road at Mile 14.7 (measured from the west end) on 27 March 2009 and 65 m north of the sea ice road at Mile 36.1 on 18 April 2010. The remaining records involved bears seen well away from the project facilities during barging operations, at locations such as West Dock in Prudhoe Bay, Cross Island, Stump Island, and Tigvariak Island.

The seasonal distribution of these sightings is broadly similar to that summarized from the LOA annual reports for 2007–2009 that were submitted to USFWS by oil and gas companies conducting marine, terrestrial, and on-ice activities on the North Slope. In 2007, seven companies reported 177 sightings, totaling 321 bears; in 2008, 10 companies reported 186 sightings, totaling 313 bears; and in 2009, 10 companies reported 245 sightings, totaling 420 bears (DeBruyn et al. 2010, 76 FR 47037). In all three years, the number of sightings peaked in August: 90 sightings (148 bears) in 2007, 87 sightings (162 bears) in 2008, and 77 sightings (number not available) in 2009 (DeBruyn et al. 2010, 76 FR 47037); September had the next highest number of sightings (Obbard et al. 2010). The early seasonal peaks in 2007 and 2008 may reflect the fact that the area of arctic sea ice reached record or near-record lows in those years. Taken together, these sightings indicate that the greatest potential for interactions between polar bears and the Point Thomson Project is likely to occur during the open-water season in late summer and fall (August–October), when the multi-year pack ice is farthest from shore and new seasonal ice begins to form.

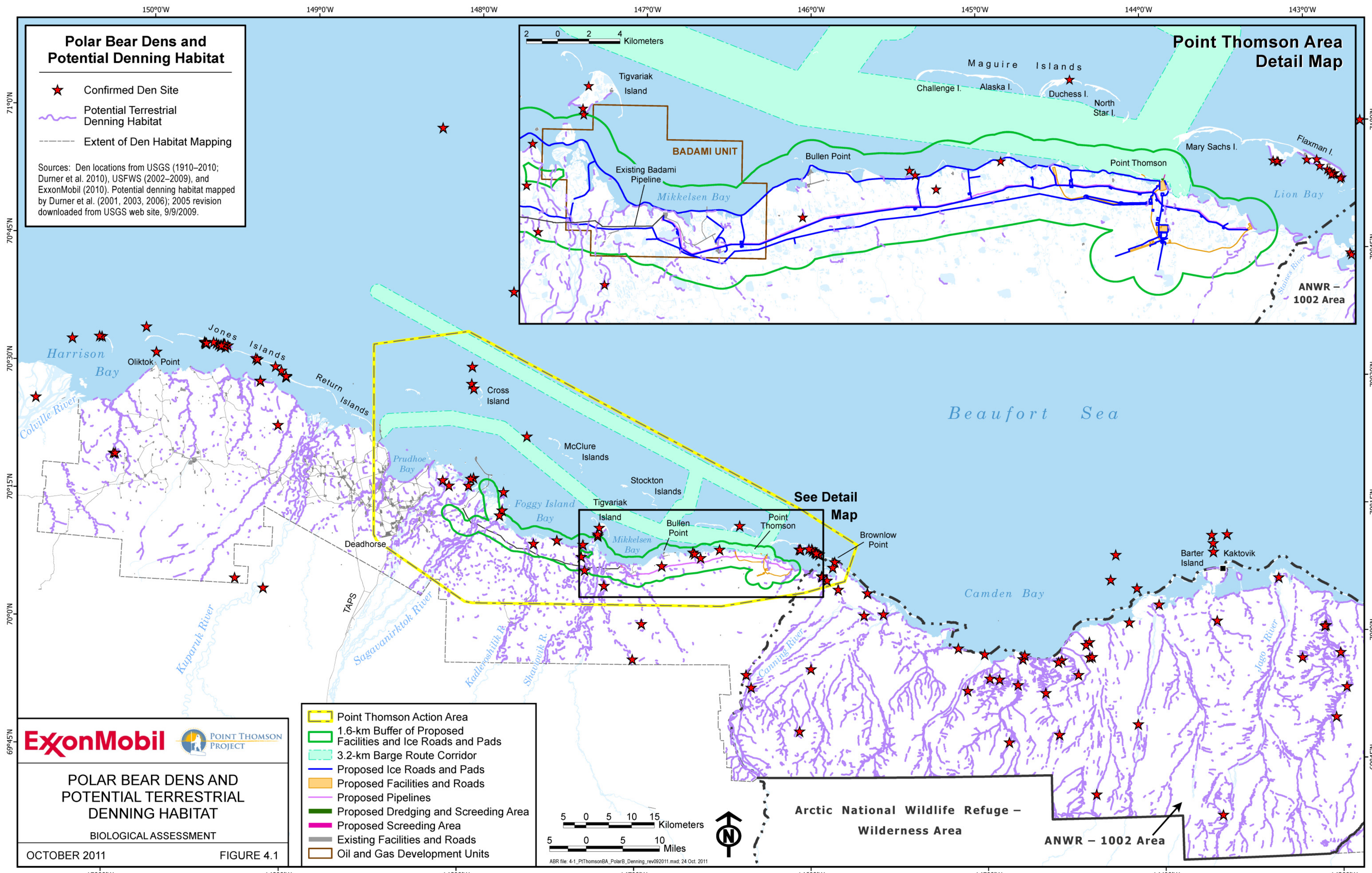
4.1.1.2 Maternal Denning

The Point Thomson Project is located in a section of coastline that has the least amount of potential denning habitat in the entire area mapped thus far by USGS in the central and eastern portions of the ACP (Durner et al. 2001, 2006) (Figure 4.1). The sample of known dens in the Action Area comprises 45 confirmed maternal dens, all of which were located on land (including barrier islands) or landfast ice (Figure 4.1). The dens in the sample were found using a variety of methods. The largest numbers were found by radio-tracking bears collared with very high frequency (VHF) radio-collars or satellite transmitters during 1989–2010 and by opportunistic encounters or searches from as early as 1913 to as recently as 2010 (Durner et al. 2010); several additional sites not yet included in the USGS master database were provided by C. Perham (USFWS, personal communication) and R. Cox (ExxonMobil, personal communication). Despite the various methods used to locate the dens, some consistent patterns of use are evident. Several areas of local concentration stand out, primarily along the barrier islands and around major river deltas, such as those of the Sagavanirktok, Shaviovik (including Tigvariak Island), and Canning rivers. Within the Action Area, Flaxman Island received the most concentrated use (13 dens). Three dens were near Cross Island, single dens were located near Dinkum Sands and Duchess Island, five were in the Brownlow Point and Canning River delta vicinity, and five were near the coast north of the proposed export sales pipeline between Bullen Point and Point Hopson. The remaining dens were located along the coast from the Shaviovik River and Tigvariak Island west to the Sagavanirktok River delta. Although the number of polar bears denning in the immediate vicinity of the proposed Point Thomson Project facilities in a specific year cannot be estimated with confidence, it is likely to be low, judging from the existing data on den locations. The largest number of dens found in the Action Area in a single winter was six in the 2008–2009 denning period, but of course that number does not accurately represent the total number denning in the area annually because it represents a small sample of the females in the population. The total number of dens occupied annually by females of the SBS stock has been estimated at 140 to 240 (Amstrup and Gardner 1994; 75 FR 76099). The occurrence of dens in the Project Area may increase in future years as a result of continuing shifts in denning from drifting sea ice to land by the SBS stock (Fischbach et al. 2007), but the amount of suitable denning habitat in the Project Area will remain small because of the limited extent of favorable topography in the area. For the sea ice or tundra ice road routes, respectively, the potential maternal denning habitat mapped by USGS (Figure 4.1) covers a total length of 66.7 and 106.9 km (41.4 and 66.4 mi) and an estimated total area of 0.43 and 0.69 km² (0.17 and 0.27 mi², 0.18–0.22% of the land area) within the 1.6-km (1-mi) buffer zones surrounding all (gravel and ice) proposed infrastructure, compared with 566.9 km (352 mi) and 3.66 km² (1.41 mi², 0.26%) in the Action Area (Table 3.1).

4.1.2 Factors Affecting the Species Environment

Global warming and the rapid decline of arctic sea-ice cover, especially during the summer, is perhaps the most prominent concern regarding the effects of human actions on polar bears (ACIA 2004, 2005; IPCC 2007). The effects of declining sea-ice cover have been discussed extensively in the scientific literature and were a major focus of the status review (Schliebe et al. 2006) and the nine reports prepared by USGS that provided the supporting background for the USFWS decision to list the species as threatened under the ESA. The analytical review conducted for the ESA listing (Schliebe et al. 2006, 73 FR 28212) described the observed effects on polar bears from declining sea ice: increased movements, changes in distribution and access to prey, alteration of denning areas and access to them, increased open-water swimming, and associated demographic changes in the bear population, as well as reductions in the availability, productivity, and access to prey populations (primarily ringed and bearded seals).

USGS researchers and other polar bear experts produced seasonal habitat models of sea ice cover. These models were based on resource selection functions developed from radio-collared bear locations and environmental data, and they were then compared with the predicted distribution of arctic sea ice over the next century from 10 general circulation models developed by the IPCC (2007) for the Arctic Ocean (Durner et al. 2009). It is relevant to note that the recently observed declines in sea-ice cover during summer have occurred at a faster rate than was predicted by the suite of IPCC general circulation models (Stroeve et al. 2007), so the habitat-change predictions based on those models may underestimate actual changes in sea-ice habitat. Predictions indicate that the decline of ice cover would be substantially greater in summer than in winter, resulting in significant contraction of summer ice cover into the High Arctic of Canada and northern Greenland (Convergent ecoregion) later in the century. The predicted contraction of summer ice cover would be greater in the Divergent ecoregion, in which the Alaska stocks of polar bears reside. Consequently, Durner et al. (2009) predicted that the range of the polar bear is likely to shrink along with the contracting ice cover. Polar bears may be forced either to travel with the contracting ice cover to high latitudes into areas with low productivity and prey availability, or else remain in traditional ranges by summering on land and fasting until winter sea ice forms. Another recent modeling analysis found a linear relationship between global mean surface air temperatures and sea-ice extent and suggested that sea-ice losses may not be irreversible and are amenable to mitigation of greenhouse gas emissions (Amstrup et al. 2010).


Polar Bear Dens and Potential Denning Habitat
Confirmed Den Site
Potential Terrestrial Denning Habitat
Extent of Den Habitat Mapping
Sources: Den locations from USGS (1910–2010; Durner et al. 2010), USFWS (2002–2009), and ExxonMobil (2010). Potential denning habitat mapped by Durner et al. (2001, 2003, 2006); 2005 revision downloaded from USGS web site, 9/9/2009.
Point Thomson Area Detail Map
Kilometers
Maguire Islands
Tigvariak Island
Challenge I.
Alaska I.
Duchess I.
North Star I.
BADAMI UNIT
Existing Badami Pipeline
Bullen Point
Mikkelsen Bay
Point Thomson
Mary Sachs I.
Flaxman I.
Lion Bay
ANWR – 1002 Area
Harrison Bay
Oliktok Point
Jones Islands
Return Islands
Colville River
Cross Island
McClure Islands
Stockton Islands
Prudhoe Bay
Foggy Island Bay
Deadhorse
See Detail Map
Brownlow Point
Beaufort Sea
Camden Bay
Barter Island
Kaktovik
TAPS
Kuparuk River
Sagavanirktok River
Kadleroshilik R.
Shaviovik R.
Canning River
Jago River
Arctic National Wildlife Refuge – Wilderness Area
ANWR – 1002 Area
ExxonMobil
POINT THOMSON PROJECT
POLAR BEAR DENS AND POTENTIAL TERRESTRIAL DENNING HABITAT
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.1
Point Thomson Action Area
1.6-km Buffer of Proposed Facilities and Ice Roads and Pads
3.2-km Barge Route Corridor
Proposed Ice Roads and Pads
Proposed Facilities and Roads
Proposed Pipelines
Proposed Dredging and Screeding Area
Proposed Screeding Area
Existing Facilities and Roads
Oil and Gas Development Units
Kilometers
Miles
N
150°0'W
149°0'W
148°0'W
147°0'W
146°0'W
145°0'W
144°0'W
143°0'W
71°0'N
70°45'N
70°30'N
70°15'N
70°0'N
69°45'N

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The other four factors analyzed by USFWS for the ESA listing decision were regarded as being of much less concern than the effects of climate change in the Arctic (Schliebe et al. 2006; 73 FR 28212). Human harvest in the past had significant negative effects on the SBS population stock, but those effects were reversed by the hunting restrictions put in place after the passage of the MMPA in 1972 (Amstrup 2003a; Allen and Angliss 2011). The SBS stock subsequently recovered by the 1990s, but has since begun to show signs of decline concurrently with habitat changes that have been attributed to climate change (Allen and Angliss 2011). The combined harvest level for the SBS stock in Alaska and Canada, which averaged 54 bears annually during 2003–2007, exceeds the annual PBR level of 22 bears calculated under MMPA regulations for the current population estimate of ~1,500 bears (Allen and Angliss 2011). Even though human-caused mortality from harvest and lethal incidental take of polar bears currently appears to exceed the PBR level for the SBS stock, USFWS did not consider that mortality to be as important as climate change and the risk of a major marine oil spill (spill effects are discussed in Section 5.1.5). USFWS concluded that "overutilization" (all human-caused take combined) did not "threaten the polar bear throughout all or a significant portion of its range" (73 FR 28280). Nevertheless, the USFWS further noted that the potential for human harvest to affect the population, especially in view of likely population declines in the future and possible synergistic effects combined with habitat loss from climate change, is expected to result in a high level of scrutiny of management effectiveness and the sustainability of harvest levels. The potential for lethal take in defense of life around local communities, as well as industrial sites, is being examined by USFWS in current conservation planning efforts (Miller 2009).

Disease and predation were not considered to pose a threat to the well-being of the species, although potential concerns exist if climate warming leads to the spread of pathogens and increased incidence of intraspecific predation (cannibalism) (73 FR 28281). The existing national and international regulatory mechanisms governing the management of polar bear populations were judged to be effective, with one crucial exception: "…there are no known regulatory mechanisms in place at the national or international level that directly or effectively address the primary threat to polar bears—the range-wide loss of sea ice habitat within the foreseeable future" (73 FR 28288). The few existing mechanisms that are in place to address anthropogenic causes of climate change are not expected to be effective in countering the growth of greenhouse gas emissions. Lastly, the USFWS evaluation of other factors (contaminants, ecotourism, and shipping) concluded that they do not pose a threat to the polar bear population at current levels, but may become more important in the future as polar bear distribution changes and declining populations become more nutritionally stressed as a result of expected environmental changes (73 FR 28292).

Factors such as attraction of polar bears to areas of human activity, behavioral disturbance by humans, and site-specific contamination generally have not had population-level effects, although concerns have been expressed about the potential effects of contamination from widespread pollutants, especially chlorinated hydrocarbons (organochlorines), in the atmosphere and food webs in the Arctic (Amstrup 2003a, Aars et al. 2006).

Several reviews and analyses of cumulative effects have commented on the increasing risk of a major oil spill in the marine environment as a result of expanding oil and gas activity in the Beaufort Sea region (Amstrup 2003a; Amstrup et al. 2006b; NRC 2003; USFWS 2008b, 2009; 76 FR 47010). USFWS commented in the listing notice that "the greatest concern for future oil and gas development is the effect of an oil spill or discharges in the marine environment impacting polar bears or their habitat" (73 FR 28265). Developments located on the mainland, such as the proposed Point Thomson Project, would be of much less concern in this regard.

Apart from climate change, most of the past and present human actions in the region of influence have occurred in terrestrial habitats that receive much less use by polar bears than do marine habitats offshore. By far, most human actions have occurred in the Prudhoe Bay and Kuparuk oilfields and associated satellite developments. The notable exceptions to this generalization are activities associated with leasing by Minerals Management Service (MMS) and seismic exploration in nearshore waters and over the continental shelf (e.g., MMS 2008). Polar bear encounters with human infrastructure are recorded much more frequently at these offshore facilities. For instance, the Endicott and Northstar islands, located offshore from the Prudhoe Bay oilfield, have recorded the highest incidences of polar bear sightings and non-lethal hazing incidents in recent years (USFWS 2009). From 2005 to 2008, the offshore facilities of the Endicott, Liberty, Northstar, and Oooguruk projects recorded 47% (182 of 390) of all polar bear sightings reported by the oil and gas industry in the region of the Beaufort Sea ITRs (76 FR 47026).

Analysis of the cumulative effects of oil and gas leasing, exploration, development, and production by the NRC (2003: p. 105) concluded that "industrial activity in the marine waters of the Beaufort Sea has been limited and sporadic and likely has not caused serious cumulative effects to ringed seals or polar bears." The overall effects of habitat alteration or loss, disturbance, and injury or mortality of polar bears from past and present actions in the region of influence have been determined to be negligible, based on USFWS analyses for the preceding and current ITRs (USFWS 2006b, 2011a; 71 FR 43925; 76 FR 47010), the ESA listing decision (Schliebe et al. 2006, 73 FR 28212), and subsequent Biological Opinions for the ITR process (USFWS 2006b, 2008, 2011b) and for marine leasing and exploration (USFWS

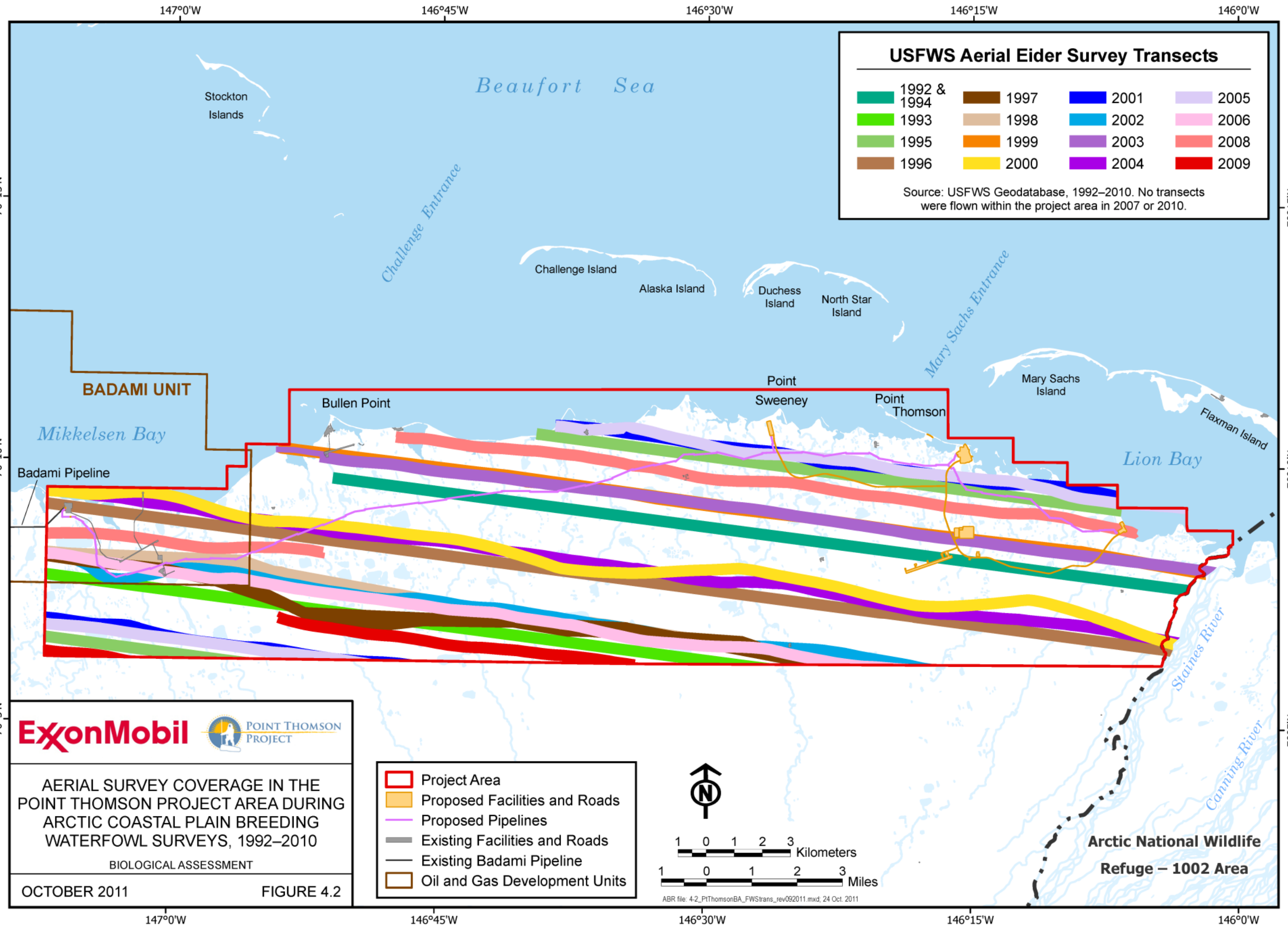
2009). The principal reason behind the negligible-impact findings (under MMPA) and the no-jeopardy findings (under ESA) of those reviews is the availability and implementation of effective mitigative measures, which are stipulated under the ITR/LOA process and have been included in the polar bear interaction plans required by the LOAs issued for all projects since 1991 in the Chukchi Sea and 1993 in the Beaufort Sea.

4.2 Spectacled Eider

4.2.1 Status in the Action Area

The Point Thomson Project Area has been traversed by aerial survey transect lines in most years that surveys have been conducted across the entire ACP by USFWS since 1992 (Figure 4.2 [USFWS Geodatabase 1992–2010]). The Project Area occurs within a low density stratum (stratum 9) for the ACP survey (see Figure 1 in Larned et al. 2010), where survey intensity is reduced (1.7% coverage [the percentage of the area sampled by survey transects] in 2009, coverage varies by year) due to predictably low numbers of Spectacled Eiders in the area of that stratum. Transects did not sample the Point Thomson Project Area every year because of the low survey intensity within stratum 9 and alternating transect locations. Furthermore, the Point Thomson Project Area encompasses the lowest density polygons (0 and 0–0.034 birds/km² [0–0.088 birds/mi²], 1992–2005; 0–0.028 birds/km² [0–0.07 birds/mi²], 2007–2010) for breeding Spectacled Eiders, estimated from 14 years of surveys (Figures 4.3 and 4.4, adapted from Figure 17 in Larned et al. 2006 and USFWS Geodatabase 1992–2010). Only two Spectacled Eider groups have been seen in the Point Thomson Project Area (both in 2003 at Bullen Point) during ACP surveys (USFWS Geodatabase 1992–2010).

Higher intensity surveys (50–100% coverage) for breeding pairs of Spectacled Eiders in the Point Thomson area have been conducted in 1994 (Byrne et al. 1994), during 1998–2002 (TERA 1999b, 2000, 2002a, 2002b), and in 2010 (Johnson et al. 2010b). Byrne et al. (1994) flew one fixed-wing survey for breeding pairs of eiders in two strata of an 8-km-wide (5.0-mi-wide) corridor ~1.6 km (1 mi) from the coast between the Sagavanirktok and Staines rivers. The second stratum, between Mikkelsen Bay and the Staines River, included much of the Point Thomson Project Area and was flown at 50% coverage. TERA conducted breeding pair surveys between 1998 and 2002 from a helicopter at 100% coverage from Badami to the Staines River within a survey area that did not extend as far inland (~1–6 km [0.8–3.7 mi] inland except ≤12 km [≤7.5 mi] inland near the Staines River) as the Point Thomson Project Area (Figure 3.5). In 2010, fixed-wing surveys were flown for eiders during the pre-breeding season at 100% coverage of the entire Point Thomson Project Area (Johnson et al. 2010b).


USFWS Aerial Eider Survey Transects
1992 & 1994
1993
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2008
2009
Source: USFWS Geodatabase, 1992–2010. No transects were flown within the project area in 2007 or 2010.
Beaufort Sea
Stockton Islands
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
Mary Sachs Island
Flaxman Island
Lion Bay
Point Sweeney
Point Thomson
Bullen Point
BADAMI UNIT
Mikkelsen Bay
Badami Pipeline
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
147°0'W
146°45'W
146°30'W
146°15'W
146°0'W
70°15'N
70°10'N
70°5'N
ExxonMobil
POINT THOMSON PROJECT
AERIAL SURVEY COVERAGE IN THE POINT THOMSON PROJECT AREA DURING ARCTIC COASTAL PLAIN BREEDING WATERFOWL SURVEYS, 1992–2010
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.2
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Existing Badami Pipeline
Oil and Gas Development Units
N
1 0 1 2 3 Kilometers
1 0 1 2 3 Miles

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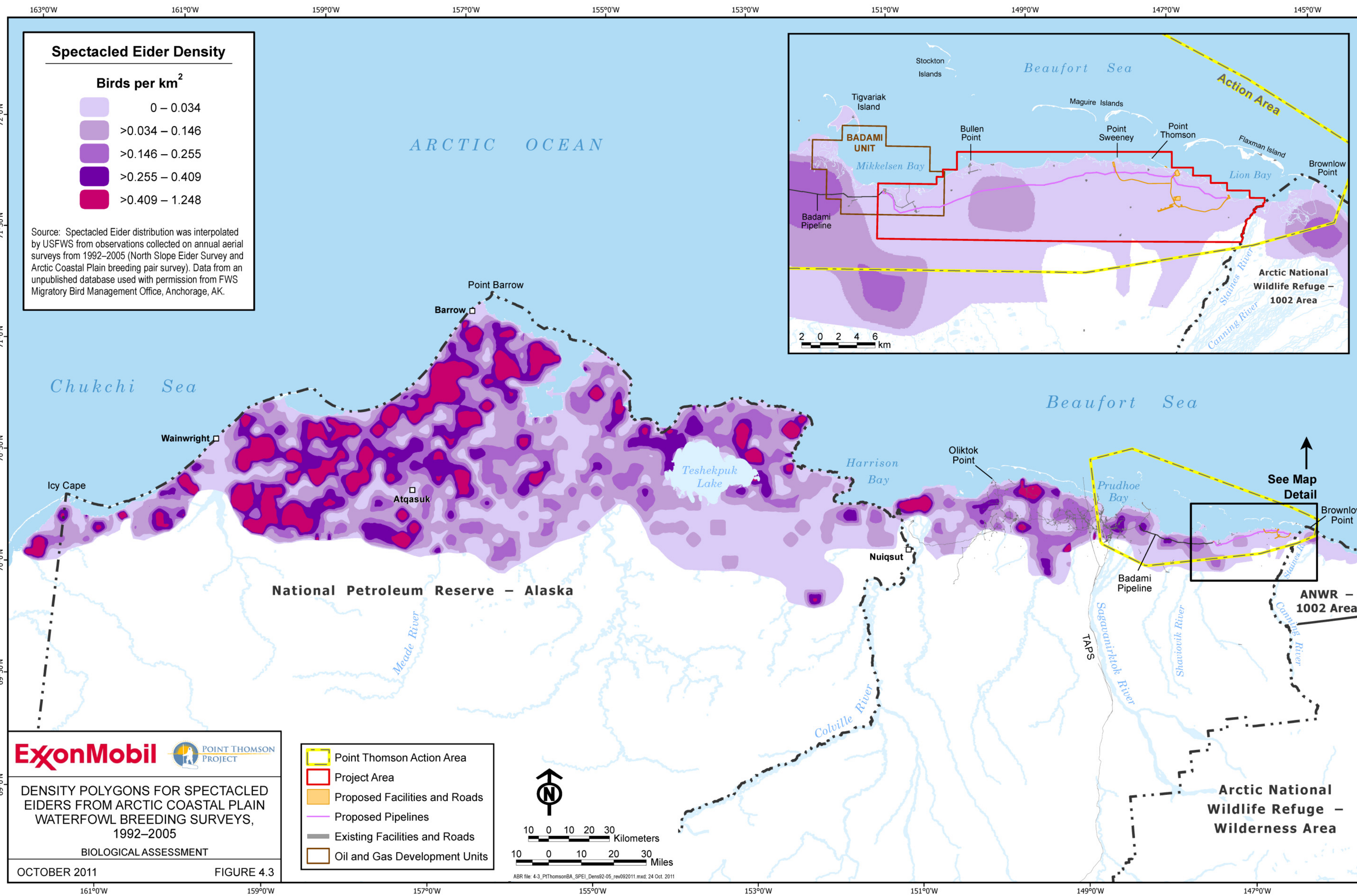
Spectacled Eider Density
Birds per km2
0 – 0.034
>0.034 – 0.146
>0.146 – 0.255
>0.255 – 0.409
>0.409 – 1.248
Source: Spectacled Eider distribution was interpolated by USFWS from observations collected on annual aerial surveys from 1992–2005 (North Slope Eider Survey and Arctic Coastal Plain breeding pair survey). Data from an unpublished database used with permission from FWS Migratory Bird Management Office, Anchorage, AK.
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Point Barrow
Barrow
Wainwright
Icy Cape
Atqasuk
Teshekpuk Lake
Harrison Bay
Oliktok Point
Nuiqsut
Prudhoe Bay
Badami Pipeline
Brownlow Point
See Map Detail
ANWR – 1002 Area
National Petroleum Reserve – Alaska
Meade River
Colville River
TAPS
Sagavanirktok River
Shaviovik River
Canning River
Arctic National Wildlife Refuge – Wilderness Area
Stockton Islands
Tigvariak Island
BADAMI UNIT
Mikkelsen Bay
Bullen Point
Maguire Islands
Point Sweeney
Point Thomson
Flaxman Island
Action Area
Lion Bay
Badami Pipeline
Staines River
Arctic National Wildlife Refuge – 1002 Area
2 0 2 4 6 km
ExxonMobil
POINT THOMSON PROJECT
DENSITY POLYGONS FOR SPECTACLED EIDERS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING SURVEYS, 1992–2005
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.3
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
10 0 10 20 30 Kilometers
10 0 10 20 30 Miles

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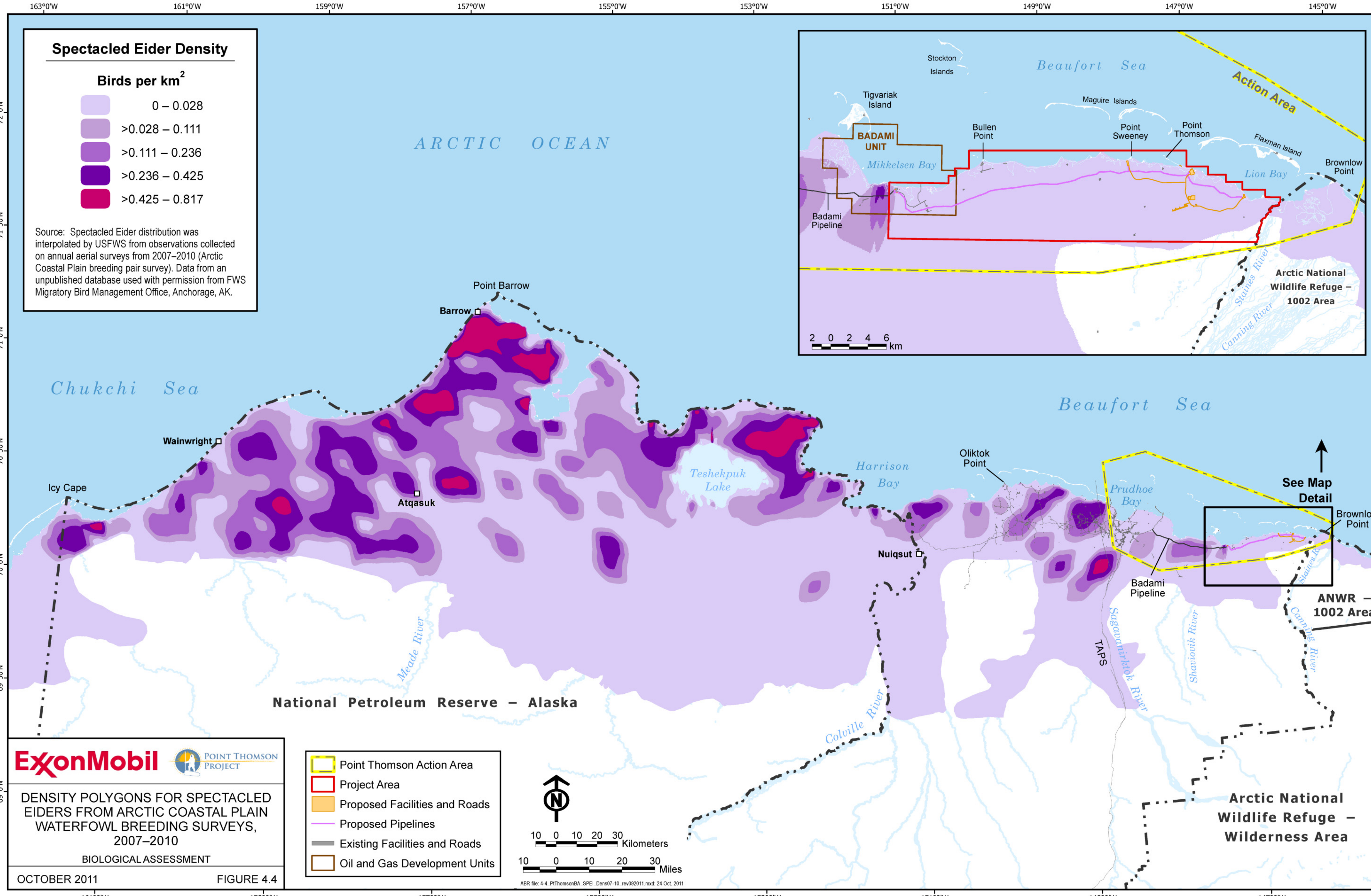

DENSITY POLYGONS FOR SPECTACLED EIDERS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING SURVEYS, 2007–2010

BIOLOGICAL ASSESSMENT

OCTOBER 2011 FIGURE 4.4

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Densities of Spectacled Eiders seen on these local surveys in the Point Thomson area were low (0–0.03 pairs/km² [0–0.09 pairs/mi²], Table 4.1). No Spectacled Eiders were observed in 2 of 6 years and 2–5 pairs were seen annually in the other four years. Most recently, no eiders were seen on a survey conducted at 100% coverage of the Point Thomson Project Area during the 2010 pre-nesting period (Johnson et al. 2010b). Most of the Spectacled Eiders observed during aerial and ground-based surveys of the Project Area were in the vicinity of the Shaviovik River and Bullen Point, and few eiders were seen east of the Shaviovik River (Figures 4.3–4.5). No Spectacled Eiders were seen east of the Shaviovik River in the Badami project area during pre-nesting, nesting, and brood-rearing surveys in 1994 (TERA 1995b). Similarly, no Spectacled Eider nests have been found in the Point Thomson Project Area during ground-based surveys (TERA 1993; Rodrigues 2002a, b), although breeding in the area was confirmed by the observation of one brood (female with four young) south of Point Sweeny in July 1998 (LGL et al. 1999). In the Beaufort Sea, no records of Spectacled Eiders have been reported east of Oliktok

Table 4.1 Abundance and density (indicated pairs/km²) of pre-nesting Spectacled Eiders in the Point Thomson Project Area, northern Alaska, 1993, 1998–2001, 2010.

Year / Location	Indicated Breeding Pairs[a]		Survey Area (km²)	Source [a]
	Number of Pairs	Density (Pairs/km²)		
1993 (Sagavanirktok to Mikkelsen Bay)	50	0.14	52.7	Byrne et al. (1994)
1993 (Mikkelsen Bay to Staines River)	5	0.03	35.0	Byrne et al. (1994)
1998	2	0.01	47.7	TERA (1999)
1999	3	0.02	47.7	TERA (2000)
2000	0	0.00	47.7	TERA (2002)
2001	2	0.01	47.7	TERA (2002)
2010	0	0	76.6	Johnson (2010)

Key:

[a] Data collected from aerial surveys of portions of the Project Area with fixed wing (Byrne et al. 1994, Johnson 2010) and helicopters (TERA 1999, 2000, 2002).

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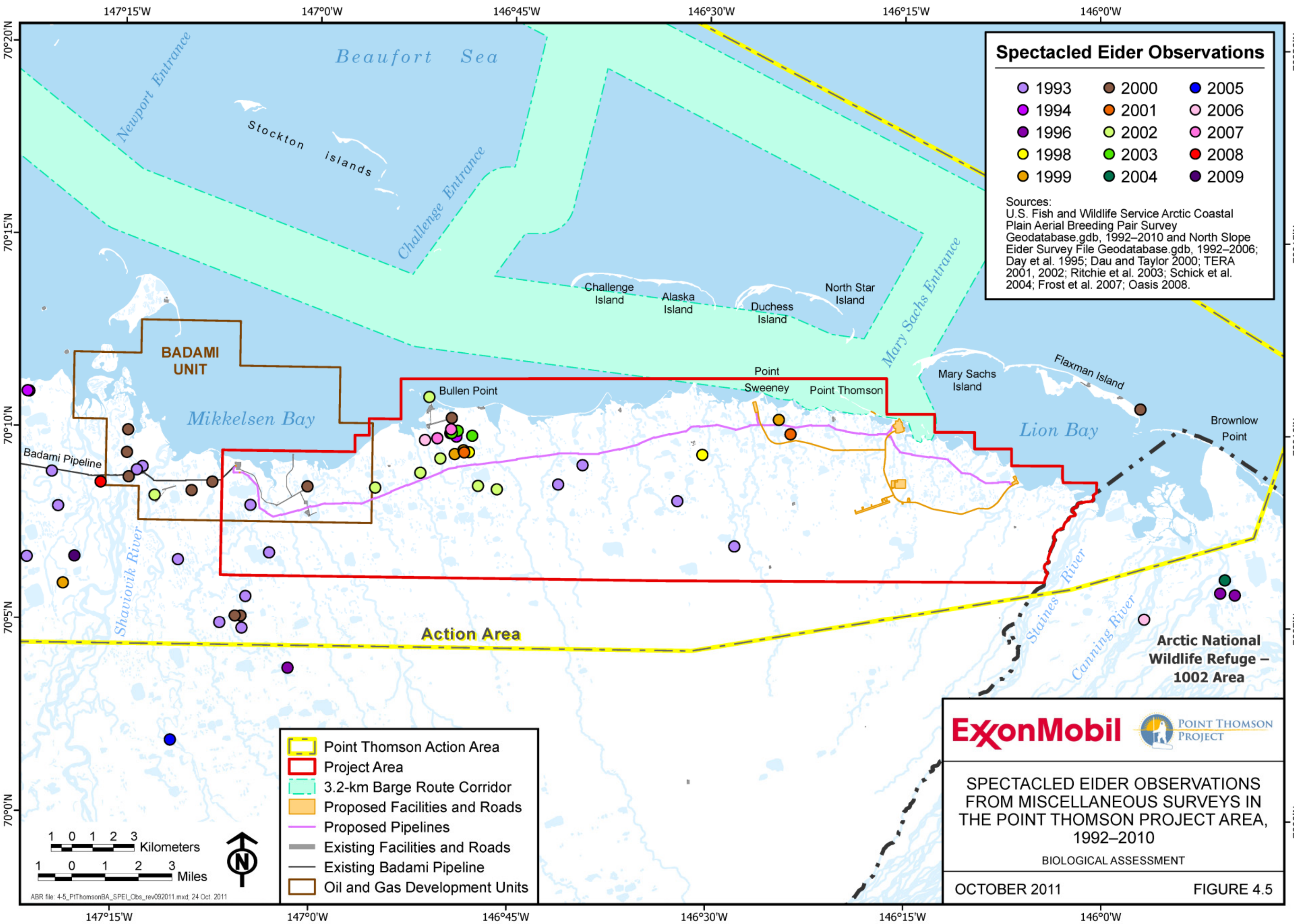
Spectacled Eider Observations
1993
1994
1996
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
Sources:
U.S. Fish and Wildlife Service Arctic Coastal Plain Aerial Breeding Pair Survey Geodatabase.gdb, 1992–2010 and North Slope Eider Survey File Geodatabase.gdb, 1992–2006; Day et al. 1995; Dau and Taylor 2000; TERA 2001, 2002; Ritchie et al. 2003; Schick et al. 2004; Frost et al. 2007; Oasis 2008.
Beaufort Sea
Newport Entrance
Stockton Islands
Challenge Entrance
Mary Sachs Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Island
Flaxman Island
BADAMI UNIT
Mikkelsen Bay
Bullen Point
Point Sweeney
Point Thomson
Lion Bay
Brownlow Point
Badami Pipeline
Shaviovik River
Staines River
Canning River
Action Area
Arctic National Wildlife Refuge – 1002 Area
Point Thomson Action Area
Project Area
3.2-km Barge Route Corridor
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Existing Badami Pipeline
Oil and Gas Development Units
Kilometers
Miles
ExxonMobil
POINT THOMSON PROJECT
SPECTACLED EIDER OBSERVATIONS FROM MISCELLANEOUS SURVEYS IN THE POINT THOMSON PROJECT AREA, 1992–2010
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.5

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Point during multiple aerial surveys of marine waters between Barrow and Brownlow Point, although it is possible a few Spectacled Eiders were not detected because not all eiders seen on these surveys were identified to species (Petersen et al. 1999; Flint et al. 2001; Noel et al. 1999, 2000, 2002a, b; Fischer et al. 2002; Fischer and Larned 2004).

A cluster of Spectacled Eider observations occurs in the western portion of the Point Thomson Project Area (Figure 4.5) because additional aerial and ground surveys for Spectacled Eiders have been conducted at the Bullen Point Short Range Radar Station (SRRS) in 1994, 2000, 2002, 2003, 2006, and 2007 (Day et al. 1995, Day and Rose 2000, Ritchie et al. 2003, Schick et al. 2004, Frost et al. 2007, Oasis Environmental 2008). These surveys produced observations of 0–14 Spectacled Eiders each year. During those six years of ground-based nest surveys, only one Spectacled Eider nest was found at the Bullen Point SRRS (in 2008), and that nest had failed before it was found and was later identified as a Spectacled Eider nest on the basis of feathers taken from the nest (Oasis Environmental 2008). In general, the Point Thomson Project Area is thought to be located at the eastern edge of the range for Spectacled Eiders on the ACP, although a few Spectacled Eiders do occasionally breed farther east in Arctic Refuge (Martin and Moitoret 1981; one nest on the Okpilak River delta in 1985, Garner and Reynolds 1986; one nest each in 2004 and 2005 on the Canning River delta, Kendall and Villa 2005, 2006). To summarize, the Point Thomson Project is within the range of Spectacled Eiders during the breeding season, but evidence of nesting is rare except in the western portion of the Point Thomson Project Area near Bullen Point and Badami. Low densities of Spectacled Eiders use the Point Thomson Project Area inconsistently, based on their lack of detection in some years and low numbers (2–5 pairs) in other years that surveys have been conducted.

4.3 Steller's Eider

4.3.1 Status in the Action Area

Although the Point Thomson Project is within the historical range of Steller's Eiders, the species has not been observed in that area in recent years. The breeding range has contracted from the ACP region to the Barrow area over the last several decades. As a result, it is highly unlikely that Steller's Eiders nest in the Point Thomson Project Area or occur in the area during the post-breeding period.

4.4 Yellow-Billed Loon

4.4.1 Status in the Action Area

The Point Thomson Project is about 145 km (90 mi) east of Alaska's easternmost concentration area for Yellow-billed Loons on the Colville River delta and in a portion of the ACP where Yellow-billed Loons are scarce (Earnst 2004). No nests of Yellow-billed Loons have been documented in the Point Thomson Project Area, but several loons were seen in the early 1980s during fall staging (one bird) and migration (7 birds) by WCC and ABR (1983). Wright and Fancy (1980) also recorded Yellow-billed Loons at their two study plots near Point Gordon and Point Sweeny in 1980. More recently, Rodrigues (2002a, 2002b) recorded Yellow-billed Loons in the Point Thomson Project Area during ground-based breeding-bird studies, but no loons were seen on plots or found to be nesting. Similarly, Yellow-billed Loons were observed incidentally from field camps involved in ground-based nest searching on the Canning River delta to the east of Point Thomson (Figure 3.8), but no evidence of breeding was recorded (Martin and Moitoret 1981, Kendall et al. 2003, Kendall and Brackney 2004, Kendal and Villa 2006, Kendall at al. 2007). Therefore, breeding by Yellow-billed Loons is unlikely to occur in the Point Thomson Project Area, but the nearshore marine environment is probably used annually by low numbers of non-breeding and post-breeding Yellow-billed Loons (Figure 3.8).

Industrial development may directly reduce available breeding habitat through construction of gravel pads or indirectly through changes to hydrology, contamination, or oil spills in breeding, feeding, and migratory areas (USFWS 2006a). Miscellaneous gravel pads and exploration sites have been built in the Action Area since the 1970s, with intense development in Prudhoe Bay on the western end of the Action Area (see details in Appendix D). Because the vast majority of Yellow-billed Loons in the Point Thomson Action Area are offshore in the marine zone, where migratory birds and non-breeders occur (North 1994, Earnst 2004), breeding is unlikely to be affected by past or current development in the Point Thomson Action Area.

A modeling study of sources of mortality suggested that current levels of losses through subsistence activities could result in a 50% reduction of the Yellow-billed Loon population in 15 years (Schmutz 2009), certainly a significant threat to a species that warrants listing under the ESA. Although there is no indication that subsistence by-catch and harvest in the Point Thomson Action Area are reducing Yellow-billed Loons, these activities elsewhere in the Yellow-billed Loon range may be affecting loons in the Action Area. Thus, it is reasonable to assume that past and present actions are negatively affecting the regional population of Yellow-billed Loons, primarily through increased mortality of adults.

5.0 EFFECTS OF THE PROJECT ON LISTED SPECIES

Three types of project-related effects are evaluated for the listed species: direct, indirect, and cumulative. Direct effects are those that occur immediately and at the location of the source or action. Indirect effects are those that are separated in time or space from the source or action. Cumulative effects summarize foreseeable future activities in the Action Area that could affect the species and their habitats. Section 7 defines cumulative effects to include future state, tribal, local, or private actions that are "reasonably certain to occur" (see 50 CFR § 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section of the document, because they would be subject to future Section 7 consultations. This narrower definition of cumulative effects eliminates from consideration virtually all oil and gas development and other construction on the ACP because those activities would require permits from the Corps for modifications to wetlands or waters of the U.S. Furthermore, under the ESA definition, cumulative effects must be reasonably certain to occur, rather than reasonably foreseeable, as under NEPA.

The categories of effects serve as the topics for subsections of the effects analysis under each species. Direct and indirect effects are discussed together under each category and are treated equally in terms of summary conclusions. All effects categories were evaluated in the context of their ultimate influence on the population of each listed species. The effects of the Point Thomson Project facilities and activities were evaluated for each species separately because their life histories, ranges, and habitats differ substantially. Effect categories are similar for the avian species, because of similar seasonal occurrence and overlapping use of terrestrial and marine environments. Therefore, effects analyses are organized under polar bears first, followed by birds, with separate sections for the evaluation of Spectacled Eiders and Yellow-billed Loons. Although the Point Thomson Project is within the historical range of Steller's Eiders, given observations over the last two decades and our understanding of their current distribution, this species is not expected to occur in the area other than rarely. As a result, the Point Thomson Project is not likely to affect Steller's Eider populations and this species is not evaluated in the sections below.

5.1 Polar Bear

Activities related to oil and gas exploration and development in the Beaufort Sea region of northern Alaska currently are subject to ITRs in effect from 3 August 2011 to 3 August 2016 (76 FR 47010). The federal reviews required for that rulemaking and the preceding one (71 FR 43926; in effect when the species was listed under the ESA) resulted in negligible-impact findings for four categories of potential impacts, provided that mitigative measures were implemented: (1) noise disturbance from stationary sources, mobile sources, vessel and aircraft traffic, seismic exploration, and exploratory drilling; (2) physical obstructions to movement, such as causeways, roads, or artificial islands; (3) human encounters; and (4) effects on prey species, mainly from spills but also from short-term local disturbances (USFWS 2006b, 2011a; 71 FR 43926; 76 FR 47010). Under the ITRs, annual LOAs are issued for specific activities or projects, which are subject to mitigative and monitoring requirements (described in 50 CFR Part 18, Subpart J), and which require project-specific interaction plans as the primary means of mitigating the potential effects of the permitted activities on polar bears, including site-specific monitoring and reporting requirements. ExxonMobil currently has such a plan in place for the Point Thomson Project (Appendix A).

Two Biological Opinions (USFWS 2008b, 2011b) concluded that the ITR rulemaking and the activities it authorized did not jeopardize the species, provided that the prescribed mitigative measures were in place. A separate analysis conducted for pending offshore lease sales (MMS 2008) produced another Biological Opinion (USFWS 2009) that reached a similar no-jeopardy conclusion, although several adverse effects (from disturbance, oil spills, and human interactions) were considered possible outcomes of the seismic surveys and exploratory drilling activities that were the subject of that analysis.

5.1.1 Permanent Loss of Habitat

The permanent, direct loss of polar bear habitat as a result of construction of the Point Thomson Project will involve a small area of the terrestrial-denning unit of critical habitat, including several bank-habitat segments of potential maternal denning habitat, as mapped by USGS (Durner et al. 2001). Most of the project facilities would be located within the terrestrial-denning unit of critical habitat. Therefore, the land area affected by gravel extraction, gravel placement, gravel storage pad, and pipeline construction (VSM placement)—estimated at approximately 117 ha (289 ac, not including the overburden stockpiles on ice pads; Table 2.3)—represents designated terrestrial-denning critical habitat that would be unavailable for use by polar bears unless the pipelines and gravel pads are removed in the future. Land affected by tundra ice roads and pads would become temporarily unavailable for denning (discussed in Section 5.1.2 below). No designated critical habitat of the sea-ice unit or barrier-island units would be lost permanently (Figure 3.1), but some portions of those units would temporarily be unavailable due to construction of the sea ice road (discussed below).

It is important to note, however, that only a small proportion of the terrestrial-denning unit of critical habitat in the Project Area represents suitable maternal denning habitat (as delineated by USGS biologists) because of the low topographic relief of the terrain and the limited distribution of suitable denning habitat characteristics across the landscape. Specifically, when considering the sea ice road route, the potential maternal denning habitat mapped by USGS (Durner et al. 2001) covers an estimated total of 43.15 ha (106.6 ac) for 193 bank-habitat segments within the 1.6-km buffer zone around all ice and gravel roads and pads (Table 3.1; the area that would need to be searched for polar bear dens before construction occurred). When considering the tundra ice road route, the comparable figures within that 1.6-km buffer zone are 69.09 ha (170.7 ac) for 286 bank-habitat segments (Table 3.1). Of the potential denning habitat mapped, four fragments, with an estimated area of 178 m^2 (1, 919 ft^2), would be affected directly by gravel placement for the West Pad access road and for the boat launch on the eastern side of the Central Pad. No other potential terrestrial denning habitat mapped by USGS would be affected directly by gravel excavation or placement for construction of any other pads, roads, or the airstrip.

5.1.2 Temporary Loss or Alteration of Habitat

Temporary loss or alteration of polar bear denning habitat would result primarily from the construction of ice roads and pads, which persist throughout each winter season in which they are constructed. The terrestrial denning habitat that would be affected directly by construction of ice roads and pads was estimated to number 16 and 31 bank-habitat segments along the sea ice and tundra ice road routes, totaling an estimated 0.22 ha (0.54 ac) and 0.37 ha (0.91 ac), respectively, of the potential denning habitat mapped by USGS. The lengths of those two ice road routes would be virtually identical, at approximately 75.6 km (47 mi), but the nature of the affected habitats would differ. The sea ice road would largely parallel the coast, closely approaching potential terrestrial denning habitat in numerous locations (Figure 4.1). That route includes spits that have been designated as part of the barrier-islands unit of critical habitat and crosses stretches of the sea-ice unit of critical habitat. Tundra ice roads and pads, including those used for pipeline construction, would directly affect more potential denning habitat than would the sea ice road route, but the tundra ice road route would be located farther inland (Figure 4.1), so the 1.6-km (1-mi) buffer around that route would include less of the barrier-island unit of critical habitat.

The effects of ice placement in potential denning habitat would be temporary until the ice roads or pads thawed during spring melt, although annual reconstruction on the same alignment would result in perennial loss of use of the specific bank-habitat segments affected. Because ice placement would not affect the topographic characteristics that create the favorable denning conditions, no long-term effects on habitat suitability would be expected to occur.

The effects of construction of ice and gravel roads and pads and pipelines would create the potential for temporary loss of use of suitable denning habitat through behavioral disturbance (the latter is described further in Section 5.1.3 below). The ITR/LOA process requires that surveys of potential denning habitat be conducted within 1.6 km of the proposed locations of roads and pads. The use of FLIR sensors has proven to be an effective means of locating dens in such surveys, as has the use of specially trained dogs (Amstrup et al. 2004b; York et al. 2004; Perham 2005; R. Shideler, ADFG, personal communication). Even so, those survey methods do not provide perfect detection and occupied maternal dens sometimes are not detected in preconstruction surveys, such as the two occupied maternal dens discovered near the sea ice road constructed to support the drilling operation at Point Thomson in 2009 and 2010.

In past years, eight and six maternal dens have been confirmed within the 1.6-km buffers around the sea ice and tundra ice road routes, respectively, based on den records maintained by federal agencies (Durner et al. 2010; C. Perham, USFWS, personal communication) (Figure 4.1). Because pregnant bears usually enter dens before construction of ice roads and ice pads begins, the locations of the roads or pads can be shifted to avoid any active dens discovered during preconstruction den surveys. Dens discovered later, after construction, would be protected by constructing ice-road bypasses and placing other restrictions on human activity within a 1.6-km (1-mi) radius as long as the dens remain occupied, in keeping with the interaction plan (Appendix A).

Water withdrawal from lakes for the construction of ice roads and pads would not be likely to cause adverse effects on polar bear habitat, provided that no occupied maternal dens occur within 1.6 km (1-mi) of the withdrawal sites or ice roads used for access. Similarly, the presence of snow dumps and drifts in the vicinity of the project facilities would have negligible effects on polar bear habitat, judging from the general lack of potential denning habitat in those areas.

In addition to maternal denning habitat, the use of shoreline habitats for coastwise movements and resting by nondenning bears would likely decrease as a result of behavioral disturbance (see Section 5.1.3 below) during project construction and operation, mainly within 1.6 km (1-mi) of the Central, West, and East pads. In particular, the presence of the Central Pad and associated facilities is likely to have the greatest local effect on the use of shoreline habitats by polar bears as a result of the pad's proximity to the shoreline north and east of the pad, the presence of the barge offloading structures at the north end of the pad, and the emergency boat launch on the east side of the pad. Bears moving through those areas would likely be disturbed by activities on, or be hazed away from, the pads. Disturbance from traffic on the pad access roads and project airstrip would likely alter the use of habitats by bears nearby, although the more inland locations of those facilities makes them less likely to be used by bears than the shoreline habitats near the pads. Overall, the effects of reduced use of local shoreline habitats near the three pads likely would be negligible.

In summary, the effects of temporary habitat loss and alteration on polar bears are expected to be negligible, with the mitigation required by the ITRs in place. Potential effects on terrestrial denning habitat could be reduced by rerouting the sea ice road slightly farther offshore or by substituting a suitable terrestrial route in areas where the route crosses or closely approaches potential denning habitat mapped by USGS. Rerouting the sea ice road could be accomplished without detrimental effects on ringed seal denning activities by keeping the route within the 3-m depth contour. After the placement of gravel pads and roads during the construction phase, the attractiveness of some potential denning habitat in the vicinity of infrastructure may be diminished for maternal females because of the presence of the facilities and associated human activity, but the amount of potential terrestrial denning habitat in the Point Thomson area (Figure 4.1) is already the lowest in the entire area of the ACP mapped thus far by USGS (Durner et al. 2001, 2006). Alteration of shoreline habitat use by bears near the three pads could be mitigated through careful management of activities to keep the portions of the pads nearest to the shoreline as free as possible of infrastructure and temporary storage of materials (from barging), especially during the late summer and fall period when the number of bears moving along the shoreline is expected to peak. The planned completion of barging operations by approximately 25 August to avoid conflicts with fall subsistence whaling would provide ancillary benefits by reducing the effects of those operations on bears moving along the shoreline.

5.1.3 Behavioral Disturbance by Project Activities

Noise and visual disturbance from human activity and operation of equipment, especially aircraft and vehicle traffic, have the potential to disturb polar bears in the vicinity of those activities (Blix and Lentfer 1992; MacGillivray et al. 2003; Perham 2005; Schliebe et al. 2006; USFWS 2006b, 2008, 2009; Andersen and Aars 2008). The greatest concern is disturbance of maternal females during the winter denning period, which can result in den abandonment and reduced survival of cubs (Amstrup 1993, Linnell et al. 2000, Lunn et al. 2004, Durner et al. 2006, USFWS 2011b). Because polar bear dens are known to occur in the Point Thomson area (Figure 4.1) and the incidence of terrestrial denning by the SBS population is increasing (Fischbach et al. 2007), the potential for disturbance of dens during the drilling, construction, and operational phases of the proposed project is of particular concern.

Amstrup (1993) reported that 10 of the 12 denning polar bears he examined tolerated exposure to a variety of disturbing stimuli near dens with no apparent change in productivity, as expressed in the survival of young. Two females denned successfully on the southern shore of a barrier island within 2.8 km (1.7 mi) of an active oil-processing facility, and other females denned and produced young successfully after a variety of human disturbances near their dens. During winter 2000–2001, two females denned and successfully produced young within 400 m and 800 m (1,312 and 2,625 ft) of remediation activities being conducted on Flaxman Island (MacGillivray et al. 2003). During winter 2010–2011, a female denned successfully on Spy Island within 50 m of part of the Nikaitchuq Project facilities (USFWS 2011b). During both 2009 and 2010, a female denned successfully within 100 meters of the sea ice road to Point Thomson. In Amstrup's (1993) study, several females responded to disturbance early in the denning period by moving to other sites, leading him to surmise that females may be more likely to abandon dens in response to disturbance early in the denning period than later. Amstrup (1993) suggested that initiation of intensive human activities during the period when females seek den sites (October to November) would give them the opportunity to choose sites in less-disturbed locations. Abandonment later in the denning period appears to exert greater effects on productivity; Amstrup and Gardner (1994) found that survival was poor for cubs that left dens prematurely in response to the movement of sea ice.

Experimental studies of noise and vibration in artificial (human-made) "dens" have been used to estimate the distances at which disturbance may occur. Blix and Lentfer (1992) reported that snow cover greatly attenuated sounds and concluded that activities associated with oil and gas exploration and development, such as seismic surveys and helicopter overflights, would not be likely to disturb denning bears at distances greater than 100 m (328 ft) from dens. In a more rigorous study, however, MacGillivray et al. (2003) compared noise levels inside and outside of artificial dens at sites on Flaxman Island in March 2002 during a variety of industrial remediation activities, including passage by different vehicles and overflights by helicopters at various distances. The authors noted that a lack of detailed information on the frequency and sensitivity of polar bear hearing thresholds confounded interpretation of the data. Snow cover provided an effective buffer, reducing low-frequency noise by as much as 25 decibels and high-frequency noise by as much as 40 decibels for activities conducted near the artificial dens. The noise levels produced by various stimuli were detectable above background levels at ranges from 0.5 km to 2 km (0.3 mi to 1.2 mi), however, depending on the stimulus. Low-frequency vibrations and noises were detected at the greatest distances. The most audible disturbance stimuli measured from inside the dens were an underground explosion, detectable in artificial dens up to 1.3 km (0.8 mi) from the source, and airborne helicopters directly overhead. Helicopters were detectable above background levels as far away as 1 km (0.6 mi), but the authors noted that noises just above background are not likely to cause biologically significant responses (MacGillivray et al. 2003). The authors noted that high variability in the tolerance of different bears to noise and disturbance, including hazing with acoustic deterrents, was an important factor in evaluating human disturbance.

Den surveys using FLIR sensors or trained dogs will be conducted annually before construction of roads and pads commences for the Point Thomson Project, as stipulated by the LOAs required for the project and by the polar bear interaction plan. If dens are detected within the 1.6-km (1-mi) buffer zone around the locations of ice roads and pads, then those structures will be relocated outside of that radius to avoid the dens, unless otherwise authorized by USFWS. For instance, the sea ice road was relocated inland in winter 2010–2011 to avoid a FLIR "hotspot" detected at the coast southeast of Point Sweeney, even though the hotspot had not been confirmed as a polar bear den.

If dens are located after ice roads and pads are built, then traffic restrictions and emergency closures are instituted, as was done in 2009 and 2010 for the Point Thomson Project during well drilling. The first den was discovered on 27 March 2009 about 100 m south of the Point Thomson sea ice road at Mile 14.7 (measured from the western end) and the second den was discovered on 18 April 2010 about 65 m north of the sea ice road at Mile 36.1 (see Appendix B for more details). Those discoveries triggered emergency road restrictions and 24-hr monitoring until the bears departed the dens, as is prescribed in the *Polar Bear and Wildlife Interaction Plan* developed for the project (Appendix A). In both cases, the females and their cubs (two in each litter) departed their dens six days after the sites were discovered by drivers on the ice road and traffic restrictions were put in place. There was no evidence to indicate that those incidents resulted in premature departure from the dens, although it is difficult to draw firm conclusions in such cases (C. Perham, USFWS, personal communication). The timing of departure from the dens was within the general range of dates (beginning of March to mid-April) expected in the region, although the den in 2010 was found at the end of that period (C. Perham, USFWS, personal communication).

Besides potential disturbance of denning females with young cubs, displacement of nondenning bears from preferred habitat is another concern, and is a primary reason that a 1.6-km (1-mi) buffer zone was established around the barrier-island unit of critical habitat, which is important for denning, refuge from human disturbance, and movements along the coast for access to denning and feeding habitats (75 FR 76086). The West and Central pads, parts of their access roads, most of the interconnecting pipelines between them, and the onshore disposal location of material produced by dredging and screeding for the barge operations would be located entirely within the 1.6-km (1-mi) disturbance buffer zone designated around the barrier-island unit of critical habitat (Figure 3.1). USFWS based that buffer zone on the mean distance (1,534 m; range 508–2,768 m [5,033 ft; range 1,667–9,081 ft]) at which maternal females with young cubs on Svalbard in April and May reacted to direct approach by humans driving two snowmobiles (Anderson and Aars 2008). Medium-sized single bears (subadults) in that study also reacted at fairly long distances (mean 1,160 m; range 375–1,353 m [3,806 ft; range 1,230–4,439 ft]) and adult males and females without cubs were the least reactive (mean 326 m; range 138–496 m [mean 1,070 ft; range 453–1,627 ft] for adult males, and mean 164 m; range 49–543 m [mean 538 ft; range 161–1,781 ft] for females without cubs). Besides reacting at longer distances, maternal females and subadults showed stronger responses than did adults without cubs.

Polar bears passing through or near the Point Thomson Project infrastructure will be exposed to a wide variety of potentially disturbing stimuli resulting from pipeline and pad construction and other human activity on all three pads, vehicles on the pads and interconnecting access roads, aircraft traffic at the airstrip, barge traffic in the lagoon system and associated offloading operations at the Central Pad pier and marine bulkhead, and drills by spill-response personnel. A wide variety of behavioral responses by polar bears is likely to occur, ranging from avoidance by maternal females with young cubs in spring to approach by curious bears or those attracted by the numerous odors emanating from the pads (discussed in Section 5.1.4). During 2006–2009, sightings at industrial operations in the Beaufort Sea region averaged 306 polar bears per year (range 170–420), of which 81% showed no change in behavior, 4% moved away from or toward industrial activity, and 15% were hazed or subjected to other deterrence measures (USFWS 2011b). In previous analyses, the USFWS (2006, 2008, 2009, 2011a, 2011b) concluded that the types of activities typical of oil and gas exploration, development, and production projects were not likely to have population-level effects on polar bear populations at the levels analyzed because the behavioral responses of the bears were short-term and localized.

The net direction of movement by maternal females leaving terrestrial denning areas with young cubs is northward, requiring crossing of roads and pipelines, but the amount of suitable denning habitat inland from the project infrastructure is limited (except along the sea ice road), so the number of such encounters would be small. The greatest likelihood for numbers of bears to encounter project infrastructure and activities is at the shoreline during the open-water season (mainly August–October), as bears move east or west along the coast in advance of the formation of seasonal ice; some animals will likely encounter all three pads. Those animals would be able to move past the West and East pads without having to cross any potential obstructions at the shoreline, in contrast to the Central Pad, where the extension of gravel to the water's edge for the barge docking structures will pose a potential obstruction. The size of the Central Pad, its proximity to the shoreline along the northern and eastern edges, and the high level of human activity occurring there will create a high potential for behavioral disturbance for polar bears moving along the shoreline. Early detection of bears by trained bear monitors and other project personnel would allow project activities to be modified to minimize disturbance of bears moving through the project vicinity. The planned cessation of barging by late August will reduce the potential for those activities to disturb bears moving along the shoreline, although some encounters are likely to occur in July and early August. Barges operating in open water may cause some short-term disturbance of bears swimming in the ocean, but the likelihood of such encounters is low. Polar bears also may be disturbed by aircraft overflights, take-offs, and landings, but the location of the airstrip and aircraft flight corridor 5–8 km (3–5 mi) inland from the coast will reduce the potential for such disturbance.

Polar bears moving along the coast through the Kuparuk and Prudhoe Bay oilfields routinely encounter human-made obstructions and are able to cross or move past them without difficulty, resulting in short-term disturbance at most (USFWS 2008b, 2009, 2011a, 2011b). Short-term behavioral responses are not likely to have population-level effects and thus are considered less problematic than den disturbance and abandonment (USFWS 2008b, 2009, 2011a, 2011b). The effects of short-term behavioral disturbance are likely to be negligible on the SBS population, although the magnitude may increase in the future if the current trend of increasing terrestrial presence of bears in late summer and autumn continues. Polar bears spending more time on land and fasting more as sea-ice cover continues to diminish are likely to experience an increase in negative effects on their energy budgets as a result of reduced access to prey (Molnár et al. 2010).

In summary, project-related disturbance is likely to result in negligible effects on the productivity of polar bears in the Project Area, provided that all required mitigative measures are implemented, as required under the current ITRs and specified in the interaction plan. The number of bears potentially affected is likely to increase during the operational life of the project as summer sea-ice cover continues to diminish, resulting in more bears being present onshore during the open-water period and traveling the coastline more in late summer and fall, especially in the barrier-island unit of critical habitat. Such an increase is expected as a result of the current trends for increasing use of coastal habitats and terrestrial denning habitats (Fischbach et al. 2007; Schliebe et al. 2008; USFWS 2006b, 2008, 2009), but existing mitigation measures should continue to be effective at minimizing the effects of project-related disturbance on the polar bear population. It is likely that maternal denning will continue to increase in terrestrial habitats in the future, although the presence of the operating Project facilities probably would discourage female bears from denning in the limited amount of suitable habitat nearby; instead, they would be more likely to seek suitable den sites in less-disturbed areas, as suggested by Amstrup (1993).

5.1.4 Attraction, Injury, and Mortality

Polar bears are curious and opportunistic hunters, frequently approaching and investigating locations where human activity occurs (Stirling 1988, Truett 1993). Proximity to humans poses risks of injury and mortality for both bears and humans and may necessitate nonlethal take through deterrence and hazing or, on rare occasions, lethal take to defend human life (Stenhouse et al. 1988, Truett 1993, Perham 2005). Stirling (1988) reported that curious polar bears commonly approached offshore drilling rigs in the Canadian Beaufort Sea whenever sea ice moved into the area, but did not remain nearby for long unless seals were present in the leads created by the rigs. Sightings of polar bears at industrial sites in the Beaufort Sea region of Alaska have increased in recent years, consistent with increasing use of coastal habitats as summer sea-ice cover has diminished (Schliebe et al. 2008, USFWS 2008b), and hazing incidents have increased accordingly. The majority of polar bear mortalities resulting from conflicts with humans in the Northwest Territories occurred during the ice-free period from August to November; most of the animals killed were subadult males (Stenhouse et al. 1988). As sea-ice cover continues to diminish in the future, the number of encounters between nutritionally stressed bears and humans is expected to increase (DeBruyn et al. 2010), which is cause for concern because of a small number of incidents in which malnourished polar bears killed and partially consumed humans at industrial sites in the Beaufort Sea in the 1970s and at the village of Point Lay in 1990 (Truett 1993, Obbard et al. 2010).

When the polar bear was listed as a threatened species in 2008 (73 FR 28212), the USFWS noted that the factors contributing to the primary threat identified in the listing analysis—rapidly diminishing sea-ice habitat—cannot realistically be regulated under their management purview. Therefore, in lieu of influencing the causes underlying climate change, such as greenhouse gas emissions, USFWS has focused on factors more amenable to regulation, such as habitat protection and the prevention and reduction of lethal take; the result of this approach is that even greater emphasis has been devoted to mitigation through interaction planning to avoid and minimize injury and mortality of polar bears (Miller 2009).

Despite increased interactions in the existing oilfields in recent years, no lethal take or injuries of polar bears had been reported (USFWS 2008b, 2009) until this year. In late August 2011, a female polar bear died several days after having been wounded by a security guard at the Endicott Project, who mistakenly used a cracker-shell instead of a bean-bag round while attempting to haze the animal. Only two polar bears have been killed in defense of human life at oil and gas industrial sites in Alaska since the late 1960s—one in winter 1968–69 and another in 1990 at the Stinson exploration site in western Camden Bay, north of Point Thomson (Perham 2005; USFWS 2006b)—and none have been killed intentionally since the Chukchi Sea and Beaufort Sea ITRs went into effect in 1991 and 1993, respectively (USFWS

2008b, 2009). Several other mortalities have been associated with military and industrial activity. A polar bear was killed at the Oliktok Point Long-range Radar Site in 1993 (Allen and Angliss 2011) after it entered a building to attack a worker who had provoked it. A radio-collared polar bear died on Leavitt Island, 8 km northwest of Oliktok Point, after ingesting ethylene glycol in a substance used for marking roads and runways in snow (Amstrup et al. 1989). In contrast, 33 polar bears were killed at industrial sites in the Northwest Territories during 1976–1986 (Stenhouse et al. 1988). Dyck (2006) reported that 618 polar bears (averaging 20 per year) were killed during 1970–2000 in the Northwest Territories and Nunavut in northern Canada, of which 25 (4%) occurred at industrial sites.

Encounters between polar bears and humans in the Point Thomson Project Area are most likely to occur at or near the coastline as bears move through in late summer and fall (August–October) and as maternal females with young cubs depart from terrestrial dens in late winter (March–April). The latter animals are the least likely to be attracted to project facilities, however, due to their greater sensitivity to disturbance. Of the 53 sightings recorded for the Point Thomson Project between 30 January 2009 and 28 October 2010, 42 involved bears seen near the Central Pad, 23 of which were estimated to be within 1.6 km of the pad (Appendix B). Most of those bears moved through the area nearby or around the pad and did not approach, but seven bears approached closely enough to warrant hazing by making noise (alarm, horn, or cracker shells) or by positioning a vehicle to divert them away from the pad. One of those incidents involved a female with yearling cubs that gained access to a dumpster in early September 2009 and were hazed away using cracker shells and a bean-bag round from a shotgun.

The ITR/LOA process has proven to be effective at addressing and mitigating the risks of polar bear encounters with humans. Besides denning surveys, the required interaction plan for the Point Thomson Project (Appendix A) stipulates monitoring and reporting of bear sightings and encounters using trained observers, as well as training of personnel in nonlethal means of protection (deterrence and hazing). Although camps and other activity areas have the potential to attract polar bears, experience demonstrates that these risks can be mitigated effectively by following the interaction plan; for example, with detection systems using bear monitors, motion/infrared sensors, and adequate lighting; safety gates, fences, and cages for workers, as well as skirting of elevated buildings; careful waste handling and snow management; chain-of-command procedures to coordinate responses to sightings; and employee education and training programs (Truett 1993; Perham 2005; USFWS 2006b, 2008, 2009; 76 FR 47010). As with grizzly bears and foxes, all project operations must be conducted to minimize the attractiveness of the construction sites to polar bears and to prevent their access to food, garbage, or other potentially edible or harmful materials. Trained bear monitors will be present on site and all polar bear sightings will be reported immediately.

Upon issuance of an LOA by the USFWS, trained personnel have authority under Section 112(c) of the MMPA to haze or otherwise take polar bears under specific circumstances involving the protection of human life. In addition, USFWS recently issued voluntary deterrence guidelines (75 FR 61631), effective 5 November 2010, to deter polar bears without serious injury or death. The deterrence guidelines include two levels: (1) passive measures intended to prevent polar bears from gaining access to property or people (fencing, gates, skirting, exclusion cages, bear-proof garbage containers), and (2) preventive measures intended to discourage bears from interactions with property or people (acoustic devices for auditory disturbance, vehicle or boat deterrence).

In addition to attraction to areas of human activity and direct interaction with humans, a second potential source of injury or mortality is premature den abandonment, which is a possible outcome of den disturbance and has been documented as an adverse effect on cub survival (Amstrup and Gardner 1994; USFWS 2008b, 2009; 76 FR 47010). The precautions against den disturbance in the interaction plan required under the ITRs and the denning surveys conducted before construction of ice roads and pads will minimize the likelihood of this potential risk.

A third potential source of injury or mortality is traffic on the sea ice road, a transportation route that will intersect the movement paths taken by females with young moving from terrestrial denning habitat to hunting areas offshore in late winter (March–April), posing a risk of vehicle strikes and disturbance-related distributional shifts. This risk notwithstanding, no vehicle strikes along similar ice roads have been reported in agency documents evaluating impacts on polar bears, indicating the impact is negligible.

A fourth potential source of injury or mortality is accidental spills, leaks, and other sources of contamination. These effects are discussed separately in Section 5.1.5 below.

Any injury or mortality would raise a concern because of the declining status of the SBS population and the fact that human-caused mortality (from hunting, not industrial activity) currently exceeds the PBR for the stock (Allen and Angliss 2011). The attraction of polar bears to facilities and attendant problems may increase through the operational life of the proposed project as more bears become stranded onshore during the open-water season due to declining sea ice, leading to increased use of coastal travel routes past the project facilities.

In summary, although the potential for injury or mortality could be high when undertaking a new development project in an area frequented by polar bears, the risks are well understood and effective mitigation is available, as is spelled out in the interaction plan required by the ITR/LOA process. Given the current and predicted declining status of the SBS stock, it is imperative that such measures be taken to avoid injury or mortality. With this mitigation in place, the net effects are likely to be negligible.

5.1.5 Effects of Spills

Polar bears are susceptible to thermal stress through fouling of their fur by direct contact with spilled petroleum products, which produces decreased body temperature and increased metabolic rate, and oil is absorbed through skin contact, through the gastrointestinal tract, and by inhalation (Engelhardt 1983). USFWS conducted a detailed analysis of oil-spill risks in the final rulemaking for the current ITRs (76 FR 47010). Contact and ingestion from grooming of oiled fur or consumption of contaminated food can lead to severe hematological and renal abnormalities. Other direct effects of spills include behavioral disturbance of bears by spill response and cleanup activities. Indirect effects include deleterious effects on the seals upon which polar bears prey. The direct and indirect effects of spills depend primarily on the seasonal timing and location of the spills and on the volume of material released into the environment. Terrestrial spills during winter would have substantially less impact on polar bears than would marine spills during the open-water and broken-ice periods in late summer and fall (76 FR 47010). 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 C.

Several reviews and analyses have commented on the potential for the effects of human activities to increase as a result of expanding oil and gas activity in the Beaufort Sea region (Amstrup 2003a; NRC 2003; USFWS 2008b, 2009, 2011b). The greatest concern identified in those studies focused on the risk of a major oil spill in the marine environment. Apart from long-term habitat loss due to declining sea-ice cover, the risk of a major oil spill in the marine environment is considered to pose the greatest acute risk to the SBS stock of polar bears (Amstrup 2003a; Amstrup et al. 2006b; Schliebe et al. 2006; USFWS 2006b, 2008, 2009, 2011b). USFWS commented in the ESA-listing notice that "the greatest concern for future oil and gas development is the effect of an oil spill or discharges in the marine environment impacting polar bears or their habitat" (73 FR 28265). The most comprehensive analysis to date regarding the likely effects of spills on the SBS population of polar bears was the modeling analysis of marine spill risks from the Northstar and Liberty projects (Amstrup et al. 2006b), located west of the Point Thomson Project. That modeling of spill scenarios and trajectories revealed the high vulnerability of polar bears to large marine spills during the open-water season in the Beaufort Sea. The authors concluded that the maximal numbers of polar bears likely to be oiled by a hypothetical undersea pipeline rupture (5,912-barrel spill) from the Liberty and Northstar projects, respectively, would be 23 and 27 bears in the September open-water period and 55 and 74 bears in the October broken-ice period (Amstrup et al. 2006b); those numbers represent 1.5–4.8% of the estimated population size in 2006. The only significant activity occurring in the marine environment for the Point Thomson Project is barging of supplies during the open-water period in summer, which would pose a minor risk of spilled fuel if a vessel carrying fuel were to run aground and break up. The number of bears potentially affected by such an accident would be smaller than the numbers that would be affected by the hypothetical large marine spills modeled by Amstrup et al. (2006b), because the spill volume and the area affected would be substantially smaller and the diesel fuel would dissipate more readily than crude oil. A small-volume spill from a hypothetical truck accident on the sea ice road during the winter would remain localized and would be relatively simple to clean up.

Spills associated with development projects located on the mainland are of much less concern for polar bears than are marine spills (76 FR 47010). If a large spill did occur on land, it would be unlikely to enter the marine environment unless it occurred directly at the coast. The risk of a large spill during the drilling, construction, and operational phases of the proposed Point Thomson Project is very low, although it cannot be ruled out. The volume of material released and the area affected likely would be small due to the volumes of material being used and the terrestrial base of spill-response activities (see maximum estimated spill calculations in Appendix C). Small releases of contaminants also can have effects, however; Amstrup et al. (1989) documented the death of a polar bear following ingestion of ethylene glycol in a substance used for marking snow roads and runways. Effective control of potentially toxic substances and careful attention to preventing spills of any size are the key to preventing such injuries. Overall, oil spills, leaks, and contaminant releases likely would pose negligible to minor effects on polar bears and their habitat in the Point Thomson area, in view of the safeguards specified in the required spill prevention and contingency plan, the low risk of a major spill, the relatively small amounts of material likely to be released under most scenarios, and the ability to detect and clean up spills quickly on land, where most project activities will occur.

5.1.6 Cumulative Effects

As was described earlier, the definition of cumulative effects in the context of ESA Section 7 includes only the effects of future nonfederal actions that are "reasonably certain to occur" (50 CFR § 402.02). Therefore, the majority of future development that may occur in the Action Area is excluded from the following discussion, which has been modified to meet the specific requirements and definition of cumulative effects in the ESA.

Commercial and transportation development, increased subsistence harvest, expansion or changes in the activities of local communities, and management and research actions by state agencies or private entities are the principal nonfederal activities that could contribute to cumulative effects on polar bears. Polar bears may be affected by oil and gas exploration and development, construction (transportation, residential, or industrial infrastructure), environmental contamination, marine shipping, wildlife research and survey activities, subsistence harvests, and recreational activities. Most development along the central Beaufort Sea coast in general, and in the Action Area in particular, is located in terrestrial habitats, which receive substantially less use by polar bears than do marine habitats offshore. Industrial facilities located on offshore islands (Endicott, Northstar, Liberty, Oooguruk projects) have recorded the highest incidences of polar bear sightings and nonlethal hazing incidents in recent years (USFWS 2009, 2011a).

Tourism is growing in Kaktovik, with commercial enterprises offering viewing opportunities of polar bears and travel in the Arctic Refuge (USFWS 2011a, 2011b), but those activities would not be likely to cause effects in the Action Area. No future plans have been publicized for road, highway, or residential expansion in the Action Area; a road once proposed by the Alaska Department of Transportation and Public Facilities to access the eastern North Slope (including the Project Area) from the Dalton Highway has been shelved. The local population of people is low (~6,800 residents in the North Slope Borough, of which only about 300 live in Kaktovik, the village nearest to Point Thomson), so the amount of human activity in the Action Area is relatively low, once away from the Prudhoe Bay area. Residents from both Kaktovik and Nuiqsut use portions of the Action Area for subsistence activities (Pedersen and Coffing 1984; Coffing and Pedersen 1985; IAI 1990a, 1990b; Pedersen 1990; SRBA 2010). No information available currently suggests that these activities will increase in the Action Area or that negative effects to the polar bear population are reasonably certain to occur as a result of such activities.

Two global issues with limited federal control that could affect polar bears and their prey in the Action Area are climate change and pollution of air and water. Although air and water pollution and contributions to greenhouse gas emissions within the United States are subject to federal regulations, some sources are not controlled by federal actions (e.g., natural methane emissions, smoke from forest fires) and international sources are not directly controlled by federal actions. Increases in air pollution in the Arctic are likely to occur given expanding global population and industrialization, particularly in Asia. Climate warming is expected to be most dramatic in the Arctic, with rates of warming nearly twice that experienced globally (ACIA 2004). The effects of these global trends are complicated, yet the forecast models—based on current trends—that have been constructed to examine the likely effects on polar bear habitats point to dramatic declines in the extent and thickness of arctic sea-ice cover, which has serious implications for the future of the species (Durner et al. 2009) and the ice-inhabiting seals on which it preys. The warming temperatures and increased precipitation year-round and longer growing seasons that are predicted to occur in the future may have implications for the stable conditions required for maternal denning period by polar bears.

The combined effects of likely future actions, particularly those located in the arctic marine environment, may contribute to adverse effects on the polar bear population in the future, primarily through expansion of coastal and offshore development and the increased risk of a major marine oil spill. The Point Thomson Project is expected to make a negligible contribution to adverse cumulative effects on polar bears, however, due to its onshore location and the demonstrated effectiveness of current mitigation. The potential negative effects of the Project will be reduced by implementing the mitigation measures required by the ITR/LOA process, as specified in the polar bear interaction plan for the project. The effects of continuing climate change pose major challenges to the future well-being of the species, leading to significant range contraction and associated population declines within 50 years if current trends continue, but the ability of federal agencies to influence the processes thought to be responsible for climate change is extremely limited. By comparison, the cumulative effects of arctic oil and gas exploration, development, and production on polar bears have been judged to be negligible to date. Concerns have been expressed, however, that future expansion of oil and gas development on both sea and land along the arctic coast may reach levels that eventually may become problematic for the SBS stock (Amstrup 2003a, USFWS 2009).

5.2 Birds

The potential direct and indirect effects on listed and candidate species of birds from construction and operation of the Project can be grouped into the following categories:

1. Potential permanent or long-term habitat loss from gravel extraction and placement for construction of the facilities;

2. Potential habitat modification or loss from gravel mining; from soil compaction, disturbance of vegetation, and delayed thaw of snow and ice accumulations following the use of ice roads; from

dust fallout, gravel spray, persistent snow drifts, impoundments, thermokarst, contaminants, and water withdrawal; and from dredging and screeding the seabed;

3. Potential behavioral disturbance by project activities such as equipment operation and human activity (construction activity, vehicles and heavy equipment, aircraft, vessels, and drill site facilities);

4. Potential indirect loss of habitat through displacement of birds that avoid project facilities and transportation routes as a result of increased noise and human activity;

5. Potential increased predation on birds or their eggs from higher predator populations that may result from attraction to anthropogenic foods or artificial structures (for perching, nesting, or denning) at the project facilities (possibly resulting in lowered productivity of listed species);

6. Injury and mortality of birds from collisions with aircraft, vehicles, or structures, and from subsistence activities (fishing, hunting, and lead shot accumulation); and

7. Potential impacts of spills from contact with or ingestion of contaminants (including oil spills) and indirect effects on plant and animal food species.

As noted above, critical habitat for listed bird species does not exist within the Action Area, therefore effects on critical habitat will not be discussed in this section. The Point Thomson Project potentially has detectable effects on one of the listed species, the Spectacled Eider, and on a proposed species, the Yellow-billed Loon. As discussed above, Steller's Eiders have not been recorded in the Action Area in recent years. The nearest observations are from the Prudhoe Bay area in 1998, outside the Action Area (Figure 3.7). It appears the eastern ACP of Alaska is no longer occupied by this species, and although they may occur there rarely, the lack of observations over the last two decades would suggest their occurrence east of Prudhoe Bay in the near future will be unlikely without a dramatic increase in population numbers and range. Because the Steller's Eider is absent to rare in the Point Thomson Action Area, the Proposed Action is not likely to affect the Steller's Eider population. Therefore, the following discussion is focused on impacts to Spectacled Eiders, Yellow-billed Loons, and their habitats.

5.2.1 Permanent Loss of Habitat

Direct permanent loss of habitat will result from construction of gravel pads and roads for Point Thomson Project facilities. Permanent loss of habitat is expected to occur only in the Project Area, where new facilities (gravel pads, roads, buildings, and pipelines) will be constructed (Figures 3.5 and 3.6). Construction of gravel pads and roads will occur during winter, when the listed avian species are elsewhere in marine environments. Although the Point Thomson Project is expected to be in operation for 30 years, at which point facilities and gravel would be decommissioned, the actual lifespan of the facilities is unknown and may depend on whether other hydrocarbon sources are found and developed in the area. Until decommissioning, wildlife habitat will be permanently lost in gravel fill areas because the disturbance is long-term and vegetation recovery is slow in the Arctic (Johnson 1987, Walker et al. 1987, Jorgenson and Joyce 1994). The expected lifespan of the Point Thomson Project encompasses at least 1–2 generations for eiders and loons (North 1994, Petersen et al. 2000), therefore, the loss of habitat to gravel fill and other structures will be treated as permanent in the context of its usefulness for birds. Under the proposed action, permanent habitat loss to the project footprint is projected to be 96.9 ha, covering 0.23% of the 420 km^2 (162-mi^2) Project Area (Figure 3.6, Tables 3.2 and 5.1). Another 40.4 ha (99.8 ac) of tundra will be excavated for the gravel mine and used for an access road, gravel storage, and overburden stockpiles (Table 2.3 and 5.3); because the gravel mine and overburden stockpiles will be used for two years or less and then reclaimed, they are discussed under modification and temporary loss of habitat in Section 5.2.2 below.

5.2.1.1 Spectacled Eider

Direct loss of habitat as a result of gravel deposition and permanent structures for the proposed action will primarily affect barren, dry, or moist habitats; 63% (61.0 ha [150 ac]) of the vegetation loss will be in vegetation types other than water and wet vegetation (Figure 3.6, Table 5.1), because roads and pads will be preferentially located in these areas to reduce impacts to wetlands and birds. Barren, dry, and moist habitats are not frequently used by breeding Spectacled Eiders (Anderson et al. 1999, Warnock and Troy

Table 5.1 Permanent loss of vegetation to the project footprint[a], Point Thomson Project Area, Alaska.

Vegetation Type	Area (ha)	% of Affected Area
River Gravels	0.81	0.8
Gravel Roads and Pads[b]	9.58	9.9
Wet Mud	0.46	0.5
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)	0.04	<0.1
Dry Barren/Forb Complex (river bars in active channels)	<0.01	<0.1
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)	1.09	1.1
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)	3.32	3.4
Dry Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra)	<0.01	<0.1
Moist Sedge, Dwarf Shrub Tundra	23.56	24.3
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	3.33	3.4
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)	18.80	19.4
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	1.36	1.4
Wet Graminoid Tundra (wet saline tundra, saltmarsh)	0.44	0.5
Wet Sedge Tundra	4.18	4.3
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)	26.63	27.5
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation	<0.01	<0.1
Water/Tundra Complex (interconnected ponds with emergent vegetation)	<0.01	<0.1
Aquatic Graminoid Tundra (emergent vegetation)	<0.01	<0.1
Water (ponds, lakes, rivers, streams, saltwater)	3.36	3.5
Total	**96.91**	**100**

Key:
[a] Includes gravel roads, pads, gravel mine, gravel storage pad, dredge material pile, boat launch, service pier, and VSMs; does not include short-term losses due to the gravel mine or overburden stockpiles.
[b] Existing gravel roads and pads that will be covered by new gravel material for the current project.

1992, Johnson et al. 2010a). Smaller amounts (35.9 ha [88.7 ac]) of wet and aquatic vegetation types, which are frequently used by Spectacled Eiders for nesting and brood-rearing, will be permanently lost. Wet and aquatic vegetation types make up 37% of the area permanently lost. The gravel footprint for the Point Thomson project will make use of existing gravel pads (9.0 ha [22 ac] or 9% of the permanent footprint area) at the Central, East, and Alaska State C-1 pads, which will reduce the impact of new construction to wetlands and avian habitat and conserve gravel.

To evaluate the effect of permanent habitat loss on breeding Spectacled Eiders, the density of eiders from surveys of the Project Area were extrapolated to the total area covered by gravel. The highest density of

Spectacled Eiders recorded on aerial surveys in the area was 0.03 pairs/km² (0.08 pairs/mi²), uncorrected for detectability bias (Byrne et al. 1994). Multiplying the density of pairs by the area of vegetation loss (90.4 ha [223 ac]) produces an estimate of 0.03 pairs or 0.06 birds that possibly would be affected by direct habitat loss annually. This estimate assumes that the total area lost to gravel is used by Spectacled Eiders (i.e., it does not factor in habitat suitability) and that the maximal density of Spectacled Eiders, which was measured in 1994 (other years and surveys produced lower estimates), reflects annual use. Both of these assumptions are likely conservative and likely overestimate the number of Spectacled Eiders affected by permanent habitat loss. The Project Area may not be used annually by Spectacled Eiders, and when they do use the area, they occur at low densities (Table 4.1). The direct loss of habitat to gravel placement and permanent structures will likely have little to no effect on breeding by Spectacled Eiders and at most possibly could affect one or two birds on less than an annual frequency. The effect on Spectacled Eiders of permanent loss of habitat will be none to minor.

5.2.1.2 Yellow-billed Loon

Yellow-billed Loons are rare in the terrestrial habitats of the Project Area (Figures 3.9 and 3.10). No Yellow-billed Loons, nests, or broods were observed within the terrestrial portion of the Project Area during surveys conducted for Yellow-billed Loons in 2010 (Johnson et al. 2010b) and no records of nesting exist from other avian aerial and ground surveys conducted in the Project Area between 1980 and 2010 (Wright and Fancy 1980; WCC and ABR 1983; Rodrigues 2002a, b; Noel et al. 2002a, b; Larned et al. 2009; Johnson et al. 2010b). Yellow-billed Loons breed on deep, open lakes. Some deep lakes are present in the Project Area (judged for lakes with >60% ice cover during surveys conducted 25–26 June 2010) (Johnson et al 2010b). The vegetation map does not provide information on lake type or depth needed to determine the direct loss of potential breeding habitat from Point Thomson Project facilities (Figure 3.6). Based on visual appraisal of individual lakes during aerial surveys, the gravel footprints of the proposed roads and pads in the Point Thomson Project Area do not appear to cover the water or shoreline of deep lakes. Based on the relatively low abundance of Yellow-billed Loons recorded in the Point Thomson Project Area and absence of project facilities covering deep lakes or their shorelines, the direct effects of gravel road and pad placement on the breeding habitat of Yellow-billed Loons are likely to be none.

Construction of the service pier and the sealift barge bulkhead at the Central Pad would result in the loss of a very small amount of habitat for Yellow-billed Loons using nearshore waters. Given the vast area available within the barrier islands offshore of Point Thomson, the effect of loss of this habitat is likely to be none to minor.

5.2.2 Modification or Temporary Loss of Habitat

Modification of wildlife habitat could be temporary or permanent depending on the type and duration of the vegetation disturbance. Temporary habitat loss will occur at the gravel mine while the mine is in production (2 years). Once mining is complete, the mine site will be permanently modified to a waterbody. Temporary habitat losses or disturbances could be caused from compaction and delayed snowmelt in the areas underlying the seasonal ice roads and pads to be used during construction and for winter access, in snow disposal sites around the pads during construction and operation, and where snow drifts form around roads and pads constructed of either ice or gravel.

5.2.2.1 Spectacled Eider

The gravel mine will cover 20.1 ha [50 ac] and be operational for two years (Figure 2.4, Table 2.3). The majority of the area affected by temporary loss and long-term to permanent modification due to gravel excavation is water and wet sedge vegetation types (56% or 11.3 ha [28 ac]), which are the most likely to be used by breeding Spectacled Eiders (Table 5.2). The mine site also will occupy 8.7 ha of barren and moist vegetation types. Each year after winter construction of gravel roads and pads, the overburden stockpiles will be picked up and replaced in the mine site. After two years the mine will be contoured and allowed to fill with water from surface runoff. Assuming the mine pit fills with water when decommissioned, the site will become a deep lake (~20 ha [49 ac] in area) with possibly some shallow shoreline areas. Because the habitats modified by the mines are small relative to the available habitat in the Project Area and because the modified habitat will likely become a lake with potential value to breeding eiders, negative effects to Spectacled Eiders are expected to be none to minor.

Seasonal ice roads and pads, overburden stockpiles on ice pads, and snow drifts will cause temporary loss or modification of habitat. Overburden stockpiles (13.8 ha [34 ac]) will be placed on ice pads used each winter for two years. Seasonal ice roads and pads will be used for three seasons during construction, but some ice pads and the sea or tundra ice road connecting Point Thomson to Endicott will be used a 4th season to support construction demobilization and drilling and may be needed in subsequent years for operations and drilling support activities.

The maximum extent of seasonal ice roads in any single year will extend 239.3 km (148.7 mi), and along with seasonal ice pads, will cover 470.0 ha (1,161 ac; Table 5.3). The sea ice road is 91.5 km (56.9 mi) long (including spur roads and the ice road reroute), of which 65.2 km (40.5 mi) will be located on shore-fast sea ice and 26.3 km (16.3 mi) will be on land. The sea ice roads will cover 145.2 ha (359 ac) of marine water and 54.1 ha (134 ac) of tundra in the Action Area. Tundra ice roads for pipeline and field construction will be needed for three years. Tundra ice roads are 147.8 km (91.8 mi) long and combined with all seasonal ice pads cover 270.8 ha (669 ac). A little more than half (52%) of the vegetation covered by seasonal ice roads and pads is in barren, dry, or moist types, and the remainder consists of wet and aquatic types (Table 5.2). The effects of delayed snowmelt and thaw of seasonal ice roads and pads would be confined primarily to the growing season in the year following use of the ice roads and pads or accumulation of snow drifts, whereas the effects of compaction may persist longer. Although some degradation of vegetation may result from ice-road and pad construction on tundra (Pullman et al. 2003), the long-term impacts are considerably less than those associated with gravel roads and pads. Ice roads and snowdrifts may not melt until after some eiders begin nesting (early to late June), thereby reducing the availability of nest sites in nesting habitat. Where most pronounced, compaction of the standing dead vegetation remaining from previous growing seasons could eliminate concealing cover used by ground-nesting birds, such as eiders. However, the vegetation damage that does occur primarily occurs in dry and moist vegetation types (Pullman 2003), which is of little consequence because those types are neither preferred nor frequently used by breeding Spectacled Eiders.

Table 5.2 Temporary and long-term (multiple years) affected areas of vegetation covered by seasonal ice roads and pads, and the gravel mine and overburden stockpile pads in the Point Thomson Project Area, Alaska.

Vegetation Type	Temporary to Short-term (tundra ice roads and pads and overburden stockpiles, including sea ice roads where on land)				Long-term (gravel mine)	
	Tundra (ha)	Sea Ice (ha)	% Affected Area		Multi-year (ha)	% Affected Area
Barren Sand/Gravel	0	1.90	0.7		0	0
Barren Gravel Outcrops	0.07	0	<0.1		0	0
River Gravels	0.34	2.63	1.1		0	0
Gravel Roads and Pads	0.48	0.12	0.2		0	0
Wet Mud	1.40	0.11	0.6		0.14	0.7
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)	1.21	0	0.5		0	0
Dry Barren/Grass Complex	0	0.05	<0.1		0	0
Dry Barren/Forb Complex (river bars in active channels)	0.24	0	0.1		0	0
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)	0.04	1.64	0.6		0	0
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)	5.14	0.09	2.0		0	0
Dry Dwarf Shrub, Fruticose Lichen Tundra (dry acidic tundra)	3.61	0.04	1.4		0	0
Moist Sedge, Dwarf Shrub Tundra	51.40	5.41	21.6		6.74	33.6
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	11.44	0.52	4.5		1.54	7.7
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)	45.46	2.83	18.3		0.32	1.6
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	1.15	0.81	0.7		0	0
Wet Graminoid Tundra (wet saline tundra, saltmarsh)	0.02	2.74	1.0		0	0
Wet Sedge Tundra	5.16	0	2.0		0	0

Vegetation Type	Temporary to Short-term (tundra ice roads and pads and overburden stockpiles, including sea ice roads where on land)				Long-term (gravel mine)	
	Tundra (ha)	Sea Ice (ha)	% Affected Area		Multi-year (ha)	% Affected Area
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)	41.89	2.00	16.7		10.01	49.9
Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh)	0	1.65	0.6		0	0
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation)	0.87	0	0.3		0	0
Water/Tundra Complex (interconnected ponds with emergent vegetation)	0.62	0	0.2		0	0
Aquatic Graminoid Tundra (emergent vegetation)	1.62	0.16	0.7		0	0
Water (ponds, lakes, rivers, streams, saltwater)	27.02	41.49	26.0		1.31	6.54
Total	**199.19**	**64.19**	**100**		**20.06**	**100**

Table 5.3 Lengths and areas of seasonal ice roads and pads in the Point Thomson Project Area, Alaska.

Ice Road or Pad Type[a]	Length (km)	Area (ha)	% of Area
Sea Ice Road	75.61	172.64	36.7
Sea Ice Road Reroute	3.57	8.15	1.7
Sea Ice Road Spur Pad		1.81	0.4
Sea Ice Water Access Road	12.30	18.39	3.9
Onshore Ice Road	75.57	115.18	24.5
Pipeline Ice Pad		14.85	3.2
Pipeline Ice Road	40.53	61.07	13.0
Infield Ice Pad		16.39	3.5
Infield Ice Road	26.07	39.20	8.3
Onshore and Offshore Water Access Ice Road	0.37	0.56	0.1
Onshore Water Access Ice Road	5.25	8.00	1.7
Organic Overburden Storage		2.19	0.5
Inorganic Overburden Storage		11.60	2.5
Total	**239.3**	**470.01**	**100**

The effects of dust fallout, gravel spray, persistent snow drifts, impoundments, thermokarst, water withdrawal, and other habitat alterations adjacent to roads also have the potential to affect eiders. The magnitude of these impacts depends on habitat type, volume of ground ice, hydrologic regime (Brown and Grave 1979, Walker et al. 1987), and season, but the area affected would be small relative to the size of the Project Area. The effects of dust fallout can be observed as far as 100 m (328 ft) from the source (Everett 1980, Walker et al. 1987, Hettinger 1992). Gravel spray is dispersed over a shorter distance than dust. The magnitude of dust effects would depend on traffic intensity, distance from the source, and substrate acidity (Everett 1980, Walker and Everett 1987, Auerbach et al. 1997). The estimated area affected by dust (100 m [328 ft] around all gravel footprints) from the Project would be 486.8 ha (1,203 ac; Table 5.4). The dust shadow includes 42% wet and aquatic vegetation types and 58% barren, dry, and moist vegetation types. The primary effects of dust fallout within this zone of influence could include advanced snowmelt (up to two weeks early), increased depth of seasonal thaw (≤0.5 m [≤1.6 ft] in ice-rich polygons), thermokarst, increased soil pH, reduced photosynthetic capability of plants, lower nutrient levels, and changes in the species composition of plant communities (Spatt 1978, Everett 1980, Spatt and

Miller 1981, Werbe 1980, Klinger et al. 1983, Walker et al. 1985, Walker and Everett 1987, Auerbach et al. 1997). Changes in the plant community include reduction in some mosses, lichens, and willows, and increases in graminoids (Hettinger 1992). Dust fallout normally would be greatest during project construction and considerably less during project operation, when there would be less traffic. Gravel placement for the Project would primarily occur during winter when snow and ice cover will reduce the potential for dust to become airborne. Summer gravel work (placement, compacting, and grading) is expected at Point Thomson, so there would be some dust fallout during construction. Dust also would be produced during normal operations, when air and vehicle traffic is active. Standard dust control practices would be implemented to help reduce the effects and amount of fugitive dust.

Table 5.4 Areas of vegetation types estimated to be affected by dust within 100 m of the project footprint[a] in the Point Thomson Project Area, Alaska.

Vegetation Type	Area (ha)	% of Affected Area
River Gravels	3.38	0.7
Gravel Roads and Pads	5.03	1.0
Wet Mud	5.37	1.1
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)	0.70	0.1
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)	10.64	2.2
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)	19.24	4.0
Moist Sedge, Dwarf Shrub Tundra	125.12	25.7
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	26.16	5.4
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)	87.02	17.9
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	3.90	0.8
Wet Graminoid Tundra (wet saline tundra, saltmarsh)	2.42	0.5
Wet Sedge Tundra	7.25	1.5
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)	150.82	31.0
Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, saltmarsh)	0.44	0.1
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation)	0.34	0.1
Water/Tundra Complex (interconnected ponds with emergent vegetation)	0.01	0.0
Aquatic Graminoid Tundra (emergent vegetation)	0.68	0.1
Water (ponds, lakes, rivers, streams, saltwater)	38.29	7.9
Total	**486.81**	**100**

Key:
[a] Includes gravel roads, pads, dredge material pile, boat launch, service pier, and the gravel mine, access road, and gravel storage and overburden stockpile pads.

Advanced snowmelt from dust fallout can have both positive and negative effects on Spectacled Eiders. Advanced snowmelt may create temporary impoundments along roads and pads if drainage is impeded. Road dust also causes early "green-up" of plant species (e.g., sheathed cottongrass, *Eriophorum vaginatum*) (Makihara 1983, Walker and Everett 1987). Temporary impoundments may have beneficial effects on eiders; in the Kuparuk Oilfield, Spectacled Eiders appear to be attracted to snow-free areas near roads during pre-nesting because of the early availability of open water (Anderson and Cooper 1994, Anderson et al. 1996). Although eiders gain early access to open water and foraging areas, their exposure to traffic-related disturbance and risk of vehicle strikes also increases. In the Project Area, early snowmelt from dust probably may attract some eiders in spring, if open water is unavailable elsewhere. However, the infrequent occurrence and low numbers of Spectacled Eiders along with dust control measures in the Project Area suggests that few if any would be found in the dust shadow at the Project. Therefore, dust fallout is likely to have an insignificant effect on Spectacled Eiders or their habitat.

Thermokarst will be a long-term to permanent habitat modification that can have both positive and negative effects on habitats used by Spectacled Eiders. Although visual and hydrologic effects are long-lasting (Lawson 1986), other ecological changes may benefit plant productivity (Challinor and Gersper 1975, Chapin and Shaver 1981, Ebersole and Webber 1983, Emers et al. 1995) and wildlife use (Truett and Kertell 1992). Thermokarst may increase habitat diversity, species richness, and plant growth on thin gravel fill (Jorgenson and Joyce 1994). In one study of habitat use, severely disturbed tundra associated with a peat road had higher waterfowl use (in relation to availability) than most other undisturbed habitats in Prudhoe Bay (Murphy and Anderson 1993). Overall, however, data are insufficient to assess the net effect of thermokarst on Spectacled Eider and other wildlife populations (Truett and Kertell 1992). Thermokarst impacts are not expected to negatively affect Spectacled Eiders in the Project Area, because of the relatively small amount of disturbed habitat that would be created and the uncertainty of any negative or positive effects from thermokarst.

Water impounded by gravel roads and pads both displaces and attracts birds, depending on the species (Troy 1986; Kertell and Howard 1992; Kertell 1993, 1994). Impoundments can be temporary, disappearing by mid-June, or they can persist through summer. Temporary impoundments preclude nesting (Walker et al. 1987) but also attract some eiders to early melt water. In the Kuparuk Oilfield, Spectacled Eiders are seen in flooded tundra impoundments near roads and pads during early June, when most tundra ponds are still ice covered (Anderson et al. 2001). Temporary impoundments probably would occur for brief periods (probably a week or less) during spring runoff, potentially affecting (both positively and negatively) Spectacled Eiders. Attraction of eiders to impoundments along roads and airstrips could increase the potential for collisions in these areas. However, concentrating construction during winter and low traffic levels during the operation phase of Project would minimize the threat of collisions during the period impoundments would be used (early June). Bridges and culverts will be installed in gravel pads and roads to maintain the natural hydrology so that impoundments should occur infrequently. Where impoundments do occur, they are not likely to be extensive, so little nesting habitat should be affected. Because of the small areas affected by impoundments, and their temporary nature, impoundments would not significantly harm Spectacled Eider habitat in the Point Thomson area.

Water withdrawal from lakes could potentially alter wetland community structure temporarily by changing the hydrologic regime and reduce the availability of suitable nest sites for Spectacled Eiders. Water withdrawal may affect nest site suitability if islets are no longer separated from shorelines, thereby allowing predators easier access to island nests. However, studies to date are inadequate to determine whether water withdrawals under current permit restrictions have reduced water levels to the point where nest sites have become unsuitable. The amount that surface levels drop depends on the amount of water withdrawn, the recharge rate, and the volume, bathymetry, and surface area of the lake; for most large lakes, water withdrawal probably has little effect on the surface level because source lakes are chosen for their large volumes. A study of lakes used for water withdrawal in NPRA found that all had regained their lost volumes by early summer (Baker 2002, Burgess et al. 2003). Also, restrictions would be placed by the State of Alaska on the proportion of water volume the Point Thomson would be permitted to withdraw from each water-source lake. Water withdrawal effects would be reduced because the largest withdrawals would occur during winter to support ice road construction, thereby allowing waterbodies to recharge during spring breakup. Therefore, the effects on Spectacled Eiders of water withdrawal, under current State restrictions, are expected to be so small as to be discountable.

Modification or temporary losses of habitat are most likely to affect bird species, such as Spectacled Eiders, that use the same nest areas each year, although displaced birds probably would nest in adjacent unaffected habitats. The modifications or temporary losses of habitat are small relative to the available habitat, limited in distribution (concentrated along gravel or ice roads and pads), mostly temporary in nature (usually one growing season or less, although temporary losses related to gravel structures could occur annually), and mitigation measures (winter construction, designated snow-deposition sites, dust control, and hydrologic maintenance) would further reduce their probability of occurrence and extent. Two features of the Point Thomson Project, the gravel mine and associated storage pads, will modify habitat for an undetermined length of time. Effects of modification or temporary loss of habitat would be lower in magnitude and duration than effects of permanent habitat loss to gravel from roads and pads.

Although several alterations—dust shadows, impoundments, and thermokarst—have positive and negative effects (early water availability and increased productivity versus potential nest site loss and attraction to areas of potential collisions), it is unclear whether costs or benefits are larger. The overall effects of habitat alteration or temporary loss range from insignificant or discountable to minor in that they may affect a few eiders on an intermittent basis.

5.2.2.2 Yellow-billed Loon

Yellow-billed Loons nest on the shorelines, islands, and emergent vegetation primarily in large, deep lakes. Temporary loss or modification of Yellow-billed Loon breeding habitat could occur from the effects of delayed ice road melting, persistent snow drifts, dust fallout, impoundments, thermokarst, water withdrawal, and other habitat alterations adjacent to roads.

Seasonal tundra ice roads and pads have the potential for indirect effects on Yellow-billed Loon habitat. Earnst (2004) suggested two ways that ice roads on land could negatively affect Yellow-billed Loons: 1) ice roads constructed across breeding lakes might delay ice melt, which could delay the onset of breeding, possibly resulting in reduced nesting success and productivity, and 2) ice roads might increase lake-ice thickness, thereby decreasing the open-water area under the ice necessary for overwintering fish that are food for breeding loons in the following summer. Another potential issue occurs where ice roads cross stream connections to deep lakes with fish populations. Failure of ice road crossing to melt during breakup could interfere with the hydrology of these streams and lakes and prevent the movement of fish into lakes. However, ice road stream crossings will be cut with slots at the end of the ice-road season, so normal flow should be maintained. Because Yellow-billed Loons apparently do not use terrestrial habitats in the Point Thomson Project Area, and because the effects of ice roads are short-term, the likelihood of ice roads having negative effects on lakes used by breeding pairs of Yellow-billed Loons is extremely low. The overall effect of seasonal ice roads and pads on Yellow-billed Loons is none to minor.

Snow dumps and snowdrifts also are unlikely to affect Yellow-billed Loons, unless they are placed on nesting lakes or near nesting habitats. If snow accumulates, or is placed, in habitats used by loons, those habitats would be unavailable for use until the snow melts in early summer, which could compromise nesting, if nest sites or nesting lakes are affected. Impoundments and water withdrawal from lakes to construct the ice roads all have the potential to affect the water level of a lake and consequently, nesting Yellow-billed Loons. Yellow-billed Loons often reuse the same nest site, and even the same nest bowl, from year to year (North 1986). If the water level of a breeding lake has changed enough to flood traditional nest sites or lower the lake surface-water level relative to the shoreline making access to the nest site difficult, loons would likely abandon the nest site, which could result in delayed nesting or even failure to breed. Impoundments can be eliminated or minimized by proper culvert placement and maintaining open culverts during breakup. Active water withdrawal of lakes could cause lakes levels to be lower than normal thereby leaving nesting sites too far from the deep water used by Yellow-billed Loons for escape or making nest sites easier to for nest predators, such as foxes, to approach. Additionally, the drawdown of lake water could affect fish populations. However, permits for water source lakes restrict the volume of water that can be withdrawn and lakes with fish populations are restricted further. Given the low likelihood of Yellow-billed Loons nesting in the Point Thomson Project Area, the effects of snow dumps or drifts, impoundments, and water withdrawal from lakes on Yellow-billed Loon habitat is none to minor.

Most Yellow-billed Loons in the Point Thomson Project Area have been recorded in shallow nearshore waters between the barrier islands and the mainland (Figure 3.8), but densities are relatively low (≤0.02 loons/km² [≤0.04 loons/mi²]; Noel et al. 1999, 2000, 2002a, b) compared to other nonbreeding birds that use the nearshore waters during summer (Petersen et al. 1999b; Noel et al. 2002a, b; Fischer et al. 2002; Fischer and Larned 2004). Dredging and screeding (leveling) of the marine floor in association with the construction and maintenance of the service pier and the sealift barge bulkhead at the Central Pad could result in some temporary and periodic loss of habitat for loons using the nearshore waters. Yellow-billed Loons primarily feed on fish by diving and would be affected by increased turbidity during screeding in summer.

Maintenance screeding to level the seafloor is expected to be needed during every summer in each of the three construction seasons prior to arrival of sealift and coastal barges. The barging season is planned to begin on approximately 15 July and end by 25 August; thus, maintenance screeding is likely to occur sometime during the first half of July. Densities of Yellow-billed Loons in the Beaufort Sea between Oliktok and Brownlow points were significantly higher in July than in June or August (Fischer and Larned 2004). However, only a few Yellow-billed Loons are likely to be within the area proposed for screeding or shallow dredging, which will start at a location approximately 12 m (40 ft) from the sealift bulkhead and progress seaward (north) to about 152 m (500 ft) to establish a maximum water depth of 1.8 m (6 ft). Following the completion of construction, periodic screeding and possibly some dredging will be required for the area seaward of the service pier. The effect is expected to be minor because of the low density of Yellow-billed Loons in the nearshore waters of the Project Area, the small area affected relative to the habitat available within the lagoon system, and the short-term need for dredging (approximately three years and on an as-needed basis thereafter). Construction of the service pier and the sealift barge bulkhead is scheduled to occur in winter and will have minimal effect on Yellow-billed Loon habitat. Therefore, the temporary loss or alteration of habitats by the Project is expected to have none to minor effects on Yellow-billed Loons.

5.2.3 Behavioral Disturbance by Project Activities

Equipment noise, vehicles, pedestrians, aircraft operations, and other activities associated with construction and operation of the project could disturb listed bird species if they occur near the Point Thomson facilities. Construction activities on the pads and roads would be a source of disturbance during the summer breeding season, but because the most disruptive construction activities (e.g., gravel mining, transport, and placement, and road and pad construction) would occur in winter when no eiders are in the Project Area, the effects of construction disturbance would be minimized. Drilling has already occurred at Point Thomson, and future drilling would occur beginning in 2015 and be year-round. As described previously in the Section 2.0, construction activities would be necessary during three summer seasons (2013–2015) following gravel placement (2012/2013 and 2013/2014), in order to prepare the gravel for operational use, hydrotest pipelines, and complete on-pad facilities work.

The reactions of birds to disturbances caused by construction and operations in the existing oilfields are well documented (WCC 1985; Hampton and Joyce 1985; Troy 1986, 1988; Anderson 1992; Anderson et al. 1992; Burgess and Rose 1993; Murphy and Anderson 1993; Johnson et al. 2003b). Vehicles and aircraft are the most ubiquitous sources of oilfield disturbance, but are less disturbing than humans on foot or natural predators (foxes, jaegers, ravens, or gulls). In general, the level of disturbance tends to increase as traffic rate and the number of large, noisy vehicles (and those with unusual profiles such as boom cranes), and aircraft increases. The effects of traffic vary during the breeding season. In the Lisburne Development Area, brood-rearing was the most sensitive period for geese and swans, although the strongest reactions were observed during pre-nesting, when birds were close to roads (Murphy and Anderson 1993). Most reactions to disturbances occur close to active facilities; for example, most reactions by geese and swans occurred within 150–200 m (492–656 ft) of pads and roads with vehicle traffic or construction activity in the Lisburne area (Murphy and Anderson 1993). Approximately 10% of all vehicle passes elicited reactions from geese and swans, with most birds displaying brief alert behavior and a small proportion of birds walking, running, or (rarely) flying (Murphy and Anderson 1993). Nesting Greater White-fronted Geese and Tundra Swans near the Alpine airstrip responded to vehicles, pedestrians, airplanes, and helicopters with concealment and or alert behaviors (Johnson et al. 2003b). Incubation behavior of Greater White-fronted Geese was not related to number of vehicles, and nesting geese concealed (a posture indicating disturbance, in which the head and body are flattened into the nest and terrain to make the bird less conspicuous) less often to vehicles than to aircraft or pedestrians. Tundra Swan incubation behavior did not appear to be adversely affected by proximity to a road, or changes in vehicle traffic rates, but incubating swans were more sensitive (showed alert postures) to vehicle traffic than to aircraft. Nesting success of Greater White-fronted Geese was not adversely affected by proximity to gravel footprints, but failed nests of other birds (primarily other geese, ducks, and loons) were nearer to roads, pads, or airstrips than were successful nests (Johnson et al. 2003b).

The effects of fixed-wing aircraft on nesting birds have been studied at the Alpine airstrip (Johnson et al. 2003b). Nesting Greater White-fronted Geese and Tundra Swans near the Alpine airstrip responded to vehicles, pedestrians, airplanes, and helicopters with concealment and or alert behaviors, and incubation constancy of Greater White-fronted Geese declined slightly with increasing airplane flights (Johnson et al. 2003b). Incubating geese at two successful nests (of 10 nests monitored) were observed to flush in response to aircraft (6 times for DC-6s, 2 times for helicopters, 1 time for a Twin Otter). Both nests were near (<150 m [492 ft]) the airstrip or near a helipad and exposed to aircraft noise levels estimated to exceed 100 decibels (measured using A-weighted scale) (dBA). Flushing was more likely to occur during DC-6 flights than during Twin Otter flights, but flushes represented ≤9% of all incubation recesses at each nest, despite >470 aircraft events at each nest. The reaction of geese to aircraft appeared to decrease as nesting progressed, suggesting that their sensitivity may have decreased. Reactions to aircraft varied by individual, by aircraft type, with distance to aircraft, and with frequency and timing of exposure. Nesting success of Greater White-fronted Geese was not related to distance from the airstrip, but nesting success of other birds (primarily other geese, ducks, and loons) declined when near the airstrip. In addition to the studies at Alpine on geese and swans, studies also were conducted on Brant reactions to fixed-wing and helicopter disturbance; these studies concentrated on molting and staging Brant in large flocks (Derksen et al. 1992, Miller et al. 1994, Ward et al. 1994, Ward et al. 1999). The Project plans call for 2–3 flights /day for fixed wing and 2–3 flights/day for helicopters, many fewer than the maximal 22 flights/day at the Alpine Development (Johnson 2003b). Landings and takeoffs by twin-engine airplanes would occur most frequently at Point Thomson, but these aircraft are smaller and produce less noise than the larger 4-engine aircraft (DC-6 and C-130) scheduled for 1–2 flights/year to transport equipment and materials. When helicopters are used, noise levels could be higher, depending on flight altitude and flight paths. Helicopter flights to and from Deadhorse will generally follow the same route and altitude used by airplanes, thus reducing noise and disturbance effects. Additional flights by helicopters might be required during summer to support civil surveys, tundra cleanup, and monitoring of hydrology, fisheries, or wildlife, and these flights would not follow the prescribed flight route.

5.2.3.1 Spectacled Eider

Specific reactions of Spectacled Eiders to road traffic, boats, or aircraft have not been studied, but general observations in the Kuparuk Oilfield indicate that Spectacled Eiders respond similarly to other waterfowl, with the greatest disturbance of birds along roads occurring when vehicles stop or are especially noisy (B. Anderson, ABR, Inc., personal communication). The distribution of eider nests in the Kuparuk Oilfield indicates that eiders select nest sites farther from roads than the sites used by pre-nesting pairs, suggesting that nesting females may be more sensitive to disturbance (Anderson et al. 1996), at least when choosing nest sites. Studies of oilfield effects on Spectacled Eider distribution on the Colville River delta found no evidence of displacement around newly constructed oilfield facilities, including an airstrip. Pre-nesting Spectacled Eiders were not significantly farther from oilfield footprints between pre- and post-construction periods for the Alpine, CD-3, and CD-4 projects (Johnson et al. 2008). In an area of concentrated Spectacled Eider nesting, the distance of nests from a new well pad and airstrip at CD-3 did not significantly vary among years, construction periods, or nest fate when compared between four years before construction and three years of construction and operation (Johnson et al. 2008). Radio-telemetry tracking of Spectacled Eider broods in the Prudhoe Bay and Kuparuk oilfields has shown that female eiders with broods do cross over oilfield roads and under pipelines to reach brood-rearing habitats (TERA 1995a, 1996).

The Project airstrip also could have short- and long-term effects on Spectacled Eiders, including behavioral disturbance of eiders by aircraft using the airstrip, temporary or permanent displacement of eiders nesting within the noise-disturbance zone around the airstrip, and habitat modification near the airstrip from dust and gravel spray (evaluated above in Moderation and Temporary Loss of Habitat). Birds can be sensitive to noise disturbance during any life-history stage, but they are more vulnerable during some periods. During nesting, eiders are restricted to one site for 3–4 weeks, and disturbance during this period can lead to nest failure. Following nesting, eiders typically move from nest sites to other locations and different habitats, and generally are capable of moving away from disturbance sources (e.g., an active airstrip) if necessary. The Point Thomson airstrip would support air-traffic levels of 2–3 flights/day for fixed wing aircraft (deHavilland Twin Otter or similar aircraft) and 2–3 helicopter flights/day. Increased air traffic could disturb any eiders occurring near the new airstrip because of increased noise levels and the visual stimulus of low-flying aircraft. Noise disturbance would be highest during takeoffs and landings by fixed-wing aircraft (single or twin-engine) and helicopters. Based on noise modeling for deHavilland DHC6 Twin Otters and Cessna 207s at the CD-3 airstrip on the Colville River delta, the area affected by 85 dBA can be approximated by an irregular shaped contour extending to

~2,050 m (6,726 ft) from the ends of the runway and ~225 m (738 ft) from the sides, which encompasses 1.26 km² (~311 ac; see Figure 2 in Johnson et al. 2004). The size and shape will be affected by the airstrip length and where aircraft land and take off, as well as throttle settings and atmospheric conditions, so this noise contour will vary. Increases in noise also would be generated by helicopters, which would also land on the airstrip. The noise from typical helicopters (Bell 206, 212, or 412) is ~92 dBA at 150 m agl (500 ft) (Johnson et al. 2003b). Helicopters and airplanes would be required to fly at 454 m agl (1,500 ft) following a flight corridor inland of the coast. Flights at this altitude are unlikely to affect Spectacled Eiders because noise levels and visual stimuli are reduced. Additional flights by helicopters might be required during summer to support civil surveys, tundra cleanup, and monitoring of hydrology, fisheries, or wildlife, and these flights would not follow the prescribed flight route.

No published information is available on the effects of aircraft overflights on Spectacled Eiders. Given the lack of species-specific data, the types and magnitudes of the effects of aircraft disturbance on nesting Spectacled Eiders are uncertain but may include displacement, a reduction in incubation constancy, increases in concealment, infrequent instances of flushing, and perhaps some reduction in nesting success where Spectacled Eider nesting occurs.

No studies have been conducted on vessel effects on Spectacled Eiders. Boat and barge traffic could result in disturbance and displacement of Spectacled Eiders. Boat traffic in the Project Area for spill-response material deployment and oil spill practice drills would occur after breakup and possibly would disturb eiders. Noisy boats, such as airboats which are used in shallow areas, have a greater potential for disturbance than small boats with outboard motors. The schedule and location of boat activities has not been defined, but oil-spill response boat traffic likely would be restricted to the coastline and streams where spill containment supplies are located. Containment sites require equipment mobilization, maintenance, and demobilization during the ice-free seasons, which is when Spectacled Eiders could be in the area. Coastal boat traffic is not likely to affect breeding Spectacled Eiders, because they tend to nest on lakes and wetlands near but not at the coast. Boat traffic on streams could potentially affect areas eiders might use for nesting, if spill containment supplies are staged along streams. Also, boat traffic in marine areas could encounter post-breeding eiders departing for molting areas. Barge traffic is scheduled for the ice free period of 15 July to 25 August, the period that Spectacled Eiders might occur in the marine zone (Figure 4.5). Nonetheless, records of Spectacled Eiders using the marine environment in the Project Area are rare and records of Spectacled Eider nests and pre-nesting groups are sparse east of Bullen Point, so it is unlikely that boat and barge traffic will encounter more than a few Spectacled Eiders on an occasional frequency. Spectacled Eiders would probably be displaced from areas of boat and barge traffic, but resume normal activities after the vessels have passed.

Based on these reviews, if Spectacled Eiders occur in the Point Thomson area near a source of disturbance related to human activity, they may show short-term alterations in their behavior and possibly minor effects on nesting success from project-related disturbance; for waterfowl in the Lisburne study, the effects occurred within 200 m of drilling pads and within 150 m (492 ft) of the gravel roads (Murphy and Anderson 1993). No Spectacled Eiders have been observed within 200 m (656 ft) of proposed gravel footprints in the Point Thomson Project Area during pre-nesting aerial surveys, nor have any nests been observed; the nearest Spectacled Eiders were a pre-nesting group ~300 m (~984 ft) from the proposed road to West Pad in 2001 and another group ~200 m (~656 ft) from the proposed pipeline in the same area in 1999 (Figure 4.5). Pipelines generally have no human activity associated with them during summer, except for tundra cleanup (for 1 or 2 summers after construction of pipeline) and in the rare cases of a leak or emergency maintenance that does not occur during winter (access to pipelines will require tundra travel, which is restricted during summer). Tundra cleanup involves workers on foot, possibly transported by helicopter, picking up debris after winter construction. Therefore, pipelines are not a site of routine human activity during summer, but could be a temporary site for human disturbance to Spectacled Eiders for a few years of tundra cleanup and emergency pipeline maintenance.

In general, the effects of vehicle traffic and construction activity on wildlife would be mitigated because Point Thomson would not be connected by all-season roads to other oil fields or the Alaska highway system, which reduces traffic levels and restricts breeding-season vehicle traffic to gravel roads in the Project Area. In addition, reliance on primarily winter construction should reduce traffic and pad-activity impacts during the breeding season. Although there would be some construction-related activity during the first two summers following gravel placement to prepare the pads for aircraft, vehicles, and operation, the levels would drop considerably after two years of construction. During the operation phase, vehicle traffic and human activity would decline from construction levels. Under these projected construction schedules and traffic rates, the potential levels of aircraft and vehicle disturbance during construction and operation likely would not have serious effects on the few Spectacled Eiders that might occur in the Point Thomson area.

Behavior changes as a result of disturbance from Point Thomson activities may affect a few individual Spectacled Eiders; however, population-level impacts are not likely to occur since Spectacled Eiders in the area are at low densities and may not occur there annually. Behavioral disturbance of individual eiders may result in decreased feeding and resting, reduced incubation constancy, flushing eiders off nests or away from broods, or displacement (see Section 5.2.4). Given the small number of birds and low probability of nests in the area, disturbance is unlikely to affect productivity of more than 1 or 2 Spectacled Eiders. Disturbance from project activities would be minimized and mitigated by infield only road access, winter construction (predominantly), low levels of aircraft traffic, and strict aircraft flight altitudes.

5.2.3.2 Yellow-billed Loon

Yellow-billed loon responses to disturbance vary with the type of disturbance, distance from disturbance, and breeding status. North (1994) described Yellow-billed Loons as being sensitive to disturbance at nests and roosting sites, but reported only 1 documented case of chick loss (to a Glaucous Gull) following a human disturbance at a nest (North and Ryan 1988). Recent studies of Yellow-billed Loons conducted from helicopters, found that most loons on nests react with alert or concealment behavior during overflights at 76 m (200 ft) above ground level (A. Wildman, ABR Inc., personal communication). Loons left their nests during helicopter overflights only when in the laying phase of nesting. When helicopters landed 100–200 m (328–656 ft) from nests, some loons left their nests by swimming away while others remained on the nest (Johnson et al. 2010a, 2011). Those loons that remained on nests departed when biologists exited the helicopter and started approaching nest sites. The distance from a loon to the helicopter or biologists at which loons left the nest varied, but the general behavioral response was to swim away from the nest and return once the people departed. The probability that the facilities and activities of the Point Thomson Project could disturb breeding Yellow-billed Loons is extremely low because nests or broods have not been observed in the Project Area. The effects of disturbance to breeding Yellow-billed Loons from Project activities is likely to be none to minor because of the low probability that loons would be using terrestrial habitats in the Project Area.

Yellow-billed Loons using the nearshore marine waters during summer may be disturbed by marine vessels and barges transporting materials and facility modules to and from the Project docks. Other activities in the nearshore waters that could affect Yellow-billed Loons would include boat traffic supporting oil spill response and oil spill drills. No data are available concerning the effects of vessels on Yellow-billed Loons (Earnst 2004), but if they react similarly to other loons when approached by vessels, they would tend to move away either by swimming or diving, or if the disturbance is severe, by taking flight.

Reported densities of Yellow-billed Loons in the Beaufort Sea between Spy Island and Brownlow Point is low (≤0.02 loons/km² [≤0.04 loons/mi²]), and most loons were west of West Dock in Prudhoe Bay (Noel et al. 1999, 2000, 2002a, b). Densities of Yellow-billed Loons were significantly different among habitats, with the highest densities near the barrier islands and the lowest densities in the marine habitat north of the barrier islands (Fisher et al. 2002). Most Yellow-billed Loons are found in water ≤ 10 m deep (Fisher and Larned 2004). Densities of Yellow-billed Loons were significantly higher in July than in June or August (Fisher and Larned 2004).

To evaluate how many Yellow-billed Loons might be affected by disturbance from marine vessel traffic, a 1.6-km (1-mi) buffer was measured around the barge route that falls inside the barrier islands, where most Yellow-billed Loons occur (Figure 3.8). No data have been published on the distance that marine vessel traffic would affect Yellow-billed Loons, but a 1.6-km (1-mi) buffer around Yellow-billed Loon nest sites is currently used as a protective zone within which development would be excluded in NPRA (Required Operating Procedure E11, BLM 2008). The area within 1.6 km (1-mi) of the barge route was multiplied by the density of Yellow-billed Loons recorded from aerial surveys of the nearshore area. The density of Yellow-billed Loons between West Dock to Brownlow Point, the portion of the surveys corresponding to the Project Action Area, was 0.005 loons/km² (0.013 loons/mi²) in both 2000 (n = 3 surveys) and 2001 (n = 2 surveys) (calculated from Tables 2, 5, and 6 in Noel et al. 2002a and Tables 2, 3, and 4 in Noel et al. 2002b). Multiplying that density by the area of the 1.6-km (1-mi) buffer (319.5 km² [123.4 mi²]) produces an estimate of <2 loons that would potentially encounter a single moving vessel and potentially be disturbed or displaced by it. This estimate assumes that the aerial surveys were a representative sample of the barge route and buffer, that the density of Yellow-billed Loons is uniform over the area sampled, and that the estimated density reflects annual use during the season barges operate (15 July–25 August). These assumptions appear reasonable for the surveys conducted by Noel et al. (2002a, b). The number of coastal barge trips (inside the barrier islands) during construction is expected to be approximately 170 round trips, during drilling between 20–100 round trips per year, and during the operation phase about 15 round trips per year may be needed (Table 2.2). Thus, numerous encounters with Yellow-billed Loons within 1.6 km (1 mi) of the barge could occur each year. Very few Yellow-billed Loons have been recorded outside the barrier islands in the Point Thomson Project Area, and it is expected that encounters with the oceangoing sealift barges (total of 10 sealift barges over three construction seasons) in that area would be unlikely (Figure 3.8).

The negative effects on loons from disturbance by barge traffic in nearshore waters in the Point Thomson Project Area are likely to be minor. Barge traffic would have a local influence on Yellow-billed Loons and be short in duration. Similar effects would be expected for small vessel traffic. Low numbers of loons are likely to be affected by each barge trip, although annually encounters could be numerous because of frequent barge trips. However, the likely response of loons to vessel traffic (particularly to slow-moving barges) is displacement by swimming or diving then swimming away from the vessel, which is a relatively low-level response to disturbance. Responses also would likely be short in duration, with loons resuming normal activities after the barges pass or when the loon stops swimming away from the vessel. Increased vessel traffic or smaller and faster vessels beyond that described here could increase the level of anthropogenic disturbance and the level of responses by Yellow-billed Loons in the marine environment. In contrast, the effects of disturbance in the terrestrial environment are less due to the low probability of Yellow-billed Loons occurring in breeding habitat in the Point Thomson Project Area. Overall, the effects of disturbance from Project related facilities and activities would be none to minor.

5.2.4 Indirect Loss of Habitat Through Displacement

Habitats experiencing increased noise levels, vehicle traffic, or exposed to aircraft overflights adjacent to oilfield facilities could become less attractive to nesting birds. High noise levels (such as during drilling or aircraft flights) could cause a long-term reduction of eider use in the immediate areas of frequent or constant disturbance. However, with major construction scheduled for winter and completed in three years at Point Thomson, the steady-state sources of noise during the operation phase (from processing plants and other facilities) should not produce high levels of noise during the breeding season when Spectacled Eiders or Yellow-billed Loons might use the area. The primary sources of noise during summers after construction is completed at Point Thomson would be aircraft and vehicles (including some heavy equipment).

Early studies of noise effects on birds in the Arctic found that simulated compressor noise did not affect nesting Lapland Longspurs (Gollop et al. 1974), but it decreased habitat use by fall-staging Snow Geese (Gollop and Davis 1974). More recently, increased noise at the Central Compressor Plant in the Prudhoe Bay Oilfield caused Spectacled Eiders (without nests) during the nesting period, Canada Geese during pre-nesting, and Tundra Swans during brood-rearing to shift away (average distances moved of 460–723 m [1,509–2,372 ft]) from habitats close to the compressor plant, although most waterfowl species (including Canada Geese during nesting, Brant, Greater White-fronted Geese, loons, ducks) habituated to the noise levels (Anderson et al. 1992). Wildlife near a new processing facility (CPF-3) in the Kuparuk Oilfield showed variable responses to disturbance (Hampton and Joyce 1985). Nesting Greater White-fronted Geese increased in numbers during the first two construction years and declined in the second two construction years within 500 m (1,640 ft) of the new airstrip at Alpine when compared with preconstruction years (Johnson et al. 2003b). Increases in nest densities away from the airstrip appeared to compensate for losses near the airstrip, with no significant effects on use of preferred habitats or nesting success. Radio-telemetry studies of Spectacled Eider broods in the Kuparuk and Prudhoe Bay oilfields found broods in habitats near (≤200 m [≤656 ft]) high-noise facilities, such as gathering centers and processing facilities (TERA 1995a, 1996). Overall, these studies suggest that waterbirds using the area may habituate to steady-state operational noises near the pads, but aircraft, drilling, or vehicle disturbance may displace a few from the immediate area (within ~500–700 m [1,640–2.297 ft]) surrounding the Point Thomson facilities. These studies also suggest that for some species, displacement may have little effect on nesting success.

5.2.4.1 Spectacled Eider

The lack of specific data on the responses of Spectacled Eiders to vehicles, aircraft, and construction activities makes an estimation of project impacts somewhat uncertain. Based on studies of other species, responses would likely include displacement from but not abandonment of preferred habitats (Murphy and Anderson 1993, Johnson et al. 2003b). The USFWS currently uses a 200-m (656-ft) buffer around Spectacled Eider nests as a zone where disturbance from human activity is prohibited. The area within 200 m of gravel roads, pads, and mine site at Point Thomson is 977 ha (2,414 ac; Table 5.5). Assuming that maximal density of Spectacled Eiders reported for the Point Thomson Project Area (0.06 birds/km^2 [0.16 birds/mi^2], Byrne et al. 1994) is evenly distributed, the 200 m (656 ft) disturbance zone could affect a maximum of 0.6 Spectacled Eiders. Because few eiders and no nests have been located in the Point Thomson Project Area, even the worst-case effect (i.e., total abandonment of the disturbance buffers by Spectacled Eiders without relocation to other areas) should affect no more than 1 or 2 individual eiders.

Project related disturbance and noise may result in displacement of a few individual Spectacled Eiders; however, population-level impacts are not likely to occur since the effects of the action will be localized in an area with low densities of Spectacled Eiders. Furthermore, disturbance from project activities to Spectacled Eiders in the Point Thomson Project Area would be minimized and mitigated by roadless access, winter construction of roads and pads, and low levels of aircraft traffic (primarily helicopters and twin-engine aircraft) during the breeding season. The effects of displacement by disturbance on Spectacled Eiders are expected to be none to minor.

5.2.4.2 Yellow-billed Loon

Because Yellow-billed Loons have not been found to nest in the Point Thomson Project Area, breeding Yellow-billed Loons would not likely be displaced from habitat by disturbance from construction, aircraft, vehicles, people, and noise. Some displacement of Yellow-billed Loons might occur in the nearshore waters during construction, maintenance, and operation of the sealift off-loading bulkhead, during dredging and screeding in the docking area, and by barge traffic. Displacement of Yellow-billed loons along the barge route would be temporary. As discussed in Section 5.2.3, no definitive zone of disturbance has been reported for Yellow-billed Loons, but applying the 1.6-km (1-mi) buffer to the coastal barge route produces an area of 319.5 km² (123.4 mi²). If Yellow-billed Loons within that zone are displaced, <2 loons might be displaced assuming the maximal density of Yellow-billed Loons recorded during aerial surveys (Noel et al. 2002a, b) is present during a barge trip. Barge trips will be frequent (80–180 per year depending on phase [Table 2.2]), so multiple encounters with loons would be expected. However, Yellow-billed Loons would likely respond with low-level reactions (swimming away) and return to the area after the barges pass, so displacement would be temporary. Overall habitat displacement from disturbance would have none to minor effects on Yellow-billed Loons, because of the low probability of displacement in terrestrial habitats, the short duration of displacement in marine areas, and the low numbers of loons affected.

Table 5.5 Areas of vegetation within a 200-m buffer used to estimate the area affected by human disturbance (construction, drilling, maintenance, and operation activities) around the project footprint[a] in the Point Thomson Project Area, Alaska.

Vegetation Type	200-m Buffer Area (ha)	% of Affected Area
River Gravels	5.78	0.6
Gravel Roads and Pads	10.91	1.1
Wet Mud	11.30	1.2
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)	2.44	0.2
Dry Barren/Forb, Graminoid Complex (saline coastal barrens)	19.67	2.0
Dry Dwarf Shrub, Crustose Lichen Tundra (Dryas tundra, pingos)	40.40	4.1
Moist Sedge, Dwarf Shrub Tundra	220.28	22.5
Moist Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	46.98	4.8
Moist Sedge, Dwarf Shrub/Wet Graminoid Complex (moist patterned ground complex)	162.61	16.6
Wet Graminoid, Dwarf Shrub Tundra/Barren Complex (frost-scar tundra complex)	11.01	1.1
Wet Graminoid Tundra (wet saline tundra, salt marsh)	6.47	0.7
Wet Sedge Tundra	21.47	2.2
Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex (wet patterned ground complex)	289.33	29.6
Wet Barren/Wet Sedge Tundra Complex (barren/saline tundra complex, salt marsh)	1.21	0.1
Wet Sedge Tundra/Water Complex (interconnected ponds with no emergent vegetation)	3.83	0.4
Water/Tundra Complex (interconnected ponds with emergent vegetation)	2.17	0.2
Aquatic Graminoid Tundra (emergent vegetation)	2.75	0.3
Water (ponds, lakes, rivers, streams, saltwater)	118.68	12.1
Total	**977.27**	**100**

Key:
[a] Includes gravel roads, pads, dredge material pile, boat launch, service pier, and the gravel mine, access road, and gravel storage and overburden stockpiles pads

5.2.5 Attraction of Predators to Facilities and Increased Predation

The effects of development on predators of nests and birds are of concern because they can reduce productivity by preying on eggs and chicks and they can reduce survivorship of adults (Truett et al. 1997, Liebezeit et al. 2009, Johnson et al. 2010a, and reviews in Day 1998 and NRC 2003). Two avian predators, Glaucous Gulls (*Larus hyperboreus*) and Common Ravens (*Corvus corax*), are attracted to garbage and food handouts at human settlements and camps. Although adequate historical records are lacking, it appears that the populations of these two species have increased because of increased availability of these anthropogenic foods and nesting sites on man-made structures. Ravens and some raptors nest on buildings and other structures in the existing oilfields, including elevated pipelines, bridges, towers, drill rigs, and wellheads (Ritchie 1991, Powell and Backensto 2009, Sanzone et al. 2010). At the Alpine Development, ravens began nesting on buildings and drill rigs where none had been before that oilfield's construction, but other avian predators (jaegers and Glaucous Gulls) did not increase in the area in the four years after initial construction (Johnson et al. 2003b). The presence of the new Point Thomson facilities could cause small increases in numbers of ravens and gulls in the Project Area if any edible garbage becomes available at the pads or the new facilities provide nesting sites for ravens. Effective food and garbage control may minimize the attraction of predators to oilfield facilities; both food and waste management handling is addressed in the Red Book, Polar Bear and Wildlife Interaction Plan, annual training, and specific project training, as part of the environmental awareness program that all workers are required to take.

Mammalian predators of birds and their eggs that also are attracted to areas of human activity where they readily feed on garbage and handouts include foxes (arctic fox, *Alopex lagopus*, and red fox, *Vulpes vulpes*) and bears (grizzly bear, *Ursus arctos*, and polar bear) (Eberhardt et al. 1982, Follmann 1989, Follmann and Hechtel 1990, Shideler and Hechtel 1993, Truett 1993). Foxes and, to a lesser extent, bears also use human structures (gravel berms and empty pipes) for denning (Burgess et al. 1993; R. Shideler, personal communication). Thus, the Point Thomson facilities would likely attract some foxes throughout the year, and possibly grizzly bears in summer and fall. The potential for attraction of polar bears is addressed in preceding sections. A study of fox denning at the Alpine Development concluded that construction of that facility had no effect on the occupation of dens in the area or on the production of pups (Johnson et al. 2003b). That study was unable to determine if foxes were attracted to the area or whether increased predation resulted, but an effective control program on food wastes probably limited any potential benefits to fox productivity.

5.2.5.1 Spectacled Eider

Increased predator populations around oilfield developments may increase predation on prey populations, such as Spectacled Eiders and their nests (Martin 1997). This effect is inferred from the higher number of foxes, increased density of fox dens (Eberhardt et al. 1982, Burgess et al. 1993), and higher numbers of bears (Shideler and Hechtel 1995), gulls, and ravens in the North Slope oilfields. Because gulls, ravens, foxes, and bears prey on eider eggs and young, increases in their populations in the Point Thomson Project Area could result in lower nesting success, lower productivity for any nests occurring in the area. Foxes also are known to prey on adult waterfowl, probably including Spectacled Eiders. Although grizzly bears eat eggs of other waterfowl, and likely would take eider eggs if available, polar bears are less likely to affect nesting Spectacled Eiders because they are not usually in the area during nesting. The attraction of predators to oilfield facilities can be reduced by strict adherence to ExxonMobil requirements concerning food and garbage control.

Construction of buildings and towers as a result of project construction would create perching areas for predatory avian species. Perch sites for avian predators on powerlines were eliminated under the proposed action, because those lines would be placed in cable trays on VSMs or buried in trenches along roadways. Pipelines (elevated 2.1 m [7 ft] minimum, as measured at VSMs) and buildings at pads would provide some perch opportunities. Potential nest sites on buildings, towers, and drill rigs would not be available for Common Ravens if special efforts to eliminate this attraction were taken. New facilities may attract some predators, and nesting attempts by Common Ravens would increase, but increases in jaegers, gulls, and fox denning (and pup production) under current food and waste management plans are less likely, as evidenced by lack of growth in numbers of these predators at a similar facility on the Colville River delta (the Alpine Development, Johnson et al. 2003b).

While a food and waste management program currently exists to reduce the attraction of predators to oilfield facilities, a few predators may be attracted to facilities because of increased nest and perch opportunities (e.g., Common Ravens) or because of previously learned associations between human development and food (e.g., bears and foxes that have experience with landfills). The increased frequency of predators in the area of oilfield development may increase the predation rate on birds and nests in the area. However, the impact to individual Spectacled Eiders would not be significant from a population standpoint because few if any nest in the Point Thomson Project Area. Any potential adverse affects on listed eiders would be minimized by food and waste management practices addressed in the Polar Bear and Wildlife Interaction Plan, the Red Book, training, and the environmental awareness program that all workers are required to take.

5.2.5.2 Yellow-billed Loon

Yellow-billed Loons face pressure from the same predators as Spectacled Eiders, and the effect of increased predator populations in the vicinity of oil field developments would be the same as for other species of ground-nesting birds. Yellow-billed Loons are susceptible to predators during nesting, when incubating adults and eggs are most accessible to predators. Elevated numbers of nest predators (i.e., predators taking eggs) would have a negative effect on Yellow-billed Loon productivity, because predation is the primary cause of egg loss and contributes to chick mortality as well. Time-lapse cameras used to observe nesting Yellow-billed Loons on the North Slope have documented egg and/or chick predation by Glaucous Gull, Parasitic Jaeger, Golden Eagle, Common Raven, red fox, and grizzly bear (Johnson et al. 2010a, 2011). Reported incidences of predation on adult Yellow-billed Loons are rare (North 1994). No effects are expected from potential increases in predator populations on Yellow-billed Loons, because Yellow-billed Loons are not known to nest in the Project Area. Most use of the Project Area is by non- or post-breeding loons in nearshore waters, where terrestrial predators are not a threat. Additionally, current oil field practices on food and waste-handling would likely reduce the attraction of predators to the Project Area, and thus reduce any potential reduction of productivity for loons.

5.2.6 Mortality and Injury

Collisions of flying birds with vehicles (trucks and aircraft at the airstrip) and with structures (pipelines, buildings, or towers) may affect Spectacled Eiders and Yellow-billed Loons at the Project facilities. Bird collisions with powerlines in the Lisburne Development Area were infrequent (estimated 0.013–0.098% of all crossings) and fatalities were an unknown proportion of those collisions (Anderson and Murphy 1988). Powerlines in the Project Area will be in cable trays on VSMs or buried along roadways and will pose no additional collision risk. The lower height and greater visibility of the pipeline/powerline combination, should not pose as great a risk for collisions as traditional elevated powerlines on poles. Collisions with buildings, towers, drill rigs, and other structures are a possibility, particularly in coastal areas where foggy conditions are prevalent. Most buildings are low (maximum height is approximately 18 m [60 ft]) and should be visible to eiders and loons under normal conditions, but communication towers (61 m [200 ft] high), would increase collision risk. Permanent communications towers will stand without guy wires, which will reduce the overall collision risk to birds. A temporary tower (23 m tall [75 ft]) with guy wires will be erected on Central Pad from December 2012 to March or April 2013. The temporary tower will be removed from service after the permanent telecommunications tower is installed and commissioned for service (March–April 2013), which is before migrating eiders and loons arrive. Drill rigs are much taller (61 m tall [200 ft]) than the permanent buildings on pads, but pose a short-term risk to flying eiders only where drilling would occur. Lighting of drill rigs and pads may attract or disorient flying eiders under low-light conditions (Day et al. 2002, 2003). Appropriate mitigation (such as light shields) may be proposed for consideration in the agency review process to reduce the probability of collisions in areas where Spectacled Eiders and Yellow-billed Loons are at risk.

Increased subsistence hunting and fishing and sport hunting could increase injury and mortality for listed species. Sport hunting would not be allowed from oilfield facilities. It is unlikely that subsistence hunting or fishing would increase in the Point Thomson Project Area because it is remote and not connected by roads to any villages. Some hunting mortality of Spectacled Eiders and Yellow-billed Loons occurs during subsistence hunting, and as bycatch during fishing (Brower and Opie 1997, Schmutz 2009). Because access to the Point Thomson Project Area will not change for subsistence hunters, and because eider and loon densities are low, it is unlikely that any changes in hunting and fishing (bycatch) mortality will occur as a result of the Point Thomson Project.

5.2.6.1 Spectacled Eider

Risks of eider collisions with vehicles, aircraft, buildings, and other structures would be greatest during summer when eiders breed or fly through the Point Thomson area. During the summer construction period, traffic levels are predicted to be high (20–30 trips/day, mostly pickup trucks with occasional service trucks). Aircraft flights will be relatively low (2–3 fixed wing and 2–3 helicopter flights/day [roundtrips]). During the operation phase, vehicle traffic would be reduced (5–10 trips/day), and collision risk would also decline. Records of Spectacled Eider collisions are not readily available, even in long-established oilfields such as Prudhoe Bay and Kuparuk, where powerlines, towers, and tall buildings are numerous and traffic levels for vehicles and aircraft are high. Relative to existing oilfield infrastructure on the North Slope, Point Thomson should pose a relatively low collision risk given the low density of pads and roads, low traffic rates, absence of elevated powerlines, and low number of tall structures. The flight paths, flight altitudes, and numbers of migrating Spectacled Eiders in the Point Thomson Project Area are unknown, so the risk of collision with tall structures is difficult to evaluate. Overall, the probability of Spectacled Eider collisions should be low because so few Spectacled Eiders occur in this area.

All the forms of mortality and injury discussed in this section have a low likelihood and frequency of occurrence for Spectacled Eiders. Mortality due to bird strikes is unlikely to occur, and if it does occur, it would be an unusual event that might affect a few individual Spectacled Eiders. Potential effects on listed eiders would be minimized and mitigated by scheduling major construction during winter, eliminating powerlines and guywires on permanent towers, and shielding lights so that birds are not attracted or disoriented. The effects of collision mortality and injury on Spectacled Eiders are likely to be none to minor.

5.2.6.2 Yellow-billed Loon

Direct mortality or injury of Yellow-billed Loons could occur from collisions by flying loons with communication towers, overhead power lines, facilities (flaring towers and buildings), vehicles, and marine vessels. These types of collisions are most likely during spring or fall migration when birds may be traversing the area and when visibility is limited (fog, snow storms, or at night). Data on the flight altitudes, flight paths, and numbers of migrating Yellow-billed Loons are lacking for the Point Thomson Project Area, so the magnitude of this hazard is unknown.

Structures located in nearshore water (e.g., the barge-bridge system) or at the coast (e.g., on the Central, East, and West pads) are likely collision risks for Yellow-billed Loons, as loons tend to migrate along the coastline and over nearshore waters (North 1994). The barge service pier extends above the sea surface just offshore from the Central Pad and could pose a collision hazard for Yellow-billed Loons flying at low altitudes during periods of poor visibility. However, the low height and short extension of these structures into marine waters reduces the collision risk. Also, the barge-bridge system will be in place only 2–4 weeks during late summer. Bird strikes along the coast could injure or kill a few Yellow-billed Loons infrequently; thus, collisions with structures at the coast would have a minor effect on loons.

Yellow-billed Loons foraging in the nearshore waters may be at risk for collisions with marine vessels, particularly when visibility is limited. Local movement of Yellow-billed Loons within the nearshore waters is unknown, but flight altitudes can be assumed to be fairly close to the water level. Because densities of Yellow-billed Loons are low in the nearshore waters and marine vessel traffic will be relatively infrequent and mostly slow-moving, the number of collisions is expected to be low, for both aerial and in-water collisions. Overall, the increased mortality of Yellow-billed Loons from collisions in the Point Thomson Project Area will be a minor effect, given the local scale of potential collisions, the low frequency of occurrence, and the low number of loons exposed to the collision hazards of Project structures.

5.2.7 Effects of Spills

The probability, volume, potential spread, and environments contaminated for different types of spills are summarized in Appendix C. This section evaluates the effects of different types of spills on listed avian species.

Direct effects of spilled oil on Spectacled Eiders and Yellow-billed Loons would depend on the amount of exposure. Heavy oiling of birds would be expected to be lethal through hypothermia or toxic effects of ingestion and inhalation (Hartung 1967, Clark 1968, Holmes et al. 1978). Light to moderate oiling of birds could reduce reproduction (through pathological effects on breeding eiders or transfer of oil to eggs) or survival (Hartung and Hunt 1966, Albers and Szaro 1978, Albers 1980, Ainley et al. 1981, Lewis and Malecki 1984, Anderson et al. 2000). The effects of other toxic material spills could be similar or more severe, depending on the material. Brine or freshwater spills would not likely have negative effects on eiders, but could affect their habitat and food.

5.2.7.1 Spectacled Eider

The primary indirect effect of spills of toxic materials (e.g., produced fluids, fuels, methanol, antifreeze, mineral oil, water soluble chemicals, and inhibitors) on Spectacled Eiders would be toxicity to aquatic organisms that are prey for eiders. Long-term toxicity (up to seven years) to phytoplankton resulted from a small experimental oil spill (Miller et al. 1978). Effects of oil spills on invertebrates would vary, depending on the species and the life stage, but in general, species diversity and density would be lowered in oiled ponds, and dipterans would be less influenced than crustaceans or predatory invertebrates (Mozley and Butler 1978, West and Snyder-Conn 1987, Burgess et al. 1995). Some zooplankton would incorporate oil into their tissue largely unchanged, thus passing their hydrocarbon burden onto their predators (e.g., birds, etc.) (Wells and Percy 1985). Spills of toxic materials other than oil could have similar effects as oil, and seawater spills could change the salinity of freshwater ponds or streams enough to cause shifts in prey diversity and density. Thus, prey availability for Spectacled Eiders could decline in waterbodies affected by spills, but the magnitude of effects would depend on the timing, amount and type of fluid spilled, and the volume and current in the affected waterbodies. Nonetheless, spill history shows that most spills are on gravel pads rarely reaching tundra: only small areas are likely to be contaminated and spill effects would likely be temporary, lasting weeks to several years. Cleanup response likely would recover the bulk of spilled oil, but some oil could remain trapped in the sediments and/or aquatic vegetation resulting in low-level toxicity locally. In larger lakes and creeks or rivers, long-term toxicity would be less likely to occur because of increased dilution and dispersion. Some toxicity might persist in these creeks for a few weeks to years, until toxic compounds were washed out of the oil trapped in the sediment or if the oiled sediment was buried under cleaner sediment. Therefore, spill effects on the invertebrate prey of Spectacled Eiders would likewise be small in scale and temporary in duration.

Spills could also contaminate vegetation, reducing cover and food species, providing a reservoir of contamination that could foul birds, or providing a pathway for ingestion of toxic material. For approximately 60% of the year, snow cover is sufficient to prevent oil spills from reaching vegetation (BLM 2004). Affects on vegetation vary by species and habitat, from causing mortality to stimulating growth; recovery from oil spills is faster in wet and aquatic sites (1–2 years) than in moist or dry sites (incomplete recovery after seven years) and better for sedges and willows than for mosses and dicotyledons (Walker et al. 1978, Walker 1996). Diesel is more phytotoxic than crude oil. McKendrick (2000) reported recovery from a diesel spill within 20 years in wet tundra without any cleanup action, but less than 5% recovery after 24 years in similarly treated dry tundra. Seawater or brine spills would kill plants on contact unless the spills were in halophytic habitats, in which case there might be no effect. Although effects of spills on vegetation at some sites may be prolonged, tundra spills of all types are generally small, so the extent of habitat affected would be limited. Given the low probability and small size of tundra spills, protection by snow and ice during a large portion of each year, the capability to contain and recover spilled material, and the recovery from oil spills of wet and aquatic habitats favored by Spectacled Eiders, spill effects on vegetation should not impact more than a few eiders over the life of the project.

In the case of a very large oil spill or even a medium spill that spread on the surface of water across tundra flooded during spring thaw, Spectacled Eiders, and other birds that spend much of their time on the water or that nest immediately adjacent to the water, could be impacted. The magnitude of impact would depend on the distribution of oil, behavior of the birds, and their density in the spill zone. If large volumes of surface oil reach the seasonally limited open water where eiders concentrate during spring, or the estuarine portions of the streams and marine lagoons during fall migration, small numbers of Spectacled Eiders could be oiled and ultimately die. A modeling study of risk from pipeline spills in the Kuparuk and Prudhoe Bay areas, based on empirical distributions of Spectacled Eiders during the pre-nesting period, predicted that a small number of eiders (<2.5 eiders) would be exposed to oil in a 459-ha (1,134 ac) tundra spill (the largest spill evaluated; McDonald et al. 2002). Because large spills on the tundra have a low probability of occurrence, and the concurrence of events (timing, location, failed containment, and concentrations of eiders) that would have to take place to expose Spectacled Eiders to these types of spills reduces the probability of occurrence even further, this type of event and the resulting catastrophic fouling of small numbers of eiders is not reasonably certain to occur.

Another potential source of spills could be from fuel shipped to Point Thomson via barge or trucked along ice roads. The volume per truck load would be relatively small (~37,854 L [~10,000 gal]) and spills along ice roads would not be likely to spread widely during the winter season, allowing for cleanup before the open water season. The risk and size of spills at sea from barge traffic is more difficult to estimate, but a very large spill (≥378,541 L [≥100,000 gal], Appendix C4) of fuel is possible if a barge is grounded and its fuel tanks are breached. Stehn and Platte (2000) estimated the exposure of Spectacled Eiders and other birds to spills at sea from the Liberty Project in the Central Beaufort Sea. Using the estimated mean density of Spectacled Eiders (and other birds) in the central Beaufort Sea area and simulated spill-trajectory paths, two eiders (0.4% of eiders in the area, based on the 90% quantile of eider density) were predicted to be exposed during a large spill (939,933 L [5,912 bbl]) within 30 days in July (Stehn and Platte 2000). These modeling studies estimated exposure for seasons when relatively high densities of Spectacled Eiders were expected on the tundra and at sea, and both concluded that a few eiders would likely be exposed to oil in the event of a tundra or marine spill in areas where Spectacled Eiders are more common than in the Point Thomson Project Area.

5.2.7.2 Yellow-billed Loon

Oil spills on land near Yellow-billed Loon breeding lakes during the summer and fall months would negatively affect breeding adults and young, if present. Direct effects from heavy oiling of plumage would be severely detrimental to loons because oiling of plumage can quickly result in death through inhalation of toxic fumes, ingestion while preening or hypothermia after loss of insulation from oiled feathers. Oil can be transferred to eggs and young, and result in egg loss and chick death. Indirect effects occur through contamination of food resources that causes changes in abundance, diversity, or caloric value of food resources. Indirect effects on food resources could ultimately affect nesting success, and overwinter survival.

Oil spills in marine waters during summer would likely affect Yellow-billed Loons. The Yellow-billed Loon population of Alaska may be at low risk from a marine oil spill in the Beaufort Sea, but the risk is higher for individuals that use marine waters near their nesting areas (Earnst 2004). Breeding Yellow-billed Loons also may be vulnerable to oil spills in nearshore waters during spring staging, when open-water leads are used along the Beaufort Sea coast (Alexander et al. 1997, Earnst 2004).

Stehn and Platte (2000) estimated the number of Yellow-billed Loons exposed to oil with simulations of an offshore oil spill from the proposed Liberty Project in the nearshore waters of the Beaufort Sea. The study area was a 400-m (1,200 ft) strip along the coastline from the Kogru River to Brownlow Point. Prevailing wind patterns in the Central Beaufort caused much of the simulated oil trajectories to hit the mainland and become stranded. Based on a 939,933-L (5,912 bbl) spill during July, the model predicted 0–8.5% (90% and 10% bird density quantiles) of the Yellow-billed Loons in the survey area would be exposed to oil. A total of eight Yellow-billed Loons would be exposed to a spill based on the 90%

quantile of bird density in the Liberty study area. If a similar large spill were to occur in the Point Thomson area, small numbers of loons could be exposed to oil, because the density of Yellow-billed Loons in the Point Thomson area is low (0.005 loons/km^2 [0.013 loons/mi^2], calculated from Noel et al. 2002a, 2002b). Applying the higher estimate of the percentage exposed (8.5% for the 90% quantile) to the observed density of Yellow-billed Loons in the Point Thomson area yields an estimate of <0.0005 loons/km^2 (<1 loon/2,000 km^2 [<1 loon/772 mi^2]) exposed to oil from a large off-shore spill. Even that estimate of exposure is likely on the high side, because the Point Thomson Project, unlike the Liberty Project, does not involve a well pad in the ocean, so it is highly unlikely that a spill that large would occur at sea or travel from facilities on land to the sea.

For onshore activities, the overall impact of oil and other contaminant leaks on Yellow-billed Loons is none to minor, because terrestrial habitats in the Point Thomson Project Area are used infrequently by this species and the probability of spills reaching breeding lakes where loons nest is low. Spills in the marine environment during summer would likely expose small numbers of Yellow-billed Loons to oil. Heavy oiling would likely result in mortality. However, because the probability of oil spills reaching marine water during the summer and the probability of spills being large enough to spread widely is low, combined with the small numbers of Yellow-billed Loons in the nearshore zone of the Action Area, the effect of spills on Yellow-billed Loons would be minor.

5.2.8 Summary of Spill Effects

Spill histories indicate that small spills can be expected to occur in the Point Thomson Project Area, but the risk of very large spills (≥378,541 L [>100,000 gal) is very low (Appendix C). The probability of a hydrocarbon spill moving into the marine environment would be lower yet, because Point Thomson Project facilities are located on land. Transportation of diesel by truck on sea ice roads or by barge is the most likely way that spills would occur in the marine environment. The direct effects of hydrocarbon spills through fouling, inhalation, and ingestion might cause mortality or reduced reproduction or survival, depending on levels of exposure. Spills affecting Spectacled Eider and Yellow-billed Loon terrestrial and marine habitats in the Point Thomson vicinity would occur infrequently, but potentially could result in some short-term negative impacts to individual birds occurring in the area. In the event of a tundra spill, contamination would not be very persistent in wet and aquatic habitats where Spectacled Eiders and Yellow-billed Loons breed. Indirect effects of spills on eider and loon prey and habitat would be temporary and spatially limited, and would not likely be as great a threat to Spectacled Eiders and Yellow-billed Loons. Spills in the marine environment, while extremely low probability events, have a greater potential to spread and encounter the low numbers of Spectacled Eiders and Yellow-billed Loons using nearshore waters in the summer season. The trajectory and spread of marine spills during summer will be dependent on spill size, water currents and wind direction. Simulation modeling of the spread of offshore oil spills in the central Beaufort Sea conducted for the Liberty project suggested that even for relatively large spills (~954,000 L [~6,000 bbls]), which are unlikely in the Point Thomson Project, much of the spill strands on shore and relatively small percentages of the birds in the area would be exposed (0.4% of Spectacled Eiders and 8.5 % of Yellow-billed Loons based on the 90% quantiles of bird densities) (Stehn and Platte 2000). Given the likely occurrence of small spill events over the life of the proposed action, it is possible that individual eiders and loons could encounter spills or contaminated sites. However, the small numbers of both Spectacled Eiders and Yellow-billed Loons in the Project Area reduces the probability that either of these species would be affected. The risk of spills to both species would be minimized by a suite of safety design measures, spill prevention and containment strategies, and regulatory requirements applicable to the oil and gas industry. Therefore, spill effects on Spectacled Eiders and Yellow-billed Loons are expected to be minor.

5.2.9 Cumulative Effects

As mentioned before, cumulative effects in the context of Section 7 of the ESA include the effects of future non-federal actions that are "*reasonably certain to occur*" (see 50 CFR § 402.02) in the Point Thomson Action Area. Non-federal actions relevant to cumulative effects for Spectacled Eiders will have similar effects on Yellow-billed Loons; therefore, the discussion of cumulative effects on both species is combined in this section. Commercial and transportation development, increased subsistence harvest, expansion or changes in activities in local communities, and management and research actions by State agencies or private groups are the principal activities that could contribute to cumulative effects on Spectacled Eiders and Yellow-billed Loons. Spectacled Eider and Yellow-billed Loon populations could be affected by oil and gas exploration and development, construction (transportation, residential, or industrial infrastructure), environmental contamination, marine shipping, wildlife research and survey activities, subsistence harvests, commercial fishing (by-catch), increases in predators, and recreational activities. Virtually any development that required gravel fill on tundra would require Federal permits, and therefore would be subject to future Section 7 consultations. Thus, development of oil and gas, roads and highways, and commercial infrastructure are excluded from detailed analysis in this section, because they require a federal action. Federal actions are not included in the cumulative effects analysis under the definition of cumulative impacts in the ESA.

Some future habitat loss or alteration could occur from activities undertaken by local residents as populations in Alaska increase, or as tourism increases. Fishing and hunting camps are probably the most likely places that habitat could be affected. Camps usually consist of a small cabin or wall tent and occupy small footprints. There are no indications that the subsistence harvests or use of camp sites would increase in the Point Thomson Project Area or during the life of the Project. The Point Thomson facilities are not connected by roads to any villages or the Dalton Highway (the only road connecting the ACP to the rest of Alaska), and thus provide no transportation advantage to local residents. The entire coastline of the Project Area appears to be used for fishing and waterfowl hunting, so some habitat degradation could occur in areas where camps are established. Tourism is not likely to affect the Action Area, except in the Prudhoe Bay area, which is connected by road and commercial airport to the rest of Alaska. Tourism is growing in Kaktovik, with commercial enterprises offering viewing opportunities of polar bears and travel in Arctic Refuge, but these activities should have no effect in the Action Area or on Spectacled Eiders or Yellow-billed Loons. The areal extent of habitats affected by hunting and fishing are likely to be quite small relative to the available habitat.

No future plans have been publicized for road, highway, or residential expansion in the Point Thomson Action Area. Habitat alteration and disturbance around camp sites would consist of foot, 4-wheeler, and snow machine trails. The local population of people is low (~6,800 residents in the North Slope Borough, of which about 300 live in Kaktovik, the nearest village to Point Thomson), so the human activity in the area is also relatively low. Both Kaktovik and Nuiqsut residents use the Point Thomson Action Area for subsistence activities (IAI 1990a, 1990b; Pedersen and Coffing 1984; Coffing and Pedersen 1985; Pedersen 1990; SRBA 2010). The amount of habitat lost or altered from future expansion of camp sites or related activities is likely to be small relative to areas already developed. The presence of noise, pedestrians, and equipment from commercial, subsistence, recreational, and research activities also could disturb local Spectacled Eiders and Yellow-billed Loons; however, no data presently exist to suggest that these activities will increase in the Point Thomson Project Area or that negative effects to the eider and loon populations are reasonably certain to occur as a result of such activities.

Withdrawal of fresh water from lakes and winter construction of ice roads and pads on State and native owned lands is regulated by the State of Alaska, and not subject to Section 7 consultation. Water withdrawal would be expected to have minor effects on Spectacled Eiders because they don't require large lakes for nest sites, but lower water levels could affect breeding Yellow-billed Loons that require stable levels around nest sites for nest defense and escape. The volume of water withdrawn for this purpose infrequently reaches the total amounted permitted, and is replaced rapidly by snowmelt runoff in spring (Baker 2002); therefore, it would not be likely that water bodies used in winter (withdrawal volumes are currently regulated by ADNR to protect fish habitat) would later present decreased foraging or nesting opportunities for Yellow-billed Loons. Because Spectacled Eiders and Yellow-billed Loons are present at such low densities in the Action Area, it would be unlikely that more than a few individuals would attempt to nest at lakes used as winter water sources in any 1 year.

Increased mortality of Spectacled Eiders and Yellow-billed Loons could result from several activities not requiring a specific federal action. Communication towers and other tall structures on the coast pose a risk for collisions. The construction of tall structures on existing gravel pads would not necessarily be subject to federal actions. The number of towers would likely increase with increasing reliance on modern wireless communications, and the number buildings and powerlines might increase if villages grow. However, no information is available to indicate that these tall structures will be constructed with reasonable certainty. Any increase in tall structures will increase the risk of injury and mortality to Spectacled Eiders and Yellow-billed Loons, and might claim small numbers of birds.

Attracting predators to breeding areas and the possibility of increased hunting by residents may cause lower productivity or mortality among eiders and loons. Predators, such as foxes and bears, attracted to nesting areas could cause losses of eggs, entire nests, and in some cases, adult eiders and loons. Improper containment or disposal of refuse at commercial developments, villages, and other human habitations, would attract potential bird predators and could lead to an increase in local predator numbers. Increased predator populations in the developed oilfields has been considered one of the major cumulative impacts on nesting tundra birds (NRC 2003), and is a factor that will be considered and mitigated during the planning for future oil and gas developments. In general, new oil and gas exploration and development actions incorporate waste and food management control plans, and, as discussed above, such development actions are also generally subject to Section 7 consultation. Subsistence harvesting is estimated to remove hundreds of Spectacled Eiders from the Alaskan population annually (58 FR 27474) and inadvertent capture of loons in fishing nets is possibly one reason the Yellow-billed Loon population has been stagnant or declining in some years (Schmutz 2009). Programs have been implemented by the USFWS and the North Slope Borough to inform hunters of harvest closures on Spectacled and Steller's eiders in an effort to decrease this source of mortality (BLM 2004). As mentioned earlier, there is no indication that subsistence hunting and fishing will increase in the Action Area in the future. No specific fishing sites have been documented for the Point Thomson Project Area, but Bullen Point and the Shaviovik River were mentioned as favored fishing locations by Kaktovik residents (IAI 1990a, Pedersen and Linn 2005, SRBA 2010). The entire coastline of the Project Area appears to be used for waterfowl hunting. Spectacled Eiders and Yellow-billed Loons could be shot by hunters or caught in fishing nets in the Point Thomson Project Area, but there is no indication that such harvests would increase in the future.

Potential future spill events associated with oil exploration and extraction activities may result in cumulative effects to eiders (see Section 5.2.7 above). The magnitude of such future effects of spills on Spectacled Eiders and Yellow-billed Loons is uncertain, but spills would likely expose a few eiders and loons to toxic materials, which would reduce reproduction and survival and possibly be lethal. Models of spills in the central Beaufort Sea area calculated from USFWS survey data predicted only two eiders and eight loons would be exposed to a large spill (~6,000 bbls, Stehn and Platte 2000) and onshore spills along the common carrier pipelines were predicted to expose <2.5 eiders to oil (McDonald et al. 2002). However, larger groups of eiders sometimes congregate on marine water, especially during molt and post-breeding migrations, and in the unlikely event that a spill occurred during these times and reached coastal marine waters, higher numbers of eiders might be contaminated. Given the spill prevention and containment measures in place in all existing and future oilfields, the contamination of more than a few Spectacled Eiders and Yellow-billed Loons is not likely to occur.

Most spills are expected to be contained on gravel pads and/or cleaned up before escape to nearby tundra. Nonetheless, some habitat degradation could result from the small spills that could occur during the life span of the Point Thomson Project, although exposure of Spectacled Eiders and Yellow-billed Loons to spilled materials would be a low probability event. Sources of spills other than the oil and gas industry would include the State of Alaska and local communities. Spills from these sources would likely be small in volume, and could involve village fuel tanks, which are on pads, or vehicles, boats, and aircraft which contain relatively small quantities (usually <379 L [<100 gal]) of fuel. The addition of these sources of spills would not appreciably increase the volume of spilled material that could be expected from existing or the proposed oil and gas development.

Two global issues affecting wildlife in the Point Thomson Action Area with limited federal control are air and water pollution and climate change. Although air and water pollution and contributions to greenhouse gas emissions within the United States are subject to federal regulations, non-anthropogenic (for example, methane gas from decomposition, smoke from forest fires) and international sources are not directly controlled by federal actions. Increases in air pollution in the Arctic are likely given expanding human populations and industrialization of Asia. Climate warming is expected to be most dramatic in the Arctic, with rates of warming nearly twice that experienced globally (ACIA 2004). The effects of these global trends are complicated and the resultant changes to wildlife and their habitats are far from clear (Martin et al. 2009). Gradual changes to wildlife habitat that have been predicted from climate change include expansion northward of plants from boreal areas (for example, shrubs and trees), reductions and/or increases in surface area of lakes and ponds, and reduction in ice coverage, thickness, and duration.

Permafrost is warming and active layers are increasing, which will have dramatic effects on wetlands and could reduce the extent of tundra (ACIA 2005), but evidence from the ACP to date does not show a clear shift away from tundra (Martin et al. 2009). The seasonal timing of thaw and freeze-up has been changing, increasing the growing season and possibly affecting migration and breeding timing in birds and mammals (Post et al. 2009). Longer breeding seasons could improve nesting success for tundra nesting birds, but changes in food (invertebrates and fish), predators, and habitat may have counter effects. It is unclear whether changes related to climate warming will benefit or harm Spectacled Eiders and Yellow-billed Loons over the short-term; the model-predicted loss of wetlands and tundra (Zöckler and Lysenko 2000) is over the next 100 years, and should that prediction become reality, important breeding habitat for both species will be drastically reduced. With many uncertainties among the contributions of climate variables, feedback mechanisms, and responses, few firm conclusions can be made about the rate and direction of change in the Arctic breeding habitat of Spectacled Eiders and Yellow-billed Loons, and the resulting impact to these species populations.

6.0 DETERMINATION OF EFFECTS

6.1 Polar Bear

The Point Thomson Project may affect, but is not likely to adversely affect, the polar bear (Table 6.1). A small number of maternal females belonging to the SBS population den annually in the Action Area, but effective mitigation measures such as preconstruction den surveys have been established for their protection under the existing ITR/LOA process. Small numbers of polar bears are likely to encounter project infrastructure and activities while moving along the coastline, especially during late summer and fall, but those encounters are likely to result in short-term behavioral responses that are unlikely to have population-level consequences. Project activities are subject to the mitigative measures established under the ITR/LOA process, which have been determined to be effective at reducing potential impacts to negligible levels, as indicated by negligible-impact findings (MMPA) in USFWS evaluations of the ITR/LOA process, as well as no-jeopardy findings (ESA) in previous Biological Opinions issued by the USFWS.

Table 6.1 Determination of effects of the Point Thomson Project on listed and candidate species and critical habitat of polar bears, Alaska.

Species/Critical Habitat	Status	Determination
Polar Bear	Threatened	Not likely to adversely affect
Polar Bear Critical Habitat	Designated	May affect, but not likely to cause destruction or adverse modification
Spectacled Eider	Threatened	Not likely to adversely affect
Steller's Eider	Threatened	Not likely to affect
Yellow-billed Loon	Candidate	Not likely to adversely affect

The Point Thomson Project would result in direct effects on small areas of two of the three units of critical habitat, but those localized effects are unlikely to result in the adverse modification of the units. A very small percentage of the terrestrial-denning unit of critical habitat would be directly affected by placement of gravel and construction of ice roads and pads. Portions of the 1.6-km (1-mi) disturbance buffer zone around the barrier-island unit of critical habitat would be affected by consistent human activity on the three pads within the zone during Project construction and operations, but no barrier-island habitat would be lost. These effects are not likely to result in alteration of the primary constituent elements of the terrestrial-denning and barrier-island habitat units to the extent that the survival and recovery of the species would be appreciably reduced. The sea-ice feeding habitat unit of critical habitat is not likely to be affected by the project.

Local effects of the Project on individual polar bears and the primary constituent elements of critical habitat are unlikely to result in significant adverse effects throughout the range of the species in Alaska, or to appreciably diminish the capability of critical habitat to satisfy the essential requirements of the species. The negligible effects of the Project will not adversely affect the potential recovery of the species.

6.2 Spectacled Eider

The Point Thomson Project may affect, but is not likely to adversely affect, the Spectacled Eider, primarily because low numbers of Spectacled Eiders have occurred in the Project Area on less than an annual frequency over the last 20 years (Table 6.1). Only a few eiders could possibly be negatively affected by Project related facilities and activities. Most effects are unlikely to result in injury or mortality; those that could result in injury or mortality have a low probability of occurrence. The combined effects of the Point Thomson Project are unlikely to result in population-level responses for Spectacled Eiders.

6.3 Steller's Eider

The Point Thomson Project is not likely to affect Steller's Eiders, because the Project is outside the species current range. The Project is within the historical range of Steller's Eiders, but none have been observed in the vicinity for over two decades.

6.4 Yellow-billed Loon

The Point Thomson Project may affect, but is not likely to adversely affect, the Yellow-billed Loon, a candidate species. As with the Spectacled Eider, low numbers of Yellow-billed Loons occur in the Project Area, but unlike eiders, none are likely to breed there. Yellow-billed Loons occur almost entirely in the marine zone, where non-breeding loons feed, rest, and migrate. The Project could affect small numbers of loons in the marine environment, but Project activities are unlikely to cause injury or mortality. Given the low numbers of Yellow-billed Loons in the marine environment and their absence in the terrestrial portion of the Project Area, the Point Thomson project is not likely to have any population-level effects on Yellow-billed Loons.

7.0 REFERENCES AND PERSONAL COMMUNICATIONS CITED

7.1 Literature Cited

Aars, J., N. J. Lunn, and A. E Derocher, eds. 2006. Polar bears: Proceedings of the 14th working meeting of the IUCN/SSC Polar Bear Specialist Group, 20–24 June 2005, Seattle, Washington. IUCN, Gland, Switzerland and Cambridge, UK.

ABR. 2006. Revegetation of capped reserve pits and former ice pads at drill site 3G. Kuparuk River Unit Oilfield. Progress report prepared for ConocoPhillips Alaska, Inc., by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 20 pp + figures.

ABR. 2009. Tundra recovery of former ice pad, Puviaq 1 exploratory well site, National Petroleum Reserve—Alaska (NPRA). Report prepared for ConocoPhillips Alaska, Inc., by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 20 pp.

ACIA. 2004. Arctic climate impact assessment. Cambridge University Press. 139 p.

ACIA. 2005. Arctic climate impact assessment. Cambridge University Press. 1042 p.

Ainley, D. G., C. R. Grau, T. E. Roudyroush, S. H. Morrell and J. M. Utts. 1981. Petroleum ingestion reduces reproduction in Cassin's Auklets. Marine Pollution Bulletin 12: 314–317.

Albers, P. H. 1980. Transfer of crude oil from contaminated water to bird eggs. Environmental Research 22: 307–314.

Albers, P. H and R. C. Szaro. 1978. Effects of No. 2 fuel oil on Common Eider eggs. Marine Pollution Bulletin 9: 138–139.

Allen, B. M., and R. P. Angliss. 2011. Alaska marine mammal stock assessments, 2010. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-223.

Alexander, S. A., D. L. Dickson, and S. E. Westover. 1997. Spring migration of eiders and other waterbirds in offshore areas of the western Arctic. In King and Common Eiders of the western Canadian Arctic. D. L Dickson, eds., pp. 6–20. Canadian Wildlife Service, Occasional Paper No. 94, Edmonton, Alberta, Canada.

Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. Arctic 46: 246–250.

Amstrup, S. C. 1995. Movements, distribution, and population dynamics of polar bears in the Beaufort Sea. Ph.D. dissertation, University of Alaska, Fairbanks.

Amstrup, S. C. 2000. Polar bear. Chapter 7, pp. 133–157 in J. C. Truett and S. R. Johnson, eds. The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, CA.

Amstrup, S. C. 2002. Section 8: Polar bear, *Ursus maritimus*. Pp. 65–70 in D. C. Douglas, P. E. Reynolds, and E. B. Rhode, eds. Arctic Refuge Coastal Plain Terrestrial Wildlife Research Summaries. U.S.

Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002–0001.

Amstrup, S. C. 2003a. Polar bear (*Ursus maritimus*). Pp. 587–610 in G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, eds. Wild Mammals of North America: Biology, Management, and Conservation. 2nd ed. Johns Hopkins University Press, Baltimore, MD.

Amstrup, S. C. 2003b. Polar bear maternal den distribution in northern Alaska. Unpublished report extracted from the Alaska Biological Science Center Polar Bear Research Database, May 5, 2003. U.S. Geological Survey, Biological Resources Division, Anchorage, AK.

Amstrup, S. C., and D. P. DeMaster. 1988. Polar bear, *Ursus maritimus*. Pp. 39–56 in J. W. Lentfer, ed. Selected marine mammals of Alaska: Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

Amstrup, S. C., and C. Gardner. 1994. Polar bear maternity denning in the Beaufort Sea. Journal of Wildlife Management 58: 1–10.

Amstrup, S. C., I. Stirling, and J. W. Lentfer. 1986. Past and present status of polar bears in Alaska. Wildlife Society Bulletin 14: 241–254.

Amstrup, S.C., C. Gardner, K.C. Myers, and F.W. Oehme. 1989. Ethylene glycol (antifreeze) poisoning of a free-ranging polar bear. Veterinary and Human Toxicology 31: 317–319.

Amstrup, S.C., G. Durner, I. Stirling, N.J. Lunn, and F. Messier. 2000. Movements and distribution of polar bears in the Beaufort Sea. Canadian Journal of Zoology 78: 948–966.

Amstrup, S. C., T. L. McDonald, and G. M. Durner. 2004a. Using satellite radiotelemetry data to delineate and manage wildlife populations. Wildlife Society Bulletin 32: 661–679.

Amstrup, S. C., G. York, T. L. McDonald, R. Nielson, and K. Simac. 2004b. Detecting denning polar bears with Forward-looking Infrared (FLIR) imagery. BioScience 54: 337–344.

Amstrup, S. C., G. M. Durner, I. Stirling, and T. L. McDonald. 2005. Allocating harvests among polar bear stocks in the Beaufort Sea. Arctic 58: 247–259.

Amstrup, S. C., I. Stirling, T. S. Smith, C. Perham, and G. W. Thieman. 2006a. Recent observations of intraspecific predation and cannibalism among polar bears in the southern Beaufort Sea. Polar Biology 29: 997–1002.

Amstrup, S. C., G. M. Durner, T. L. McDonald, and W. R. Johnson. 2006b. Estimating potential effects of hypothetical oil spills on polar bears. U.S. Geological Survey report, Alaska Science Center, Anchorage. 56 pp.

Amstrup, S. C., B. G. Marcot, and D. C. Douglas. 2007. Forecasting the range-wide status of polar bears at selected times in the 21st century. U.S. Geological Survey administrative report, Alaska Science Center, Anchorage, AK. 126 pp.

Amstrup, S. C., E. T. DeWeaver, D. C. Douglas, B. G. Marcot, G. M. Durner, C. M. Bitz, and D. A. Bailey. 2010. Greenhouse gas mitigation can reduce sea-ice loss and increase polar bear persistence. Nature 468: 955–958.

Andersen, M., and J. Aars. 2008. Short-term behavioural response of polar bears (*Ursus maritimus*) to snowmobile disturbance. Polar Biology 31: 501–507.

Anderson, B.A. 1992. The effects of Point McIntyre/GHX-2 gravel hauling on Brant. Unpublished report by Alaska Biological Research, Inc. to ARCO Alaska, Inc., Anchorage. 22 pp.

Anderson, B. A., and B. A. Cooper. 1994. Distribution and abundance of Spectacled Eiders in the Kuparuk and Milne Point oilfields, Alaska, 1993. Final report prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by Alaska Biological Research, Inc., Fairbanks, AK. 71 pp.

Anderson, B. A., and S. M. Murphy. 1988. Lisburne Terrestrial Monitoring Program—1986 and 1987: The effects of the Lisburne powerline on birds. Report for ARCO Alaska, Inc., Anchorage, AK, by Alaska Biological Research, Inc., Fairbanks, AK. 60 pp.

Anderson, B. A., C. B. Johnson, B. A. Cooper, L. N. Smith, and A. A. Stickney. 1999. Habitat associations of nesting Spectacled Eiders on the Arctic Coastal Plain of Alaska. Pages. 27– 33 in Behaviour and ecology of sea ducks (R. I. Goudie, M. R. Petersen, G. J. Robertson, eds.). Occasional Paper 100. Canadian Wildlife Service. Ottawa, Ontario.

Anderson, B.A., S.M. Murphy, M.T. Jorgenson, D.S. Barber, and B.A. Kugler. 1992. GHX-1 waterbird and noise monitoring program. Unpublished report by Alaska Biological Research, Inc. and BBN Systems and Technologies to ARCO Alaska, Inc., Anchorage. 132 pp.

Anderson, B. A., R. J. Ritchie, and A. A. Stickney. 1996. Avian studies in the Kuparuk Oilfield, Alaska, 1995. Final report prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 55 pp.

Anderson, B. A., R. J. Ritchie, A. A. Stickney, and A. M. Wildman. 2001. Avian studies in the Kuparuk Oilfield, Alaska, 2000. Final report prepared for PHILLIPS Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 88 pp.

Anderson, B. A., R. J. Ritchie, A. A. Stickney, and A. M. Wildman. 2002. Avian studies in the Kuparuk Oilfield, Alaska, 2001. Final report prepared for PHILLIPS Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Anderson, B. A., A. A. Stickney, T. Obritschkewitsch, and J. E. Shook. 2008. Avian studies in the Kuparuk Oilfield, Alaska, 2007. Data summary report for ConocoPhillips Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Anderson, B. A., A. A. Stickney, T. Obritschkewitsch, and J. E. Shook. 2009. Avian studies in the Kuparuk Oilfield, Alaska, 2008. Data summary report for ConocoPhillips Alaska, Inc., and the Kuparuk River Unit, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Anderson, D. W., S. H. Newman, P. R. Kelly, S. K. Herzog, and K. P. Lewis. 2000. An experimental soft-release of oil-spill rehabilitated American coots (Fulica americana): lingering effects on survival, condition and behavior. Environmental Pollution 107: 285–294.

Auerbach, N. A., M. D. Walker, and D. A. Walker. 1997. Effects of roadside disturbance on substrate and vegetation properties in arctic tundra. Ecological Applications 7:218–235.

Baker (Michael Baker Jr.). 2002. National Petroleum Reserve–Alaska (NPR–A) lake monitoring and recharge study. Report 25288-MBJ-DOC-001, for ConocoPhillips Alaska, Inc., Anchorage, AK. 158 pp.

Bellrose, F. C. 1980. Ducks, geese, and swans of North America. Third Edition. The Stackpole Company, Harrisburg, PA. 540 pp.

Bergen, S., G. M. Durner, D. C. Douglas, and S. C. Amstrup. 2007. Predicting movements of female polar bears between summer sea ice foraging habitats and terrestrial denning habitats of Alaska in the 21st century: Proposed methodology and pilot assessment. U.S. Geological Survey administrative report, Alaska Science Center, Anchorage, AK. 20 pp.

Bergman, R. D., R. L. Howard, K. F. Abraham, and M. W. Weller. 1977. Water birds and their wetland resources in relation to oil development at Storkersen Point, Alaska. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. Resource Publication 129. 38 pp.

Bethke, R., M. K. Taylor, S. C. Amstrup, and F. Messier. 1996. Population delineation of polar bears using satellite-collar data. Ecological Applications 6: 311–317.

Bishop, S. C., J. G. Kidd, T. C. Cater, K. N. Max, and P. E. Seiser. 2001. Land rehabilitation studies in the Kuparuk Oilfield, Alaska, 2000. Report for PHILLIPS Alaska, Inc., and the Kuparuk River Unit, Anchorage, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 64 pp.

Blix, A. S., and J. W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and development activities. Arctic 45: 20–24.

BLM (Bureau of Land Management). 2004. Alpine Satellite Development Plan Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management, with assistance from Minerals Management Service, Anchorage, AK.

BLM. 2008. Northeast National Petroleum Reserve-Alaska: Final supplemental integrated activity plan/environmental impact statement. Bureau of Land Management, Anchorage, AK, USA.

Bockstoce, J. R. 1986. Whales, Ice, and Men: The History of Whaling in the Western Arctic. University of Washington Press, Seattle.

Bockstoce, J. R., and J. J. Burns. 1993. Commercial whaling in the North Pacific sector. Pp. 563–577 in J. J. Burns, J. J. Montague, and C. J. Cowles, eds. The Bowhead Whale. Society for Marine Mammalogy, Lawrence, KS.

Brook, R. K., and E. S. Richardson. 2002. Observations of polar bear predatory behaviour toward caribou. Arctic 55: 193–196.

Brower, C. D., A. Carpenter, M. L. Branigan, W. Calvert, T. Evans, A. S. Fischbach, J. A. Nagy, S. Schliebe, and I. Stirling. 2002. The polar bear management agreement for the southern Beaufort Sea: an evaluation of the first ten years of a unique conservation agreement. Arctic 55: 362–372.

Brower, H. K. Jr. and R. Opie. 1997. North Slope Borough Subsistence Harvest Documentation Project: Data for Nuiqsut Alaska for the Period July 1, 1994 to June 30, 1995. Technical Report by North Slope Borough.

Brown, J., and N. A. Grave. 1979. Physical and thermal disturbance and protection of permafrost. Pages 51–91 in Proceedings of the Third International Conference on Permafrost. Vol. 2. National Research Council of Canada, Ottawa.

Burgess, R. M., and J. R. Rose. 1993. Snow Goose. 1992 Endicott Environmental Monitoring Program. Unpubl. draft report prepared by Science Applications Intl. Corp., Anchorage, AK for U.S. Army Corps of Engineers, Alaska District, Anchorage, AK.

Burgess, R. M., C. B. Johnson, P. E. Seiser, A. A. Stickney, A. M. Wildman, and B. E. Lawhead. 2002. Wildlife studies in the Northeast Planning Area of the National Petroleum Reserve–Alaska, 2001. Report for PHILLIPS Alaska, Inc., Anchorage, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 71 pp.

Burgess, R. M., C. B. Johnson, A. M. Wildman, P. E. Seiser, J. R. Rose, A.K. Prichard, T. J. Mabee, A. A. Stickney, and B. E. Lawhead. 2003. Wildlife studies in the Northeast Planning Area of the National Petroleum Reserve–Alaska, 2002. Report prepared for ConocoPhillips Alaska, Inc., Anchorage, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 126 pp.

Burgess, R. M., M. T. Jorgenson, T. C. Cater, B. A. Anderson, L. L. Jacobs, and B. E. Lawhead. 1995. Ecological impact assessment and restoration options for the DS-5 oil spill. Final Report, prepared for CH2MHill and ARCO Alaska, Inc., Anchorage, AK, by ABR, Inc., Fairbanks, AK.

Burgess, R. M., J. R. Rose, P. W. Banyas, and B. E. Lawhead. 1993. Arctic fox studies in the Prudhoe Bay Unit and adjacent undeveloped area, 1992. Unpublished report by Alaska Biological Research, Inc. to BP Exploration (Alaska) Inc., Anchorage. 16 pp.

Burns, J. J. 1970. Remarks on the distribution and natural history of pagophilic pinnipeds in the Bering and Chukchi seas. Journal of Mammalogy 51: 445–454.

Burns, J. J., L. H. Shapiro, and F. Fay. 1981. Ice as marine mammal habitat in the Bering Sea. Pp. 781–797 in D. W. Hood and J. A. Calder, eds. The Eastern Bering Sea Shelf: Oceanography and Resources. Vol. 2. U.S. Department of Commerce, NOAA, Office of Marine Pollution Assessment, Juneau, AK.

Byrne, L. C., R. J. Ritchie, and D. A. Flint. 1994. Spectacled Eider and Tundra Swan surveys: Kuvlum corridor, Sagavanirktok River to Staines River. Draft report prepared for ARCO Alaska, Inc., Anchorage, AK, by Alaska Biological Research, Inc., Fairbanks.

Challinor, J. L., and P. L. Gersper. 1975. Vehicle perturbation effects upon a tundra soil-plant system: II. Effects on the chemical regime. Soil Science Society of America Proceedings 39:689–695.

Chapin III, F. S., and G. R. Shaver. 1981. Changes in soil properties and vegetation following disturbance of Alaskan arctic tundra. Journal of Applied Ecology 18:605–617.

Clark, R. B. 1968. Oil pollution and the conservation of seabirds. pp. 76–112 in Proceedings of the International Conference on Oil Pollution of the Sea.

Coffing, M. W. and S. Pedersen. 1985. Caribou hunting: land use dimensions, harvest level, and cultural of the regulatory 1983–1984 in Kaktovik, Alaska. Report by the Alaska Department of Fish and Game, Division of Subsistence, Fairbanks. Technical Paper No. 120. 38 p.

Corps (U.S. Army Corps of Engineers). 2011. Point Thomson Project Draft Environmental Impact Statement. Alaska District, Alsaska Regulatory Division CEPOA-RD. JBER, AK.

Cronin, M. A., S. C. Amstrup, and K. T. Scribner. 2006. Microsatellite DNA and mitochondrial DNA variation in polar bears (*Ursus maritimus*) from the Beaufort and Chukchi seas, Alaska. Canadian Journal of Zoology 84: 655–660.

Day, R. H. 1998. Predator populations and predation intensity on tundra nesting birds in relation to human development. Report for U.S. Fish and Wildlife Service, Fairbanks, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 106 pp.

Day, R. H., and J. R. Rose. 2000. Eider surveys at six Dewline sites in northern Alaska, June 2000. Unpublished report prepared for U.S. Fish and Wildlife Service, Fairbanks, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 16 pp.

Day, R. H., A. K. Prichard, J. R. Rose, and A. A. Stickney. 2002. Migration and collision avoidance of eiders and other birds at Northstar Island, Alaska: Results of permit-stipulated studies in 2001. Final Report, prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 113 pp.

Day, R. H., A. K. Prichard, J. R. Rose, and A. A. Stickney. 2003. Migration and collision avoidance of eiders and other birds at Northstar Island, Alaska, 2001 and 2002. Final Report, prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 128 pp.

Day, R. H., R. J. Ritchie, and D. A. Flint. 1995. Spectacled and Steller's eider surveys at remote Air Force sites in Alaska, 1994. Unpublished report prepared for EA Engineering, Science, and Technology, Redmond, WA, and the U.S. Air Force, Eielson Air Force Base, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 66 pp.

Dau, C. P. 1974. Nesting biology of the Spectacled Eider (*Somateria fischeri*) (Brandt) on the Yukon-Kuskokwim Delta, Alaska. M.Sc. thesis, University of Alaska, Fairbanks.

Dau, C. P. 1976. Clutch sizes of the Spectacled Eider on the Yukon-Kuskodwim Delta, Alaska. Wildfowl 27:111–113.

Dau, C. P. and P. D. Anderson. 2001, Aerial population survey of common eiders and other waterbirds in nearshore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 30 June –3 July 2001. U.S. Fish and Wildlife Service, Anchorage, Alaska. 16 pp.

Dau, C. P. and P. D. Anderson. 2002. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 25–29 June 2002. U.S. Fish and Wildlife Service, Anchorage, Alaska. 15 pp.

Dau, C. P., and K. S. Bollinger 2009. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 1–5 July, 2009. Unpublished report, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Anchorage, AK. 20 pp.

Dau, C. P. and S. A. Kistchinski. 1977. Seasonal movements and distribution of the Spectacled Eider. Wildfowl 28: 65–75.

Dau, C. P., and W. W. Larned. 2004. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 24–27 June 2004. U.S. Fish and Wildlife Service, Anchorage, Alaska. 19 pp.

Dau, C. P., and W. W. Larned. 2006. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 25–27 June 2006. U.S. Fish and Wildlife Service, Anchorage, Alaska. 19 pp.

Dau, C. P., and W. W. Larned. 2007. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain, Alaska, 22–24 June 2007. U.S. Fish and Wildlife Service, Anchorage, Alaska. 18 pp.

Dau, C. P. and W. W. Larned. 2008. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 24–26 June 2008. USFWS Migratory Bird Management Division, Anchorage, AK.

Dau. C. P. and E. J. Taylor. 2000a. Aerial population survey of common eiders and other waterbirds in nearshore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 28 June–2 July 1999. U.S. Fish and Wildlife Service, Anchorage, Alaska. 21 pp

Dau. C. P. and E. J. Taylor. 2000b. Aerial population survey of common eiders and other waterbirds in nearshore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 3–12 July 2000. U.S. Fish and Wildlife Service, Anchorage, Alaska. 23 pp.

DeBruyn, T. D., T. J. Evans, S. Miller, C. Perham, E. Regehr, K. Rode, J. Wilder, and L. J. Lierheimer. 2010. Polar bear conservation in the United States, 2005–2009. Pp. 179–198 in M. E. Obbard, G. W. Thiemann, E. Peacock, and T. D. DeBruyn, eds. 2010. Polar bears: Proceedings of the 15th working meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009. Occasional Paper of the IUCN Species Survival Commission No. 43, Gland, Switzerland and Cambridge, UK.

Derksen, D. V., T. C. Rothe, and W. D. Eldridge. 1981. Use of wetland habitats by birds in the National Petroleum Reserve–Alaska. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C. Resource Publication 141. 27 pp.

Derksen, D. V., K. S. Bollinger, D. Esler, K. J. Jensen, E. J. Taylor, M. W. Miller, and M. W. Weller. 1992. Effects of aircraft on behavior and ecology of molting Black Brant near Teshekpuk Lake, Alaska. Final report, prepared for U. S. Bureau of Land Management, Fairbanks, AK, and U. S.

Minerals Management Service, Anchorage, AK, by U. S. Fish and Wildlife Service, Anchorage, AK, and Texas A&M University, College Station. 227 pp.

Derocher, A. E., Ø. Wiig, and G. Banjord. 2000. Predation of Svalbard reindeer by polar bears. Polar Biology 23: 675–678.

Durner, G. M., S. C. Amstrup, and K. J. Ambrosius. 2001. Remote identification of polar bear maternal den habitat in northern Alaska. Arctic 54: 115–121.

Durner, G. M., S. C. Amstrup, and A. S. Fischbach. 2003. Habitat characteristics of polar bear terrestrial maternal den sites in northern Alaska. Arctic 56: 55–62.

Durner, G. M., S. C. Amstrup, R. Nielson, and T. McDonald. 2004. The use of sea ice habitat by female polar bears in the Beaufort Sea. OCS Study MMS 2004-014. U.S. Department of Interior, Minerals Management Service, Anchorage, AK. 41 pp.

Durner, G. M., S. C. Amstrup, and K. J. Ambrosius. 2006. Polar bear maternal den habitat in the Arctic National Wildlife Refuge, Alaska. Arctic 59: 31–36.

Durner, G. M., D. C. Douglas, R. M. Nielson, S. C. Amstrup, T. L. McDonald, I. Stirling, M. Mauritzen, E. W. Born, Ø. Wiig, E. DeWeaver, M. C. Serreze, S. E. Belikov, M. H. Holland, J, Maslanik, J. Aars, D. A. Bailey, and A. E. Derocher. 2009. Predicting 21st-century polar bear habitat distribution from global climate models. Ecological Monographs 79: 25–58.

Durner, G. M., A. S. Fischbach, S. C. Amstrup, and D. C. Douglas. 2010. Catalogue of polar bear (*Ursus maritimus*) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 1910–2010. U.S. Geological Survey Data Series 568, Reston, VA. 14 pp.

Durner, G. M., J. P. Whiteman, H. J. Harlow, S. C. Amstrup, E. V. Regehr, and M. Ben-David. 2011. Consequences of long-distance swimming and travel over deep-water pack ice for a female polar bear during a year of extreme sea-ice retreat. Polar Biology [published online, 14 Jan. 2011: http://www.springerlink.com/content/032201r34q534455/]

Dyck, M. 2006. Characteristics of polar bears killed in defense of life and property in Nunavut, Canada, 1970–2000. Ursus 17: 52–62.

Earnst, S. L. 2004. Status assessment and conservation plan for the Yellow-billed Loon (*Gavia adamsii*). Scientific Investigations Report 2004-5258, by U.S. Department of the Interior, U.S. Geological Survey, Reston, VA. 42 pp.

Earnst, S. L., R. M. Platte, and L. Bond. 2006. A landscape-scale model of yellow-billed loon (*Gavia adamsii*) habitat preferences in northern Alaska. Hydrobiologia 567:227–236.

Earnst, S. L., R. A. Stehn, R. M. Platte, W. W. Larned, and E. J. Mallek. 2005. Population size and trend of Yellow-billed Loons in northern Alaska. Condor 107:289–304.

Eberhardt, L. E., W. C. Hanson, J. L. Bengtson, R. A. Garrott, and E. E. Hanson. 1982. Arctic fox home range characteristics in an oil-development area. Journal of Wildlife Management 46: 183–190.

Ebersole, J. J., and P. J. Webber. 1983. Biological decomposition and plant succession following disturbance on the Arctic Coastal Plain, Alaska. Pages 266–271 in Permafrost Fourth International Conference Proceedings. 17–22 July 1983, University of Alaska, Fairbanks. National Academy Press, Washington, D.C.

Emers, M., J. C. Jorgenson, and M. K. Raynolds. 1995. Response of arctic tundra plant communities to winter vehicle disturbance. Canadian Journal of Botany 73:905–917.

Engelhardt, F. R. 1983. Petroleum effects on marine mammals. Aquatic Toxicology 4: 199–217.

Everett, K. R. 1980. Distribution and properties of road dust along the northern portion of the haul road. Chapter 3 in Environmental engineering and ecological investigations along the Yukon River-Prudhoe Bay haul road, J. Brown and R. L. Berg, editors. CRREL report 80–19. U.S. Army Cold Regions Research Engineering Laboratory, Hanover, New Hampshire. 203 pp.

ExxonMobil Corporation. 2009. Point Thomson Project Environmental Report (November 2009). ExxonMobil Corporation, Anchorage, AK. 796 pp.

Fay, F. H. 1974. The role of ice in the ecology of marine mammals of the Bering Sea. Pp. 383–399 in D. W. Hood and E. J. Kelley, editors. Oceanography of the Bering Sea. University of Alaska, Fairbanks.

Ferguson, S. H., M. K. Taylor, and F. Messier. 2000. Influence of sea ice dynamics on habitat selection by polar bears. Ecology 81: 761–772.

Fischbach, A. S., S. C. Amstrup, and D. C. Douglas. 2007. Landward and eastward shift of Alaskan polar bear denning associated with recent sea ice changes. Polar Biology 30: 1395–1405.

Fischer, J. B., and W. W. Larned. 2004. Summer distribution of marine birds in the western Beaufort Sea. Arctic 57:143–159.

Fischer, J. B, T. J. Tiplady, and W. W. Larned. 2002. Monitoring Beaufort Sea waterfowl and marine birds, aerial survey component. Report prepared for Minerals Management Service, Anchorage, AK, by U. S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK. OCS Study, MMS 2002-002. 136 pp.

Flint, P. L. and J. B. Grand. 1999. Incubation Behavior of Spectacled Eiders on the Yukon-Kuskokwim Delta, Alaska. Condor 101: 413–416

Flint, P. L., and M. P. Herzog. 1999. Breeding of Steller's Eiders, *Polysticta stelleri*, on the Yukon-Kuskokwim Delta, Alaska. Canadian Field Naturalist 113: 306–308.

Flint, P. L., R. B. Lanctot, J. C. Franson, T. Hollmen, J. Fischer, J. B. Grand, and B. Howell. 2001. Monitoring Beaufort Sea waterfowl and marine birds. Annual Progress Report prepared by U.S. Geological Survey, Alaska Biological Science Center, Anchorage, AK. 43 pp. + append.

Follmann, E. H. 1989. The importance of advance planning to minimize bear–people conflicts during large-scale industrial and transportation developments in the North. In Bear–people conflicts: Proceedings of a symposium on management strategies, M. Bromley, ed., pp. 105–110. NWT Department of Renewable Resources, Yellowknife, NWT,. 246 pp.

Follmann, E. H., and J. L. Hechtel. 1990. Bears and pipeline construction in Alaska. Arctic 43: 103–109.

Fredrickson, L. H. 2001. Steller's Eider (*Polysticta stelleri*). In The Birds of North America, No. 571 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.; The American Orthithologists' Union. 24 pp.

Frost, G. V., R. J. Ritchie, and T. Obritschkewitsch. 2007. Spectacled and Steller's eiders surveys at U.S. Air Force radar sites in Northern Alaska, 2006. Unpublished report prepared for the U.S. Air Force, Elmendorf Air Force Base, Alaska, by ABR, Inc., Fairbanks, Alaska.

Frost, K. J. , L. F. Lowry, G. Pendleton, and H. R. Nute. 2004. Factors affecting the observed densities of ringed seals, *Phoca hispida*, in the Alaskan Beaufort Sea, 1996–99. Arctic 57: 115–128.

Garlich-Miller, J., J. G. MacCracken, J. Snyder, R. Meehan, M. Myers, J. M. Wilder, E. Lance, and A. Matz. 2011. Status review of the Pacific walrus (*Odobenus rosmarus divergens*). U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK.

Gabrielson, I. N., and F. C. Lincoln. 1959. The birds of Alaska. Stackpole Company, Harrisburg, PA. 922 pp.

Garner, G W., and H. V. Reynolds, eds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment, 1985 update report—Baseline study of the fish, wildlife, and their habitats, Vol. 2. Anchorage, AK: U.S. Fish and Wildlife Service.

Gerhardt, F., R. Field, and J. Parker. 1988. Bird–habitat associations on the North Slope, Alaska: Chronological species summaries, 1987. U.S. Fish and Wildlife Service, Anchorage, AK. 55 pp.

Gollop, M.A., and R.A. Davis. 1974. Gas compressor noise simulator disturbance to snow geese, Komakuk Beach, Yukon Territory, September, 1972. Arctic Gas Biological Report Series No. 14: Chapter 8.

Gollop, M. A., J. G. Goldsberry, and R. A. Davis. 1974. Effects of gas compressor noise simulator disturbance to terrestrial breeding birds, Babbage River, Yukon Territory, June, 1972. Arctic Gas Biological Report Series No. 14: Chapter 2.

Grand, J. B. and P. L. Flint. 1997. Productivity of Nesting Spectacled Eiders on the Lower Kashunuk River, Alaska. Condor 99:926–932

Hampton, P. D., and M. R. Joyce. 1985. Kuparuk bird and noise study. Unpublished draft report by Entrix, Inc., to ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage. 343 pp.

Hartung, R. 1967. Energy metabolism in oil-covered ducks. Journal of Wildlife Management 31: 798–804.

Hartung, R. and G. S. Hunt. 1966. Toxicity of some oils to waterfowl. Journal of Wildlife Management 30: 564–570.

Hettinger, L.R. 1992. Prudhoe Bay Waterflood project environmental monitoring program 1987 West Road Tundra Vegetation. Appendix III in U.S. Army Corps of Engineers. Prudhoe Bay Water Flood Project Environmental Monitoring Program 1987.

Holmes, W. N., J. Cronshaw, and J. Gorsline. 1978. Some effects of ingested petroleum on seawater-adapted ducks (*Anas platyrhynchos*). Environmental Research 17: 177–190.

Hunter, C. M., H. Caswell, M. C. Runge, E. V. Regehr, S. C. Amstrup, and I. Stirling. 2010. Climate change threatens polar bear populations: a stochastic demographic analysis. Ecology 91: 2883–2897.

IAI (Impact Assessment Inc.). 1990a. Subsistence resource harvest patterns: Kaktovik. Special Report No. 8. OCS Study MMS 90-0038. Prepared by Impact Assessment Inc. for the United States Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region,: Anchorage, AK.

IAI. 1990b. Subsistence resource harvest patterns: Nuiqsut. Special Report No. 9. OCS Study MMS 90-0038. Prepared by Impact Assessment Inc. for the United States Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region,: Anchorage, AK.

IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, New York, NY. 996 pp.

Johnson, L. A. 1987. Management of northern gravel sites for successful reclamation: A review. Arctic and Alpine Research 19: 530–536.

Johnson, C. B. 1995. Abundance and distribution of eiders on the Colville River delta, Alaska, 1994. Final report prepared for ARCO Alaska, Inc., and Kuukpik Unit Owners, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 12 pp.

Johnson, C. B., R. M. Burgess, B. E. Lawhead, J. P. Parrett, J. R. Rose, A. A. Stickney, and A. M. Wildman. 2003a. Wildlife studies in the CD North study area, 2002. Third annual report prepared for ConocoPhillips Alaska, Inc., Anchorage by ABR, Inc. — Environmental Research and Services, Fairbanks.

Johnson, C. B., R. M. Burgess, B. E. Lawhead, J. Neville, J. P. Parrett, A. K. Pritchard, J. R. Rose, A. A. Stickney, and A. M Wildman. 2003b. Alpine Avian Monitoring Program, 2001. Fourth annual and synthesis report prepared for ConocoPhillips Alaska, Inc., Anchorage, and Anadarko Petroleum Corporation by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Johnson, C. B., M. T. Jorgenson, R. B. Burgess, B. E. Lawhead, J. R. Rose, and A. A. Stickney. 1996. Wildlife studies on the Colville River delta, 1995. Fourth annual report, prepared for ARCO Alaska, Inc., and Kuukpik Unit Owners, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 154 pp.

Johnson, C. B., J. P. Parrett, and P. E. Seiser. 2006. Spectacled Eider monitoring at the CD-3 development, 2005. Annual Report, prepared for ConocoPhillips Alaska, Inc., Anchorage, AK and Anadarko Petroleum Corporation, Anchorage, AK, by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 35 pp.

Johnson, C. B., J. P. Parrett, and P. E. Seiser. 2007. Spectacled Eider monitoring at the CD-3 development, 2006. Final Annual Report, prepared for ConocoPhillips Alaska, Inc., Anchorage, AK and Anadarko Petroleum Corporation, Anchorage, AK, by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 39 pp.

Johnson, C. B., J. P. Parrett, and P. E. Seiser. 2008. Spectacled Eider monitoring at the CD-3 Development, 2007. Annual report for ConocoPhillips Alaska, Inc., Anchorage, AK, and Anadarko Petroleum Corporation by ABR, Inc.—Environmental Research & Services, Fairbanks, AK. 43 pp.

Johnson, C. B., A. M. Wildman, J. P. Parrett, J. R. Rose, and T. Obritschkewtitsch. 2010a. Avian Studies for the Alpine Satellite Development Project, 2009. Seventh annual report for ConocoPhillips Alaska, Inc., Anchorage, AK, and Anadarko Petroleum Corporation by ABR, Inc.—Environmental Research & Services, Fairbanks, AK. 71 pp.

Johnson, C. B., A. M. Wildman, J. P. Parrett, J. R. Rose, T. Obritschkewitsch, and P. Seiser. 2011. Avian studies for the Alpine Satellite Development Project, 2010. Eighth annual report for ConocoPhillips Alaska, Inc., and Anadarko Petroleum Corporation, Anchorage, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Johnson, C. B., A. M. Wildman, and P. E. Seiser. 2010b. Point Thomson Project: eider and loon surveys, 2010. Report prepared for URS Corporation, Anchorage, AK and ExxonMobil Corporation, Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK.

Johnson, C. B., A. Zusi-Cobb, A. M. Wildman, A. A. Stickney, and B. A. Anderson. 2004. Biological assessment for Spectacled and Steller's eiders in the Alpine Satellite Development Project Area. Report for ConocoPhillips Alaska, Inc., and Anadarko Petroleum Corporation, Anchorage, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 119 pp.

Johnson, S. R., and D. R. Herter. 1989. The birds of the Beaufort Sea. BP Exploration (Alaska) Inc., Anchorage. 372 pp.

Jones, R. D. 1965. Returns from Stellers's Eider banded in Izembek Bay, AK. Wildfowl 16:83–85.

Jorgenson, M. T. and M. R. Joyce. 1994. Six strategies for rehabilitating land disturbed by oil development in Arctic Alaska. Arctic 47:374–390.

Kalxdorff, S. B. 1997. Collection of local knowledge regarding polar bear habitat use in Alaska. Technical Report MMM 97-2, U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK.

Kalxdorff, S. B. 1998. Distribution and abundance of marine mammal carcasses along the beaches of the Bering, Chukchi, and Beaufort seas, Alaska, 1995–1997. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK.

Kalxdorff, S., S. Schliebe, T. Evans, and K. Proffitt. 2002. Aerial survey of polar bears along the coast and barrier islands of the Beaufort Sea, Alaska, September–October 2001. U.S. Fish and Wildlife Service and LGL Alaska Research Associates, Inc., Anchorage, AK.

Kendall, S., and A. Brackney. 2004. Nest ecology of tundra-nesting birds at the Canning River delta, Arctic National Wildlife Refuge, Alaska, June–July 2003. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, AK.

Kendall, S., and C. Villa. 2005. Nest Ecology for Tundra Nesting Birds at the Canning River delta, Arctic National Wildlife Refuge, Alaska, June–July 2004. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

Kendall, S., and C. Villa. 2006. Nest Ecology for Tundra Nesting Birds at the Canning River delta, Arctic National Wildlife Refuge, Alaska, June–July 2005. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

Kendall, S., D. Payer, and C. Buchholtz. 2003. Nest Ecology for Tundra-Nesting Birds at the Canning River delta, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska.

Kendall, S., C. Villa, and J. Leibezeit. 2007. Nest ecology of tundra-nesting birds at the Canning River delta, Arctic National Wildlife Refuge, Alaska, June–July 2006. U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, AK.

Kertell, K. 1991. Disappearance of the Steller's Eider from the Yukon-Kuskokwim Delta, Alaska. Arctic 44: 177–187.

Kertell, K. 1993. Macroinvertebrate production and waterbird use of natural ponds and impoundments in the Prudhoe Bay Oil Field. Unpublished report by LGL Alaska Research Associates, Inc. to BP Exploration (Alaska) Inc., Anchorage, Alaska. 60 pp.

Kertell, K. 1994. Water quality and Pacific Loon breeding biology on natural ponds and impoundments in the Prudhoe Bay Oil Field, Alaska. Unpublished report by LGL Alaska Research Associates, Inc. to BP Exploration (Alaska) Inc., Anchorage. 50 pp.

Kertell, K., and R. Howard. 1992. Secondary productivity of impounded wetlands in the Prudhoe Bay Oil Field: Implications for waterbirds. Unpublished report by LGL Alaska Research Associates, Inc. to BP Exploration (Alaska) Inc., Anchorage. 57 pp.

King, J. and C. Dau. 1997. Expanded aerial searches for Steller's Eiders on the Arctic Coastal Plain of Alaska, 1997. Unpubl. report prepared by U.S. Fish and Wildlife Service, Fairbanks, AK. 4pp.

Kistchinski, A. A., and V. E. Flint. 1974. On the biology of the Spectacled Eider. Wildfowl 24: 5–15.

Klinger, L.F., D.A. Walker and P.J. Weber. 1983. The effects of gravel roads on Alaskan arctic coastal plain tundra. Pages 628–633 in Permafrost Fourth International Conference Proceedings. 17–22 July 1983, University of Alaska, Fairbanks. National Academy Press, Washington, D.C.

Larned, B., M. R. Petersen, K. Laing, R. Platte, and J. I. Hodges. 1995. Progress report: Location and characteristics of Spectacled Eider molting and wintering areas, 1993–94. Unpubl. report, by U.S. Fish and Wildl. Serv., Migratory Bird Manage., National Biological Serv., Alaska Science Center, Anchorage, AK. 24 pp.

Larned, W. W., and T. Tiplady. 1997. Late winter population and distribution of Spectacled Eiders (*Somateria fischeri*) in the Bering Sea, 1996–97. Unpubl. report, by U.S. Fish and Wildlife Service, Migratory Bird Management, Waterfowl Branch, Anchorage, AK. 11 pp.

Larned, W., R. Stehn, and R. Platte. 2006. Eider breeding population survey, Arctic Coastal Plain, Alaska, 2006. U.S. Fish and Wildlife Service, Migratory Bird Management–Waterfowl Management Branch, Soldotna, AK. 53 pp.

Larned, W. W. and K. S. Bollinger. 2009. Steller's Eider spring migration surveys southwest Alaska, 2009. U.S. Fish and Wildl. Serv., Division of Migratory Bird Management, Anchorage, AK.

Larned, W. W., R. S. Stehn, and R. M. Platte. 2009. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2008. Unpublished report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 42 pp.

Larned, W. W., R. S. Stehn, and R. M. Platte. 2010. Waterfowl Breeding Population Survey. Arctic Coastal Plain, Alaska, 2009. U.S. Fish and Wildlife Service, Migratory Bird Management, Waterfowl Management Branch, Soldotna and Anchorage, Alaska.

Lawson, D. E. 1986. Response of permafrost terrain to disturbance: a synthesis of observations from northern Alaska, U.S.A. Arctic and Alpine Research 18: 1–17.

Leffingwell, E. de K. 1919. The Canning River region, northern Alaska. U.S. Geological Survey Professional Paper 109, Washington, DC.

Lentfer, J. W. 1972. Polar bear sea-ice relationships. International Conference on Bear Research and Management 2: 165–171.

Lentfer, J. W. 1975. Polar bear denning on drifting sea ice. Journal of Mammalogy 56: 716–718.

Lentfer, J. W., and R. Hensel. 1980. Alaskan polar bear denning. International Conference on Bear Research and Management 4: 101–108.

Lewis, S. J. and R. A. Malecki. 1984. Effects of egg oiling on larid productivity and population dynamics. Auk 101: 584–592.

Liebezeit, J. R., S. J. Kendall, S. Brown, C. B. Johnson, P. Martin, T. L. McDonald, D. C. Payer, C. L. Rea, B. Streever, A. M. Wildman, and S. Zack. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications 19: 1628–1644.

Linnell, J. D. C., J. E. Swenson, R. Andersen, and B. Barnes. 2000. How vulnerable are denning bears to disturbance? Wildlife Society Bulletin 28: 400–413.

LGL Alaska Research Associates, Inc., Woodward-Clyde Consultants, Lazy Mountain Research, Applied Sociocultural Research, Jack Lobdell and Associates, Northern Economics, Inc., OASIS Environmental, Inc., and HCG, Inc. 1999. Point Thomson Area Development 1998 Environmental Study Results and Baseline Environmental Statement. Prepared for Point Thomson Working Interest Owners, Anchorage, AK. Various pages.

Lunn, N. J., I. Stirling, D. Andriashek, and E. Richardson. 2004. Selection of maternity dens by female polar bears in western Hudson Bay, Canada, and the effects of human disturbance. Polar Biology 27: 350–356.

Lysne, L. A., E. J. Mallek, and C. P. Dau. 2004. Nearshore surveys of Alaska's Arctic Coast, 1999–2003. Unpublished report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 60 pp.

MacGillivray, A. O., D. E. Hannay, R. G. Racca, C. J. Perham, S. A. MacLean, and M. T. Williams. 2003. Assessment of industrial sounds and vibrations received in artificial polar bear dens, Flaxman Island, Alaska. Report to ExxonMobil Production Co. by JASCO Research Ltd., Victoria, BC, and LGL Alaska Research Associates, Inc., Anchorage, AK. 60 pp.

Makihara, J. S. 1983. The effects of coal dust on surface albedo and thaw depth in northern Alaska. Abstract in Final Proceedings, Permafrost: Fourth International Permafrost Conference. Washington, D.C.: National Academy Press.

Mallek, E. J., R. Platte, and R. Stehn. 2002. Aerial Breeding Pair Surveys of the Arctic Coastal Plain of Alaska, 2001. U.S. Fish and Wildlife Service Waterfowl Management Branch, Fairbanks, Alaska.

Mallek, E. J., R. Platte, and R. Stehn. 2007. Aerial Breeding Pair Surveys of the Arctic Coastal Plain of Alaska, 2006. U.S. Fish and Wildlife Service Waterfowl Management Branch, Fairbanks and Anchorage, Alaska.

Martin, P. D. 1997. Predators and scavengers attracted to locales of human activity. In NPR–A Symposium Proceedings. OCS Study MMS 97-0013, pp. 6–24. U.S. Department of the Interior, Minerals Management Service, Anchorage, AK.

Martin, P. D., and C. S. Moitoret. 1981. Bird populations and habitat use, Canning River delta, Alaska. Unpublished report, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks, Alaska. 188 pp.

Martin, P. D., J. L. Jenkins, F. J. Adams, M. T. Jorgenson, A. C. Matz, D. C. Payer, P. E. Reynolds, A. C. Tidwell, and J. R. Zelenak. 2009. Wildlife response to environmental arctic change. Report from the Wildlife response to environmental Arctic change (WildREACH): Predicting Future Habitats of Arctic Alaska Workshop. 17–18 November 2008, Fairbanks, Alaska. U.S. Fish and Wildlife Service, Fairbanks, AK. 138 pp.

Mauritzen, M., S. E. Belikov, A. N. Boltunov, A. E. Derocher, E. Hansen, R. A. Ims, Ø. Wiig, and N. Yoccoz. 2003. Functional responses in polar bear habitat selection. Oikos 100: 112–124.

McDonald, T. L., S. Wolfe, P. Jensen, B. Haley, W. J. Wilson, and R. G. B. Senner. 2002. Risk assessment for a proposed spectacled eider unusually sensitive area (USA), Alaska North Slope. Prepared for BP Exploration (Alaska) Inc. and PHILLIPS Alaska, Inc. by West, Inc. and LGL Alaska Research Associates, Inc. 27 pp.

McKendrick, J. D. 2000. Vegetative responses to disturbance. Pages 35–56 in J. C. Truett and S. R. Johnson, eds. The natural history of an arctic oilfield. Academic Press, San Diego, CA. .

Miller, M. C., V. Alexander, and R. J. Barsdate. 1978. The effect of oil spills on phytoplankton in an arctic lake and ponds. Arctic 31(3): 192–218.

Miller, M. W., K. C. Jensen, W. E. Grant, and M. W. Weller. 1994. A Simulation Model of Helicopter Disturbance of Molting Pacific Black Brant. Ecological Modeling 73: 293–309.

Miller, S. 2009. Spotlight Species Action Plan: Polar bear [draft]. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK. 10 pp.

Miller, S., S. Schliebe, and K. Proffitt. 2006. Demographics and behavior of polar bears feeding on bowhead whale carcasses at Barter and Cross islands, Alaska, 2002–2004. OCS Study MMS 2006-14 final report to Minerals Management Service, Alaska OCS Region, by U.S. Fish and Wildlife Service, Anchorage, AK. 29 pp.

MMS (Minerals Management Service). 2008. Beaufort and Chukchi Sea Planning Areas, Oil and Gas Lease Sales 209, 212, 217, and 221, Draft Environmental Impact Statement. OCS EIS/EA MMS 2008-055. U.S. Department of Interior, MMS, Alaska Outer Continental Shelf Region, Anchorage, AK.

Molnár, P. K., A. E. Derocher, G. W. Thiemann, and M. A. Lewis. 2010. Predicting survival, reproduction, and abundance of polar bears under climate change. Biological Conservation 143: 1612–1622.

Monnett, C., and J. S. Gleason. 2006. Observations of mortality associated with extended open-water swimming by polar bears in the Alaskan Beaufort Sea. Polar Biology 29: 681–687.

Moulton, V. D., W. J. Richardson, T. L. McDonald, R. E. Elliott, and M. T. Williams. 2002. Factors influencing local abundance and haulout behavior of ringed seals (*Phoca hispida*) on landfast ice in the Alaskan Beaufort Sea. Canadian Journal of Zoology 80: 1900–1917.

Mozley, S. C. and M. G. Butler. 1978. Effects of crude oil on aquatic insects of tundra ponds. Arctic 31: 299–241.

Murphy, S. M., and B. A. Anderson. 1993. Lisburne Terrestrial Monitoring Program—The effects of the Lisburne Development Project on geese and swans, 1985–1989. Unpublished report by Alaska Biological Research, Inc. to ARCO Alaska, Inc., Anchorage, Alaska. 202 pp.

Myres, M. T. 1958. Preliminary studies of the behavior, migration and distributional ecology of the eider ducks in northern Alaska, 1958. Interim Progress Report to Arctic Institute of North America. McGill University, Montreal, Quebec.

Nickles, J. R., R. Field, J. Parker, R. Lipkin, and J. Bart. 1987. Bird–habitat associations on the North Slope, Alaska. Progress report, Fiscal Year 1986. U.S. Fish and Wildlife Service, Anchorage, AK. 96 pp.

NRC (National Research Council). 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press, Washington, D.C. 288 pp.

Noel, L. E. and R. H. Pollard. 1996. Yukon Gold ice pad tundra vegetation assessment: 1993 through 1995. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by LGL Alaska Research Associates, Inc., Anchorage, AK. 35 pp + appendices.

Noel, L. E., S. R. Johnson, and G. M. O'Doherty. 2002a. Aerial surveys of molting waterfowl in the barrier island-lagoon systems between Spy Island and Brownlow Point, Alaska, 2001. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by LGL Alaska Research Associates, Inc., Anchorage, AK. 116 pp.

Noel, L. E., S. R. Johnson, and R. Rodrigues 2002b. Aerial surveys of molting waterfowl in the barrier island-lagoon systems between Spy Island and Brownlow Point, Alaska, 2000. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by LGL Alaska Research Associates, Inc., Anchorage, AK. 69 pp.

Noel, L. E., S. R. Johnson, and P. F. Wainwright. 1999. Aerial surveys of molting waterfowl in the barrier island-lagoon system between the Stockton Islands and Flaxman Island, Alaska, 1998. Final report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by LGL Alaska Research Associates, Inc., Anchorage, AK and LGL Limited, Environmental Research Associates, Sidney, BC. 53 pp.

Noel, L. E., S. R. Johnson, and P. F. Wainwright. 2000. Aerial surveys of molting waterfowl in the barrier island-lagoon system between Spy Island and Brownlow Point, Alaska, 1999. Report for BP Exploration (Alaska) Inc., Anchorage, AK, by LGL Alaska Research Associates, Inc., Anchorage, AK, and LGL Limited, Environmental Research Associates, Sidney, BC. 64 pp. + append.

Noel, L. E., G. M. O'Doherty, R. J. Rodrigues, and B. Haley. 2002c. Pre-nesting, brood-rearing and molting waterfowl southeast of Teshekpuk Lake, National Petroleum Reserve–Alaska, Summer 2001. Report for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc., Anchorage, AK. 51 pp.

North, M. R. 1986. Breeding biology of Yellow-billed Loon on the Colville River delta, arctic Alaska. MS Thesis, North Dakota State University, Fargo.

North, M. R. 1990. Distribution, abundance, and status of Spectacled Eiders in Arctic Alaska. Unpubl. report, by U. S. Fish and Wildlife Service, Alaska Fish and Wildl. Research Center, Anchorage, AK.

North, M. R. 1994. Yellow-billed Loon (*Gavia adamsii*). In The Birds of North America, No. 121 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.; The American Orthithologists' Union. 24 pp.

North, M. R., and M. R. Ryan. 1988. Yellow-billed Loon, *Gavia adamsii*, breeding chronology and reproductive success in arctic Alaska. Canadian Field-Nat. 102:485–490.

North, M. R., and M. R. Ryan. 1989. Characteristics of lakes and nest sites used by Yellow-billed Loons in arctic Alaska. Journal of Field Ornithology 60:296–304.

North, M. R., J. L. Schwerin, and G. A. Hiemenz. 1984. Waterbird studies on the Colville River delta, Alaska: 1984 summary report. Unpublished progress report by Office of Special Studies, U.S. Fish and Wildlife Service, Anchorage, Alaska. 18 pp.

Nygård, T., B. Frantzen, and S. Švažas. 1995. Steller's Eiders *Polystricta stelleri* wintering in Europe: numbers, distribution and origin. Wildfowl 46:140–156.

Oasis Environmental, Inc. 2008. Spectacled and Steller's eider ground-based nest surveys and avian inventory at six U.S. Air Force Radar Sites in northern Alaska. Report prepared for U.S. Air Force, Elmendorf AFB, AK, by Oasis Environmental, Inc., Anchorage, AK.

Obbard, M. E., T. L. McDonald, E. J. Howe, E. V. Regehr, and E. S. Richardson. 2007. Polar bear population status in southern Hudson Bay, Canada. U.S. Geological Survey administrative report, Alaska Science Center, Anchorage, AK. 32 pp.

Obbard, M. E., G. W. Thiemann, E. Peacock, and T. D. DeBruyn, eds. 2010. Polar bears: Proceedings of the 15th working meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009. Occasional Paper of the IUCN Species Survival Commission No. 43, Gland, Switzerland and Cambridge, UK. 235 pp.

Obritschkewitsch, T., and P. D. Martin. 2002a. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2001. Technical Report, NAES-TR-02-01, by U.S. Fish and Wildlife Service, Fairbanks, AK. 43 pp.

Obritschkewitsch, T. and P. D. Martin. 2002b. Breeding biology of Steller's eiders nesting near Barrow, Alaska, 2002. Technical Report, U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. 33 pp.

Obritschkewitsch, T., P. D. Martin, and R. S. Suydam. 2001. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 1999–2000. Technical Report, NAES-TR-01-04, by U.S. Fish and Wildlife Service, Fairbanks, AK, and North Slope Borough, Department of Wildlife Management, Barrow, AK. 113 pp.

Obritschkewitsch, T., and R. J. Ritchie. 2010. Steller's Eider surveys near Barrow, Alaska, 2009. Final report prepared for U.S. Bureau of Land Management, Fairbanks, AK, and U.S. Fish and Wildlife Service, Fairbanks, AK, by ABR, Inc., Fairbanks, AK. 11 pp.

Pedersen, S. 1990. Caribou hunting: land use dimensions, harvest level, and selected aspects of the hunt during regulatory year 1987–88 in Kaktovik, Alaska. Technical Paper No. 172.

Pedersen, S. and M. Coffing. 1984. Caribou hunting: land use dimensions and recent harvest patterns in Kaktovik, Northeast Alaska. Report by Alaska Department of Fish and Game, Division of Subsistence, Fairbanks. Technical Paper No. 92. 54 p.

Pedersen, S. and A. Linn, Jr. 2005. Kaktovik 2000–2002 subsistence fishery harvest assessment. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Management Program. Final Report for FIS Study 01-101.

Perham, C. 2005. Proceedings: Beaufort Sea polar bear monitoring workshop, September 3–5, 2003, Anchorage, Alaska. OCS Study MMS 2005-034, prepared for Minerals Management Service, Alaska OCS Region, Anchorage, AK.

Petersen, M. R. 1980. Observations of wing-feather moult and summer feeding ecology of Steller's Eiders at Nelson Lagoon, Alaska. Wildfowl 31: 99–106.

Petersen, M. R. and D. C. Douglas. 2004. Winter ecology of Spectacled Eiders: environmental characteristics and population change. Condor 106: 79–94.

Petersen, M. R., P. L. Flint, W. W. Larned, and J. B. Grand. 1999. Monitoring Beaufort Sea waterfowl and marine birds. Annual Progress Report prepared by U.S. Geological Survey, Alaska Biological Science Center, Anchorage, AK. pp. 33.

Petersen, M. R, J. B. Grand, and C. P. Dau. 2000. Spectacled Eider (*Somateria fischeri*). In The Birds of North America, No. 547 (A. Poole and F. Gill, eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.; The American Orthithologists' Union. 24 pp.

Petersen, M. R., W. W. Larned, and D. C. Douglas. 1999a. At-sea distribution of Spectacled Eiders: A 120-year-old mystery resolved. Auk 116: 1009–1020.

Petersen, M. R., J. F. Piatt, and K. A. Trust. 1998. Foods of the Spectacled Eiders *Somateria fischeri* in the Bering Sea, Alaska. Wildfowl 49:124–128.

Post, E., M. C. Forchhammer, M. S. Bret-Harte, T. V. Callaghan, T. R. Christensen, B. Elberling, A. D. Fox, O. Gilg, D. S. Hik, T. T. Høye, R. A. Ims, E. Jeppesen, D. R. Klein, J. Madsen, A. D. McGuire, S. Rysgaard, D. E. Schindler, I. Stirling, M. P. Tamstorf, N. J. C. Tyler, R. van der Wal, J. Welker, P. A. Wookey, N. M. Schmidt, and P. Aastrup. 2009. Ecological dynamics across the Arctic associated with recent climate change. Science 325:1355–1358.

Powell, A. N., and S. Backensto. 2009. Common ravens (*Corvus corax*) nesting on Alaska's North Slope oil fields. Final report to U.S. Department of the Interior, Minerals Management Service, Anchorage, AK, by University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Fairbanks, AK. OCS Study MMS 2009-007. 37 pp.

Pullman E. R, M.T. Jorgenson, T. C. Cater, W. A. Davis and J. E. Roth. 2003. Assessment of ecological effects of the 2002–2003 ice road demonstration project. Final Report, prepared for ConocoPhillips Alaska, Inc., Anchorage, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 39 pp.

Quakenbush, L., and J. Cochrane. 1993. Report on the conservation status of the Steller's Eider (*Polysticta stelleri*), a candidate threatened and endangered species. Unpubl. manuscript, by U.S. Fish and Wildlife Service, Ecological Services, Alaska. 26 pp.

Quakenbush, L. T., R. H. Day, B. A. Anderson, F. A. Pitelka, and B. J. McCaffery. 2002. Historical and present breeding season distribution of Steller's Eiders in Alaska. Western Birds 33: 99–120.

Quakenbush, L.T. and R.S. Suydam. 1999. Periodic non-breeding of Steller's Eiders near Barrow, Alaska, with speculations on possible causes. Pages 34–40 in Goudie, R.I., M.R. Petersen, and G.J. Robertson, eds. Behaviour and ecology of sea ducks. Canadian Wildlife Service Occasional Paper No 100, Ottawa, Ontario.

Quakenbush, L. T., R. S. Suydam, K. M. Fluetsch, and C. L. Donaldson. 1995. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 1991–1994. Unpubl. Tech. Report NAES-TR-95-03, by U.S. Fish and Wildlife Service, Northern Alaska Ecological Services, Fairbanks, AK, and North Slope Borough, Dep. Wildl. Manage., Barrow, AK. 53 pp.

Quakenbush, L., R. Suydam, and T. Obritschkewitsch. 2000. Habitat use by Steller's Eiders during the breeding season near Barrow, Alaska, 1991–1996. Unpubl. report, by Univ. Alaska Fairbanks, North Slope Borough, and U.S. Fish and Wildlife Service, Fairbanks, AK. 45 pp.

Quakenbush, L., R. Suydam, T. Obritschkewitsch, and M. Deering. 2004. Breeding biology of Steller's Eiders (*Polysticta stelleri*) near Barrow, Alaska, 1991–99. Arctic 57:166–182.

Regehr, E. V., S. C. Amstrup, and I. Stirling. 2006. Polar bear population status in the southern Beaufort Sea. U.S. Geological Survey Open-File Report 2006-1337, Reston, VA. 20 pp.

Regehr, E. V., C. M. Hunter, H. Caswell, S. C. Amstrup, and I. Stirling. 2007. Polar bears in the southern Beaufort Sea, I: Survival and breeding in relation to sea ice conditions, 2001–2006. U.S. Geological Survey administrative report, Alaska Science Center, Anchorage, AK.

Regehr, E. V., C. M. Hunter, H. Caswell, S. C. Amstrup, and I. Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort sea in relation to sea ice. Journal of Animal Ecology 79: 117–127.

Ritchie, R. J. 1991. Effects of oil development on providing nesting opportunities for Gyrfalcons and Rough-legged Hawks in northern Alaska. Condor 93: 180–184.

Ritchie, R. J., and J. G. King. 2001. Results of Steller's Eider surveys near Barrow, Admiralty Bay, and Meade River, Alaska, 1999 and 2000. Report for North Slope Borough, Wildlife Department, Barrow, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 19 pp.

Ritchie, R. J., and J. G. King. 2004. Steller's Eider surveys near Barrow, Alaska, 2004. Report for U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, AK; North Slope Borough, Barrow, AK; and Alaska Army National Guard, Fort Richardson, AK, by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. 15 pp

Ritchie, R. J., C. T. Schick, and J. E. Shook. 2003. Spectacled and Steller's eiders surveys and habitat mapping at U. S, Air Force Radar Sites in Northern Alaska. Unpublished report prepared for the U. S. Fish and Wildlife Service, Ecological Services, Fairbanks, AK, and U.S. Air Force, Elmendorf Air Force Base, AK by ABR, Inc. — Environmental Research and Services, Fairbanks, AK. . 45 pp.

Rode, K. D., S. C. Amstrup, and E. V. Regehr. 2007. Polar bears in the southern Beaufort Sea, III: Stature, mass, and cub recruitment in relationship to time and sea ice extent between 1982 and 2006. U.S. Geological Survey administrative report, Alaska Science Center, Anchorage, AK. 28 pp.

Rode, K. D., S. C. Amstrup, and E. V. Regehr. 2010. Reduced body size and cub recruitment in polar bears associated with sea ice decline. Ecological Applications 20: 768–782.

Rodrigues, R. 2002a. Preliminary assessment of tundra-nesting birds in the Point Thomson area, Alaska, 2001. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for BP Exploration (Alaska) Inc., Anchorage, AK. 26 pp. + append.

Rodrigues, R. 2002b. Nest Density, Nest Survival, and Habitat Use of Tundra-Nesting Birds, Point Thomson, Alaska 2002. Prepared for BP Exploration (Alaska) Inc. by LGL Alaska Research Associates, Inc. Anchorage, Alaska. 32 pp. + append.

Rojek , N. A. 2005. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2004. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. Technical Report. 40 pp.

Rojek , N. A. 2006. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2005. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. Technical Report. 53 pp.

Rojek, N. A. 2007. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2006. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. Technical Report. 53 pp.

Rojek, N. A. 2008. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2007. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. Technical Report. 45 pp.

Rojek, N. A., and P. D. Martin. 2003. Breeding biology of Steller's Eiders nesting near Barrow, Alaska, 2003. Technical Report, U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Office, Fairbanks, AK. 42 pp.

Rothe, T. C., C. J. Markon, L. L. Hawkins, and P. S. Koehl. 1983. Waterbird populations and habitat analysis of the Colville River delta, Alaska: 1981 summary report U.S. Fish and Wildlife Service, Anchorage, AK. 131 pp.

Sanzone, D., B. Streever, B. Burgess, and J. Lukin (editors). 2010. Long-term ecological monitoring in BP's North Slope Oil Fields: 2009 Annual Report. BP Exploration (Alaska) Inc., Anchorage, Alaska.

Schick C. T., G. V. Frost, and R. J. Ritchie. 2004. Spectacled and Steller's eiders surveys and habitat mapping at U. S, Air Force Radar Sites in Northern Alaska, 2003. Unpublished report prepared for the U. S. Air Force, Elmendorf Air Force Base, AK, by ABR, Inc.—Environmental Research and Services, Fairbanks, AK. 64 pp.

Schliebe, S. L., and T. Evans. 2002. Stock assessment for polar bear (*Ursus maritimus*): Alaska Beaufort Sea stock. U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK.

Schliebe, S., S. Kalxdorff, and T. Evans. 2001. Aerial surveys of polar bears along the coast and barrier islands of the Beaufort Sea, Alaska, September–October 2000. U.S. Fish and Wildlife Service and LGL Alaska Research Associates, Inc., Anchorage, AK.

Schliebe, S., T. Evans, K. Johnson, M. Roy, S. Miller, C. Hamilton, R. Meehan, and S. Jahrsdoerfer. 2006. Range-wide status review of the polar bear (*Ursus maritimus*). U.S. Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK. 262 pp.

Schliebe, S., K. D. Rode, J. S. Gleason, J. Wilder, K. Proffitt, T. J. Evans, and S. Miller. 2008. Effects of sea ice extent and food availability on spatial and temporal distribution of polar bears during the fall open-water period in the southern Beaufort Sea. Polar Biology 31: 999–1010.

Schmutz, J. A. 2009. Model based predictions of the effects of harvest mortality on population size and trend of Yellow-billed Loons. U.S. Geological Survey. Open-File Report 2009-1040. 18 pp.

Sexson, M., M. R. Peterson, and A. N. Powell. 2011. Distribution and migratory timing of threatened Spectacled Eiders in the Beaufort and eastern Chukchi seas. Poster presented at Alaska Marine Science Symposium, January 2011, Anchorage, AK.

Shideler, R., and J. Hechtel. 1993. Oilfield grizzly project—1993 summary. Unpublished report by Alaska Department of Fish and Game, Fairbanks. 6 pp.

Shideler, R., and J. Hechtel. 1995. Grizzly bear use of the North Slope oil fields. Paper presented at North Slope Environmental Studies Conference, 9–10 March 1995, BP Exploration (Alaska) Inc., Anchorage.

Simpson, S. G., J. Barzen, L. Hawkins, and T. Pogson. 1982. Waterbird studies on the Colville River delta, Alaska: 1982 summary report U.S. Fish and Wildlife Service, Anchorage, AK. 24 pp.

Sjölander, S., and G. Ågren. 1976. Reproductive behavior of the Yellow-billed Loon, *Gavia adamsii*. Condor 78: 454–463.

Smith, T. G. 1980. Polar bear predation of ringed and bearded seals in the land-fast sea ice habitat. Canadian Journal of Zoology 58: 2201–2209.

Smith, T. S., S. T. Partridge, S. C. Amstrup, and S. Schliebe. 2007. Post-den emergence behavior of polar bears (*Ursus maritimus*) in northern Alaska. Arctic 60: 187–194.

Spatt, P.D. 1978. Seasonal variation of growth conditions on a natural and dust impacted *Sphagnum* (Sphagnaceae) community in northern Alaska. M.S. thesis, University of Cincinnati, Cincinnati, Ohio. 103 pp.

Spatt, P. D., and M. C. Miller. 1981. Growth conditions and vitality of *Sphagnum* along the Alaska Pipeline Haul Road. Arctic 34: 48–54.

SRBA (Stephen R. Braund & Associates). 2010. Subsistence mapping of Nuiqsut, Kaktovik, and Barrow. MMS OCS Study Number 2009-003. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage.

Stehn, R. and R. Platte. 2000. Exposure of birds to assumed oil spills at the Liberty Project. Unpublished report prepared for Minerals Management Service, Anchorage, AK, by U. S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK. 71 pp.

Stehn, R. A., C. P. Dau, B. Conant, and W. I. Butler, Jr. 1993. Decline of Spectacled Eiders nesting in western Alaska. Arctic 46: 264–277.

Stenhouse, G. B., L. J. Lee, and K. G. Poole. 1988. Some characteristics of polar bears killed during conflicts with humans in the Northwest Territories, 1976–86. Arctic 41: 275–278.

Stickney, A. A., R. J. Ritchie, B. A. Anderson. D. A. Flint, P. W. Banyas, and J. G. King. 1993. Tundra Swan and Brant surveys on the Arctic Coastal Plain, Colville River to Staines River, 1992. Report for ARCO Alaska, Inc., and BP Exploration (Alaska) Inc., Anchorage, AK, by Alaska Biological Research, Inc., Fairbanks, AK. 83 pp.

Stirling, I. 1988. Attraction of polar bears, *Ursus maritimus*, to offshore drilling sites in the eastern Beaufort Sea. Polar Record 24: 1–8.

Stirling, I. 2002. Polar bear *Ursus maritimus*. in W. F. Perrin, B. Würsig, J. G. M. Thewissen, eds. Encyclopedia of Marine Mammals. Academic Press, San Diego, CA.

Stirling, I., and D. Andriashek. 1992. Terrestrial maternity denning of polar bears in the eastern Beaufort Sea area. Arctic 45: 363–366.

Stirling, I., and C. L. Parkinson. 2006. Possible effects of climate warming on selected populations of polar bears (*Ursus maritimus*) in the Canadian Arctic. Arctic 59: 261–275.

Stirling, I, D. Andriashek, P. Latour, and W. Calvert. 1975. The distribution and abundance of polar bears in the eastern Beaufort Sea. Beaufort Sea Technical Report No. 2, Department of the Environment, Victoria, B.C.

Stirling, I., H. Cleator, and T. G. Smith. 1981. Marine mammals. Pp. 44–58 in I. Stirling and H. Cleator, eds. Polynyas in the Canadian Arctic. Canadian Wildlife Service Occasional Paper 45. Ottawa, Ontario.

Stirling, I., N. J. Lunn, and J. Iacozza. 1999. Long-term trends in the population ecology of polar bears in western Hudson Bay n relation to climatic change. Arctic 52: 294–306.

Stirling, I., E. Richardson, G. W. Thiemann, and A. E. Derocher. 2008. Unusual predation attempts of polar bears on ringed seals in the southern Beaufort Sea: Possible significance of changing spring ice conditions. Arctic 61: 14–22.

Stroeve, J., M. M. Holland, W. Meier, T. Scambos, and M. Serreze. 2007. Arctic sea-ice decline: Faster than forecast. Geophysical Research Letters 34: L09501.

TERA (Troy Ecological Research Associates). 1993. Preliminary characterization of the breeding-season bird community in the vicinity of the Yukon Gold ice pad. Report for BP Exploration (Alaska) Inc., Anchorage, by TERA, Anchorage, AK. 10 pp.

TERA. 1995a. Preliminary characterization of summer bird use of the proposed Badami development area. Report for BP Exploration (Alaska) Inc., Anchorage, by TERA, Anchorage, AK. 30 pp.

TERA. 1995b. Distribution and abundance of Spectacled Eiders in the vicinity of Prudhoe Bay, Alaska: 1991–1993. Final report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 20 pp.

TERA. 1996. Distribution and abundance of Spectacled Eiders in the vicinity of Prudhoe Bay, Alaska: 1994 status report. Final report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 15 pp.

TERA. 1999a. Spectacled Eiders in the Beaufort Sea: Distribution and timing of use. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 19 pp.

TERA. 1999b. The distribution of Spectacled Eiders in the vicinity of the Pt. Thomson Unit. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 7 pp.

TERA. 2000. The distribution of Spectacled Eiders in the vicinity of the Pt. Thomson Unit, 1999. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 10 pp.

TERA. 2002a. Spectacled Eiders movement in the Beaufort Sea: distribution and timing of use. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, and Bureau of Land Management, Fairbanks AK, by Troy Ecological Research Associates, Anchorage, AK. 22 pp.

TERA. 2002b. The distribution of Spectacled Eiders in the vicinity of the Point Thomson Unit: 1998–2001. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK.

TERA. 2003. Molt migration of Spectacled Eiders in Beaufort Sea region. Report prepared for BP Exploration (Alaska) Inc., Anchorage, AK, by Troy Ecological Research Associates, Anchorage, AK. 17 pp.

Troy, D. M. 1986. Prudhoe Bay Waterflood Project Environmental Monitoring Program Terrestrial Studies—1984. Unpublished report by LGL Alaska Research Associates, Inc. to Envirosphere Company, Anchorage. 163 pp.

Troy, D. M. 1988. Bird use of the Prudhoe Bay Oil Field during the 1986 nesting season. Unpublished report by LGL Alaska Research Associates, Inc. to Alaska Oil and Gas Association, Anchorage. 96 pp.

Troy, D. M. 1994. Distribution and abundance of Spectacled Eiders near Prudhoe Bay. Page 14 in North Slope Environmental Studies Conference, Anchorage, Alaska, 14–15 February 1994. BP Exploration (Alaska), Inc., Anchorage, Alaska, and ARCO Alaska, Inc., Anchorage, Alaska.

Truett, J. C., editor. 1993. Guidelines for oil and gas operations in polar bear habitats. Outer Continental Shelf Study MMS 93-008, U.S. Department of the Interior, Minerals Management Service, Washington, DC. 104 pp.

Truett, J. C., and K. Kertell. 1992. Tundra disturbance and ecosystem production: implications for impact assessment. Environmental Management 16: 485–494.

Truett, J. C., M. E. Miller, and K. Kertell. 1997. Effects of arctic Alaska oil development on Brant and Snow Geese. Arctic 50: 138–146.

USFWS (U.S. Fish and Wildlife Service). 1995. Habitat conservation strategy for polar bears in Alaska. U.S. Fish and Wildlife Service, Marine Mammals Management. Anchorage, AK.

USFWS. 1996. Spectacled Eider recovery plan. U.S. Fish and Wildlife Service, Anchorage, AK. 157 pp.

USFWS. 2002. Steller's Eider recovery plan. U.S. Fish and Wildlife Service, Fairbanks, AK. 27pp.

USFWS. 2006a. Conservation agreement for the Yellow-billed Loon (*Gavia adamsii*). U.S. Fish and Wildlife Service, Fairbanks, AK. 29pp.

USFWS. 2006b. Environmental assessment: Final rule to authorize the incidental take of small numbers of polar bear (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) during oil and gas activities in the Beaufort Sea and adjacent coastal Alaska. U.S. Department of Interior, Fish and Wildlife Service. 97 pp.

USFWS. 2008a. Analysis of listed Steller's eiders. Unpublished report, U.S. Fish and Wildlife Service, Fairbanks, Alaska.

USFWS. 2008b. Programmatic Biological Opinion for polar bears (*Ursus maritimus*) on Beaufort Sea incidental take regulations. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. 65 pp.

USFWS. 2009. Final Biological Opinion for Beaufort and Chukchi Sea Program Area lease sales and associated seismic surveys and exploratory drilling. Consultation with Minerals Management Service, Alaska OCS Region, by U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. 168 pp.

USFWS. 2011a. Final environmental assessment: Final rule to authorize the incidental take of small numbers of polar bear (*Ursus maritimus*) and Pacific walrus (*Odobenus rosmarus divergens*) during oil and gas activities in the Beaufort Sea and adjacent coastal Alaska. U.S. Department of the Interior, Fish and Wildlife Service. 72 pp.

USFWS. 2011b. Programmatic Biological Opinion for polar bears (*Ursus maritimus*), polar bear critical habitat, and conference opinion for the Pacific walrus (*Odobenus rosmarus divergens*) on Beaufort Sea incidental take regulations. U.S. Fish and Wildlife Service, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. 93 pp.

Walker, D. A. 1996. Disturbance and recovery of arctic Alaskan vegetation. Ecological Studies 120: 35–71.

Walker, D.A., and K.R. Everett. 1987. Road dust and its environmental impact on Alaskan taiga and tundra. Arctic and Alpine Research 19: 479–489.

Walker, D. A., N. D. Lederer, and M. D. Walker. 1985. Vegetation changes at permanent transects along the Dalton Highway and the Prudhoe Bay Spine Road. In P.J. Webber, D.A. Walker, V. Komarkova, and J.J. Ebersole, eds. Baseline monitoring methods and sensitivity analysis of Alaskan arctic tundra. Final report to U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

Walker, D. A., P. J. Webber, E. F. Binnian, K.R. Everett, , N. D. Lederer, E. A. Nordstrand, and M. D. Walker. 1987. Cumulative impacts of oil fields on northern Alaskan landscapes. Science 238: 757–761.

Walker, D. A., P. J. Webber, K. R. Everett, and J. Brown. 1978. Effects of crude and diesel oil spills on plant communities at Prudhoe Bay, Alaska, and the derivation of oil spill sensitivity maps. Arctic 31: 242–259.

Ward, D. H., R. A. Stehn, and D. V. Derksen. 1994. Response of staging Brant to disturbance at Izembek Lagoon, Alaska. Wildl. Soc. Bull. 22: 220–228.

Ward, D. H., R. A. Stehn, W. P. Erickson, and D. V. Derksen. 1999. Response of fall-staging Brant and Canada Geese to aircraft overflights in southwestern Alaska. Journal of Wildlife Management 63: 373–381.

Warnock, N. D., and D. M. Troy. 1992. Distribution and abundance of Spectacled Eiders at Prudhoe Bay, Alaska: 1991. Final report, prepared for BP Exploration (Alaska) Inc., Anchorage, by Troy Ecological Research Associates, Anchorage, AK. 21 pp.

Werbe, E. 1980. Disturbance effects of a gravel highway upon Alaskan tundra vegetation. M.S. thesis, University of Colorado, Boulder, Colorado. 153 pp.

WCC and ABR (Woodward-Clyde Consultants and Alaska Biological Research). 1983. Terrestrial environmental study for Point Thomson development project. Report for Exxon Company, Thousand Oaks, CA, by Woodward Clyde Consultants, Anchorage, AK, and Alaska Biological Research, Fairbanks, AK.

WCC (Woodward-Clyde Consultants). 1985. Lisburne development environmental studies: 1984. Vol. 2—Caribou, birds, and oceanography. Report for ARCO Alaska, Inc., Anchorage, AK, by Woodward Clyde Consultants, Anchorage, AK, 1985.

Wells, P. G., and J. A. Percy. 1985. Effects of oil on arctic invertebrates. Pages 101–156 in F. R. Englehardt, ed. Petroleum effects in the arctic environment. Elsevier Applied Science Publishers, London.

West, R. L., and E. Snyder-Conn. 1987. Effects of Prudhoe Bay reserve pit fluids on water quality and macroinvertebrates of Arctic tundra ponds in Alaska. 87. U.S. Fish and Wildl. Service, Washington, DC. 48.

Wozencraft, W. C. 2005. Order Carnivora. Pp. 532–628 *in* D. E. Wilson and D. M. Reeder, editors. Mammal Species of the World: A Taxonomic and Geographic Reference. 3rd edition. Johns Hopkins University Press, Baltimore, MD.

Wright, J. M., and S. G. Fancy. 1980. The response of birds and caribou to the 1980 drilling operation at the Point Thomson #4 well. Report for Exxon Company, U.S.A., Anchorage, AK, by LGL Ecological Research Associates, Inc., Fairbanks, AK. 62 pp.

York, G., S. C. Amstrup, and K. Simac. 2004. Using forward-looking infrared (FLIR) imagery to detect polar bear maternal dens: Operations manual. OCS Study MMS 2004-062, prepared for Minerals Management Service, Alaska OCS Region, by U.S. Geological Survey, Alaska Science Center, Anchorage. 58 pp.

Zöckler, C. and I. Lysenko. 2000. Water birds on the edge: first circumpolar assessment of climate change impact on Arctic breeding water birds. WCMC Biodiversity Series No. 11. World Conservation Monitoring Centre, Cambridge, U.K.

7.2 Agency Databases Cited

U.S. Fish and Wildlife Service Arctic Coastal Plain Aerial Breeding Pair Survey Geodatabase.gdb, 1992–2010. Contact: Robert Platte, USFWS, Migratory Bird Management Division, Anchorage, AK.

U.S. Fish and Wildlife Service North Slope Eider Survey File Geodatabase.gdb, 1992–2006. Contact: Robert Platte, USFWS, Migratory Bird Management Division, Anchorage, AK.

U.S. Fish and Wildlife Service 2008 Yellow-billed Loon Registry DVD. Contact: Jennifer Jenkins, USFWS, Fairbanks Fish and Wildlife Field Office, Fairbanks, AK.

7.3 Personal Communications

Anderson, Betty, ABR, Inc., personal communication, 2009.

Bart, John, Boise State University, personal communication, 1995.

Burns, John J., Sr., ADFG (retired), personal communication, 2003.

Cox, Rachel, ExxonMobil Corp., personal communication, 2010.

Evans, Thomas, USFWS, personal communication, 2010.

Johnson, Charles, ABR, Inc., personal communication, 2010.

Perham, Craig, USFWS, personal communication, 2009, 2010.

Shideler, Richard, ADFG, personal communication, 2009.

Swem, Ted, USFWS, personal communication, 2010.

Wildman, Ann, ABR, Inc., personal communication, 2010.

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APPENDIX A

Polar Bear and Wildlife Interaction Plan North Slope, Alaska

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POLAR BEAR AND WILDLIFE INTERACTION PLAN

NORTH SLOPE, ALASKA

Exxon Mobil Corporation
P.O. Box 241449
Anchorage, Alaska 99524-1449

October 2010

TABLE OF CONTENTS

APPENDICES

FIGURES

ACRONYMS AND ABBREVIATIONS

ACS	Alaska Clean Seas
ADF&G	Alaska Department of Fish and Game
AOGA	Alaska Oil and Gas Association
AOGCC	Alaska Oil and Gas Conservation Commission
C-Plan	Contingency Plan
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ESA	Endangered Species Act
FLIR	Forward Looking Infrared
km	Kilometer
LOA	Letter of Authorization
LRAD	Long range acoustic device
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NSB	North Slope Borough
NSTC	North Slope Training Cooperative
PIC	Person-In-Charge
PTU	Point Thomson Unit
SPCC	Spill Prevention Control and Countermeasure
USFWS	United States Fish and Wildlife Service
USGS	United State Geologic Survey

1.0 INTRODUCTION

ExxonMobil, as Operator and on behalf of the Point Thomson leaseholders, drilled the PTU-15 and PTU-16 wells in accordance with the February 10, 2009, Plan of Operations. During 2011, ExxonMobil plans to continue work in the Point Thomson area to demobilize the drilling equipment and begin preparations for construction of gravel infrastructure. During 2011, seasonal barge traffic with shallow draft landing craft or barges that land on the shoreline, an ice road connecting the Endicott causeway with the Point Thomson area, and off-road vehicles will all be used to support the operations. During this time period, ExxonMobil may be conducting various scientific and engineering field studies in support of design and permitting efforts. In addition, ExxonMobil may perform well remediation and rehabilitation work at various sites within the general Point Thomson area in compliance with Alaska Oil and Gas Conservation Commission (AOGCC) requirements (Figure 1). This remediation work could occur during the 2010-2011 winter or 2011 summer seasons and may include well re-entry and well plugging activities and gravel pad remediation.

The polar bear is a marine mammal species protected by provisions of the Marine Mammal Protection Act (MMPA) and is a threatened species under the Endangered Species Act (ESA). The ESA listing was accompanied by a special rule for the polar bear that "generally adopts existing conservation regulatory requirements under the MMPA and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as the appropriate regulatory provisions for this threatened species." The MMPA prohibits the "taking" of marine mammals except for specific authorized purposes and conditions. "Take", as defined by the MMPA, means to "harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal". "Harassment" has been further defined as, any act which:

> i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or
>
> (ii) 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 (Level B harassment).

The federal agency responsible for the management of polar bears is the United States Fish and Wildlife Service (USFWS). The USFWS has published regulations for the issuance of Letters of Authorization (LOA), under Title 50 Code of Federal Regulation (CFR) Part 18, Subpart J, pertaining to the taking of polar bears incidental to oil and gas exploration, development, and production activities in the Beaufort Sea and the adjacent northern coast from 2006-2011 (71 FR 43926). This LOA applies only to disrupting polar bear behavioral patterns (Level B harassment). Individual oil and gas operators must apply to the USFWS for coverage of their development activities under this LOA. This Polar Bear and Wildlife Interaction Plan will be submitted annually with ExxonMobil's LOA application to USFWS in partial fulfillment of the requirements of 50 CFR 18, Subpart J.

The USFWS has also issued separate LOAs to North Slope operators authorizing intentional takes of polar bears by harassment (hazing) in order to deter bears when they threaten human safety or property or to prevent them from habituating to human encampments. These LOAs are issued under Sections 101 (a)(4)(A), 109 (h), and 112 (c) of the MMPA and are issued only for specially trained personnel and under certain operational conditions. This Polar Bear and Wildlife Interaction Plan establishes ExxonMobil's policies and procedures relating to intentional takes of polar bears by trained and authorized personnel and will be submitted as part of the application for an LOA for take by harassment.

Section 101 (c) of the MMPA allows, without prior authorization, the taking of a polar bear, including lethal take, if such taking is imminently necessary in self-defense or to save the life of a person in immediate danger. Any such takings must be reported to the USFWS Marine Mammal Management Office immediately. This Polar Bear and Wildlife Interaction Plan contains the appropriate contact information and reporting forms if any of these emergency situations occur.

It is ExxonMobil policy to protect the health and safety of people and to protect the environment. This Polar Bear and Wildlife Interaction Plan provides work crews with an understanding of the importance of polar bear safety precautions and identifies practices intended to minimize the opportunities for incidental encounters between polar bears and project personnel and to ensure safety for the bears and humans. Grizzly bears, managed by the Alaska Department of Fish and Game (ADF&G), also occur in the Point Thomson area and present similar safety issues. The approaches for avoiding conflicts with polar bears and grizzlies are essentially the same. The procedures for detection and deterrence of polar bears presented in this document will also be applied to grizzly bears in accordance with the standard practices developed jointly by the USFWS and Alaska Department of Fish and Game (ADF&G). This plan also addresses interaction with other wildlife found in the project area such as caribou, rodents, birds, etc.

ExxonMobil recognizes that the project routes of travel and the onshore drill sites are areas of wildlife use and is committed to minimizing impacts to wildlife. ExxonMobil will update this Polar Bear and Wildlife Interaction Plan annually or as needed, obtain annual LOAs from the USFWS, and conduct operations in accordance with those authorizations and the provisions of this plan.

2.0 SUBSISTENCE PLAN OF COOPERATION

Polar bears, caribou, seals, and other wildlife are subsistence resources for Alaska Natives. Alaska Natives have developed a management plan to ensure that subsistence harvests from this Beaufort Sea polar bear population do not exceed biologically acceptable limits. Some project personnel could be Alaska Natives who, as subsistence hunters, might otherwise be authorized to take polar bears. However, Alaska Natives employed in the program must abide by project rules and procedures. During periods when traveling to and from the project area and during active service at the project location, subsistence hunting is not authorized. For example, an Alaska Native employee may be assigned tasks as a polar bear monitor. In the course of these assigned duties, he may be required to use deterrent measures including the use of firearms, which are authorized only because he is a project member designated to carry out such measures, not because he is an Alaska Native who might otherwise be entitled to subsistence hunting rights.

A Subsistence Plan of Cooperation is required by 50 CFR 18, Subpart J to mitigate potential conflicts between oil and gas activities and subsistence hunting. Point Thomson is approximately 60 miles west of Kaktovik, the closest North Slope Village, and approximately 120 miles east of Nuiqsut.

ExxonMobil will conduct its activities in accordance with this section of the Plan, which is intended to ensure coordination of ExxonMobil's activities with the villages of Kaktovik and Nuiqsut to mitigate and prevent any potential conflicts when operating in close proximity to subsistence users. Further, the planned activities have minimal potential to interfere with subsistence activities in the area based on previous and ongoing discussions with Kaktovik and Nuiqsut village representatives and documented subsistence harvests. ExxonMobil has an ongoing dialogue with these communities and will update or modify its efforts to mitigate subsistence impacts as new information warrants. Barge activities have been planned to avoid the fall subsistence whaling season. Barging will be conducted in accordance with a Conflict Avoidance Agreement and will employ the use of Marine Mammal Observers (MMOs) and Communication Centers which will further reduce the potential for impacts to subsistence.

3.0 BACKGROUND ON THE INTERACTION PLAN

This Polar Bear and Wildlife Interaction Plan describes procedures ExxonMobil employees and contractors will follow to protect personnel, bears, and other wildlife. The Beaufort Sea population of polar bears is estimated to be between 1,800 and 2,200 bears, with an average density of about one bear per 30 to 50 square miles. Bears are not uniformly distributed in the region and may concentrate in certain habitats and areas such as barrier island complexes. There also tend to be differences in habitat use by sex and age classes of bears. Subadult bears may be forced to use lower quality habitat by more dominant animals, for example. Male and non-pregnant female polar bears do not hibernate or spend extended periods in dens. However pregnant females enter dens from mid-November to mid-December and usually emerge with cubs from early March to mid-April.

In the Point Thomson vicinity, polar bears may be encountered throughout the year. Polar bears often spend time on shore during summers when the ice pack is distant. It will be critical to minimize bear encounters and reduce the risks to both people and bears by implementing the Polar Bear and Wildlife Interaction Plan and ensuring that workers are aware of and practice bear-safe behavior. Even though there are serious risks associated with interactions with bears, most hazards can be avoided, and the potential for others can be greatly reduced.

This Polar Bear and Wildlife Interaction Plan provides a relevant, usable approach to reduce threats to people and bears and the impacts of the project on bears in the area.

There are two major aspects of human-bear interactions addressed by this document:

1). Human Impacts on Bears:
  a) Den disturbance/den abandonment/cub mortality (greatest threat to bears).
  b) Possibility of bear mortality from access to improperly stored toxic substances such as antifreeze, or from an oil spill.
  c) Harassment of bears by aircraft, watercraft, or vehicles.

d) Bears consuming human food and garbage (food-conditioning) or getting too comfortable around people, work sites, or camps (habituation).

2). Bear Impacts on Human Activity:

a) Injury or death from a bear attack (surprise encounters pose the greatest risk, though attacks are very rare).
b) Property damage by bears.
c) Work stoppages (from short delays as a bear moves through an area to extended closures around a den site).

Even though human safety is foremost, the welfare of bears is also important. The goal is to reduce risks to both.

4.0 EDUCATION AND TRAINING

ExxonMobil is committed to providing high-quality, relevant training for workers. The goal of polar bear awareness training is to encourage safer behavior on the part of workers and to minimize the impacts of the project on polar bears.

ExxonMobil and contractor personnel will receive an environmental orientation as part of the Arctic Pass Training program before beginning work tasks in the project area. The Arctic Pass training program is required for project team members traveling to Deadhorse and/or the Central Pad and contains a "Polar Bear and Wildlife Awareness" module. In most instances, the orientation will be given in Anchorage or upon initial arrival at contractor facilities in Deadhorse. A major feature of the orientation will consist of viewing the complete or modified version of "Polar Bears: Safety and Survival," a video prepared by the Alaska Oil and Gas Association (AOGA) in cooperation with experts from the Federal and state wildlife regulatory agencies. The video is part of the North Slope Training Cooperative (NSTC) training that personnel must undertake in order to work on the North Slope. This training film covers the life history and the biological status of the Beaufort Sea polar bear population; the MMPA with regard to polar bears; and the measures to be taken to minimize human/bear encounters. Implementing the early detection and safe avoidance procedures provides the best guarantee that a harmful encounter (for either bears or people) will not occur.

Selected project personnel will also be trained in polar bear and grizzly bear deterrence (see Section 6, Deterrence and Hazing). This training, which has been developed and conducted jointly by ADF&G and the USFWS to address deterrence of polar bears and grizzly bears on the North Slope, will be provided to select individuals who will be authorized to perform hazing operations to protect human health and welfare if necessary. This authorization and any restrictions will be specified under an LOA issued by the USFWS pursuant to Sections 101(a)(4), 109(h), and 112(c) of the MMPA. Only properly trained and authorized personnel will have access to deterrence firearms. A third party contractor with the requisite qualifications may also be retained to provide bear protection and deterrence services. Personnel authorized to haze bears will be required to take a refresher deterrence training course every year.

ExxonMobil will use a number of approaches to provide and reinforce bear-related safety and conflict prevention messages to ensure that all workers get the necessary, correct guidance:

- Environmental orientation as part of Arctic Pass
- Additional targeted training sessions as needed
- Refresher classes – yearly for designated bear monitors/authorized hazers
- Safety meetings – used to increase/reinforce awareness of bears, specific issues, how to avoid problems
- Videos – the complete or modified version of the AOGA Polar Bear video, "Staying Safe in Bear Country"
- Posters around the facilities
- Warning signs posted at facility exits and other potentially dangerous locations
- Periodic handouts and/or Environmental Bulletins regarding bear safety and interaction

4.1 INDIVIDUAL WORKER RESPONSIBILITIES

Proper employee conduct is crucial to the success of the Polar Bear and Wildlife Interaction Plan. Every worker needs to understand that, although ExxonMobil is making significant efforts to protect people and bears, individuals must also take personal responsibility for educating themselves and avoiding encounters with bears. Workers on the Point Thomson Project will:

- Attend safety training and follow the rules/procedures established for bear interactions.
- Take personal responsibility for safety.
- Be alert whenever in areas where bears might be.
- Always look around before leaving a vehicle or building. Check for bears outside doors, around stairs, corners of buildings, connexes, material storage, and especially areas such as dumpsters or incinerators.
- Be extra cautious when working outside during evening hours and hours of darkness, or when fog or blowing snow reduces visibility. Remain within the lighted work areas.
- Immediately notify on-site security personnel when bears are sighted.
- Avoid bear encounters and retreat to safety when appropriate.
- Never approach bears or linger in exposed areas to take photographs.
- Drive carefully when wildlife is in the vicinity - wildlife has the right-of-way.
- Never feed wildlife (feeding rodents, foxes, birds, bears, or any other wildlife will not be tolerated).
- Always remove food/garbage from vehicles/watercraft/aircraft. Operators must be responsible for the cleanliness of their vehicles/watercraft/aircraft (including pickup truck beds).
- Never litter or pour unfinished beverages (such as sodas or coffee) on the ground.
- Understand that there will be serious consequences for mishandling food/garbage that attracts animals.

4.2 BEAR MONITOR RESPONSIBILITIES

In addition to the responsibilities workers share, dedicated bear monitors will be maintained on location to look for and identify evidence of bear presence in the project vicinity. While human safety is the top priority, it is vitally important to emphasize that early detection and avoidance measures are equally designed to prevent encounters that might result in harm to humans and bears. The early detection of bears is one of the bear monitor's major duties.

Upon finding bear sign or sighting a bear, bear monitors will notify the on-site Security Supervisor. Bear monitors will also be assigned to continually watch a bear while it is in the project vicinity. Project personnel will be instructed to report any bear sightings or interactions to the designated bear monitor and the on-site Security Supervisor. Bear monitors will investigate reports of bear tracks or bears on the pad, may be assigned to guard work crews, and may haze and deter bears if adequately trained (see Section 6, Deterrence and Hazing). They will also do routine safety checks, and be responsible for maintaining the daily log (see Section 9, Polar Bear Reporting and Record Keeping).

4.3 COORDINATION OF TASKS AMONG EXXONMOBIL GROUPS

Point Thomson personnel includes ExxonMobil employees as well as contractors on-site. The overlapping areas of responsibility between these groups will be coordinated by the on-site Security Supervisor to achieve the most efficient approach to bear detection, worker safety, and minimizing impacts on bears. There is a need for clear understanding of everyone's duties and good lines of communication so incorrect assumptions are not being made about respective responsibilities. This issue will be a key component of initial and ongoing bear safety training efforts.

5.0 SITE DESIGN AND OPERATIONS

ExxonMobil will incorporate the following elements into the design and operation of Point Thomson facilities to minimize the impacts of activities on bears and to reduce risks to people:

- Early detection of bears in the area through a combination of site design, bear monitors, vigilant workers, and proper lighting.
- Minimizing attractants and eliminating rewards by using bear-resistant storage for food, garbage, and hazardous substances, incineration of wastes, backhauling unburnable wastes, and enforcing bans on littering and feeding wildlife.
- Clear roles and responsibilities to quickly report bears sighted near camp/work areas and an effective communication system to warn other workers of bears and direct appropriate responses.
- Authorized, well-trained personnel able to haze/deter bears in limited and necessary circumstances, using approved protocols.

5.1 DETECTING BEARS

ExxonMobil will use a combination of approaches to detect bears in the vicinity of its facilities and work sites. Detecting bears as early as possible provides the greatest number of options and safest scenarios.

Site Design and Layout: Basic design and layout considerations will help detect bears.

Sight distances in the more heavily traveled areas of the pads will be maximized as practical to reduce chances of surprise encounters and ambushes.

Appropriate visibility will be maintained for the stretch of road leading to the pad (since bears often follow the path of least resistance and may walk up roads to facilities) as well as around dumpsters, incinerators, and sewage disposal units (odors might attract curious bears).

The site layout will attempt to avoid dead end corners and alleys. A bear could get trapped if it is spooked or hazed into a blind alley that does not have an escape route, or a bear could corner a worker there.

Lighting Systems: Bright lighting may have a deterrent effect on a wary bear but more importantly, bright lighting increases the chances that workers will see a bear if one is near. Areas with high worker traffic and areas with higher potential for bear encounters (doors, outdoor work areas, food/garbage storage sites, parking areas, dumpsters, incinerators, and other heavily used areas) will be properly illuminated during periods of darkness. Although lighting will assist workers in seeing bears that may be within the immediate area, these lights may not help spot distant bears; thus outdoor work areas may be provided with additional lighting as considered necessary. Lighting will be directed downwards to prevent light emissions upwards and outwards that may be attractive to birds during inclement weather.

Building Exits: The main camp entrances and other high traffic doors will be equipped with steel cages that provide a safe area to protect exiting workers. Exterior doors will be kept closed to prevent curious bears from entering buildings. Windows or cameras may also be used on some doors to help detect bears outside.

Vigilant Workers: ExxonMobil recognizes that observant workers and bear monitors are among the best ways to detect bears and are a crucial part of early detection efforts. Worker awareness will be stressed in environmental briefings, safety meetings, posters, and other ways to continually reinforce the need for vigilance. Sightings by equipment operators, security, and other personnel who spend significant time working on the pad will also help locate bears. Sighting information will be communicated to all personnel.

Bear Monitors: Bear monitors will be employed and trained to watch for approaching bears and monitor their movements when they are near facilities and work crews. Bear monitors will be deployed to allow for continuous coverage. Work schedules and standard routines will be adjusted as necessary to minimize fatigue and help make bear monitors as effective as possible. The best lookout locations for bear monitors will be assessed on a continuous basis as the facilities expand and sight lines change.

Perimeter Sweeps: Bear monitors and security will regularly patrol the perimeter of the facilities scanning for bears and looking for bear sign. They will scan for bear tracks in the snow or ground, and tracks will be reported to Security and investigated to ensure that a bear is not hidden somewhere on the pad.

5.2 LIMITING BEAR ACCESS

A concerted effort will be made at the permanent facilities to limit bear hiding places.

Bear cages are in place around main access doors to the camp and smoke shack to provide workers an additional safety measure to check for bears before stepping outside.

At Point Thomson, whenever practical, materials and equipment will be stored in ways that minimize potential hiding/ambush sites, such as packing things close together and capping pipes with a diameter greater than 30 inches.

Enclosed walkways will be employed, where practical, to minimize outdoor foot traffic. The importance of keeping doors that bears can access closed will be emphasized.

5.3 BEAR-RESISTANT STORAGE

Hazardous materials that could pose a threat to the health and safety of polar bears (such as glycol, lubricants, motor oil, fuel, and drilling mud with hydrocarbons) will be stored so bears can not contact them (e.g. inside buildings, sheds, connexes, drums, locking steel containers). Secure bear-resistant storage methods will also be used for handling food and garbage.

5.4 FOOD AND GARBAGE MANAGEMENT

ExxonMobil is committed to preventing wildlife from obtaining any human provided food or garbage at Point Thomson. This is an extremely serious issue. Bears that learn to associate human activity with a possible meal are not only potentially dangerous, but are also at greater risk of getting killed in other areas. Securing food and garbage and enforcing the feeding ban are among the best ways to reduce encounters and conflicts, and are also relatively easy to achieve at a controlled, remote development such as Point Thomson. Preventing bears from developing bad habits is a priority.

At Point Thomson, food will be kept inside buildings and only permitted in vehicles/watercraft/aircraft in containers that minimize odors, for short periods, when workers are unable to use the dining facilities. Food (other than survival gear) or refuse will not be left in parked vehicles/watercraft/aircraft after a shift is over, and will be disposed of properly.

Scrap metal and other non-bear-resistant dumpsters on the pad will be kept free of food waste.

Incinerating food and garbage is one of the best ways to eliminate the problems associated with disposal. The pad will have a small, batch process garbage incinerator to reduce and minimize solid waste that would require off-site transport and disposal. Any food wastes that could attract wildlife will be incinerated daily on-site or stored temporarily in enclosed containers.

Food waste includes used cooking oil and containers that have been used for food and beverages (lunch sacks, paper plates, Styrofoam containers, plastic utensils, etc.). These items can contribute to bear problems if not disposed of properly.

ExxonMobil has a zero tolerance policy for feeding wildlife. This is covered in the site orientation, Arctic Pass training, and in the North Slope Environmental Field Handbook, which is distributed at NSTC training. Any worker caught feeding wildlife will be removed from the project. There will also be serious consequences for carelessness with food and garbage disposal. Personnel will be reminded regularly that they should not litter, leave any uneaten foods in parked vehicles or pickup truck beds, throw garbage in scrap dumpsters, or pour unfinished drinks on the ground.

5.5 SEWAGE AND WASTEWATER

Sewage and wastewater odors are potential attractants to bears. The camp will be equipped with a wastewater treatment plant that discharges treated wastewater under an NPDES permit. Sewage sludge will be incinerated on-site regularly or stored in enclosed tanks prior to shipment to the NSB treatment plant in Deadhorse.

5.6 SNOW REMOVAL

If possible, snow will be kept cleared away from around buildings to minimize potential hiding places for bears and other wildlife.

5.7 CARCASS REMOVAL

Carcasses of marine or terrestrial animals may be found near facilities and attract bears and/or foxes, creating a safety hazard. Depending on the type of animal involved, ExxonMobil will contact the appropriate agencies (National Marine Fishery Service [NMFS], ADF&G, or USFWS) and request that they move or dispose of the carcass as soon as possible or authorize ExxonMobil to do so. Depending on the size and condition of a carcass, it may be towed off site to be removed. ExxonMobil will follow the protocols of the responsible agency for dealing with carcasses to prevent them from attracting and feeding wildlife near the facility. Records of any such actions will be kept and provided to appropriate agencies. ACS personnel are trained to handle carcasses.

5.8 COMMUNICATIONS/BEAR WARNINGS

ExxonMobil has clear communication protocols for bear encounters. Good two-way communication among all personnel on-site is an essential part of safely working in bear habitat. Every worker must notify the bear monitor, security, or supervisors when they see a bear or bear tracks. Supervisors and bear monitors will warn the camp and workers/crews of a bear's location and communicate with them regarding what actions to take as well as when it is safe to resume work. The Point Thomson facility has a bear-specific alarm to alert workers on the pad that a bear is in the vicinity and they need to seek safety inside. The alarm consists of three blasts of an air horn or vehicle horn. During the site orientation, workers will be briefed so they are aware of the bear alarm, how it sounds, and the need to seek a safe retreat when it sounds. Other approaches for providing bear warnings will also be used such as radios and intercoms, as well as lights and placards at exit doors when a bear hazard is present.

The Central Pad uses a color coded Bear Encounter / Sighting Alarm Procedure, detailed below, to inform workers of bear safety conditions.

RED ALERT:

- A bear is sighted within 300 yards of the pad and is advancing
- Three (3) blasts of a vehicle or air horn (followed by a radio announcement)

- Security will rebroadcast the radio announcement and will dispatch the Bear Monitor
- Personnel move inside a secure building
- The Bear Monitor will maintain constant sight of the bear
- The Person-In-Charge (PIC), Security and the Bear Monitor will maintain communication

ORANGE ALERT:

- A bear is sighted within 300 yards of the pad, but is not advancing
- Notify Security who will dispatch the Bear Monitor
- The PIC and Security will decide whether it is safe for personnel to attend to essential work/personnel will be transported via vehicle
- The PIC or Security will broadcast a radio announcement concerning the work level allowed
- The Bear Monitor will maintain constant sight of the bear
- If visual contact is lost or the bear advances toward the pad – the site will go to Red Alert

An all clear will be announced by the PIC when normal operations may continue.

5.9 REGULAR ALARM MAINTENANCE AND SAFETY CHECKS

Safety/security personnel will be responsible for checking that mechanical, structural, or electronic elements of the bear alarm system are functioning properly. This will include checking the bear alarm, the bear-resistant storage containers, and access controls (doors, cameras, cages, and gates) to make sure they are functional. Safety/security personnel will report any problems to the appropriate maintenance staff, as well as make sure bear-accessible doors are not propped open, and scrap metal dumpsters are not being used for food wastes. The bear monitor will investigate unusual activity by birds, foxes, or ground squirrels, which can indicate people feeding wildlife or being careless with food/garbage. A quick response to stop food/garbage mishandling is critical.

6.0 DETERRENCE AND HAZING

ExxonMobil staff and contractors will operate under LOA stipulations that authorize designated personnel to deter bears away from facilities and areas of human activity under specified conditions. The goal of deterrence will be to keep both people and bears safe by discouraging a bear from displaying adverse behavior (such as approaching facilities or workers, or getting into food and garbage). The major strategy is hazing – a form of deterrence to get a bear to move away, usually from work sites and facilities. It is in the best interests of human and bear safety for bears to keep their distance. Individuals authorized to conduct bear deterrence will receive specialized training offered by, or approved by the USFWS. The following sections describe the procedures for active deterrence and hazing of bears by authorized personnel.

6.1 BEAR DETERRENCE TRAINING

It is crucial to have well-trained individuals perform deterrence activities. USFWS Marine Mammals Management or ADF&G personnel will provide the training. A third party contractor may also be authorized if the training content is consistent with agency courses and the trainer is approved by the agencies. Training for authorized hazers will occur annually. Designated hazers will be firearms qualified and familiar with the capabilities and limitations of the tools. Practice with actual deterrents is crucial and will be included in classes.

Deterrence Training will include the following topics:

- Regulatory issues: MMPA/ESA, “take,” LOAs
- The Polar Bear and Wildlife Interaction Plan
- Basic natural history of polar and grizzly bears
- Behavior of polar and grizzly bears
- Preventing bear conflicts
- Hazing/deterrence principles
- Capabilities and limitations of deterrents
- Hazing/deterrence techniques and protocols
- Scenarios
- Accountability/reporting requirements
- Field training practice session with the actual deterrents
- Report writing and required forms

6.2 HAZING/DETERRENCE PRINCIPLES

1. Deterrence works best when other preventative strategies to keep bears from obtaining food and garbage rewards are successful.
2. The effectiveness of deterrents is a function of whether or not the bear has been rewarded for a behavior in the past, and how strong its motivation is. The most difficult animal to deal with is a very hungry, determined bear that has repeatedly gotten into food and garbage previously at a site. The easiest animal to deal with is a curious, somewhat wary bear that has never been previously rewarded by food associated with human activity.
3. Deterrent efforts also benefit from good detection efforts. Early detection of a bear’s approach or presence permits more preparation time and provides more options for deterrent actions.
4. The best scenario is to be prepared to use deterrents, but to not have to use them, letting a bear move on by the facility or through the area on its own while being monitored.
5. Deterrents should be used only for very specific, approved objectives and should never be used unnecessarily or out of frustration.
6. When and where deterrents are used will be determined by stipulations of the LOAs, established protocols, and the best judgments of the designated hazers. All other options will be pursued before resorting to deterrents unless otherwise specified.

7. If a bear in a non-emergency situation is to be hazed, the least intense methods will be used first.
8. Finesse is usually better than excessive force – just making a curious bear think twice about approaching people or entering facilities by moving a vehicle toward it may be enough to discourage it.
9. Restraint in resorting to deterrent rounds and more serious tools is important. The desired result can often be obtained by less intensive methods.
10. There is no perfect deterrent, but there are many options and usually a combination of techniques used by a well-trained hazer with understanding of bears works well.
11. Effectiveness of deterrents varies with conditions/context.
12. Overuse of deterrents can decrease their effectiveness. Bears will get used to most deterrents if repeatedly exposed to them. This is especially true of noises, but is also true of rubber bullets.

6.3 HAZING/DETERRENCE TOOLS AND TECHNIQUES

Hazing and deterring a bear basically involves trying to prevent the bear from some activity or getting it to move away by intimidating or frightening it. In the context of this project, it should be done either visually, with sound, or with a small amount of physical contact. Details about the advantages and limitations of the various deterrents will be covered in training sessions for hazers.

One way to intimidate a bear is visually with size and movement. Generally a bear perceives large size and movement towards it as assertive/dominant. Moving towards a bear with a large piece of equipment is often enough to haze it. Vehicles, heavy equipment, snowmobiles, and helicopters can all be used to haze bears.

Noise is another way to intimidate or frighten a bear into moving away. Depending on the situation air horns, sirens, firecracker shells, even yelling or clapping can haze a bear, at least for a short time. Making noise with construction equipment as you haze a bear can also be effective but bears can quickly get used to, and start to ignore noises.

Physical contact either from a chemical irritant such as bear pepper spray or from non-lethal ammunition such as a 12 gauge beanbag, is another good way to dissuade a bear from approaching or frequenting facilities.

Bear pepper spray is a good close-range deterrent in the right circumstances but the canisters may not work well when cold.

Striking a bear with a non-lethal round works well because bears are not used to random physical contact and hitting a bear with one of the projectiles can be a good way to get a reaction from the animal, especially from a wary, non-food-conditioned bear. However, the effectiveness also may decrease with repeated use and it is difficult to provide enough punishment to dissuade a highly motivated, determined bear from food rewards.

At Point Thomson, where attractants are minimized and food and garbage carefully controlled, hazing a bear should be accomplished with a vehicle or piece of heavy equipment, in addition to cracker shells. If vehicular hazing is ineffective, more intensive deterrent tools can be used.

6.4 DETERRENTS TO BE KEPT ON-SITE

1. A 12 gauge shotgun used for both deterrence and protection. If not being used in hazing, the shotgun will be carried loaded with a lethal round (slugs) as the first option to fire.
2. Twelve gauge deterrent rounds such as "bean bags" and cracker shells. Cracker shells should only be fired away from the pad, and caution is necessary in dry conditions to avoid starting a tundra fire.
3. Bear pepper spray.
4. Long range acoustic device (LRAD) (high decibel electronic acoustic deterrent)
5. Small air horns.

Firearms and deterrents will be stored in a locked cabinet within the guard shack, and their use limited to authorized bear hazers.

6.5 BEAR BEHAVIOR AND DETERRENCE

A hazer who understands bear behavior and knows about the type and strength of a bear's motivation will be much better at using deterrents successfully.

Bears are not territorial. They have personal space and use a pecking order to share resources. The more dominant animals can access areas first and less dominant bears work around them. Bears will defer to more dominant animals and try to avoid conflicts with larger, stronger bears. That tendency can be used in hazing efforts. If a bear does not know the status of another animal it bases its reaction on whether or not that animal's behavior is perceived as that of a dominant animal. The behavior of hazers should communicate dominance to bears even before they use deterrent rounds.

Bears also react differently if they are outside their normal comfort zone. Meeting a bear in the middle of its natural habitat creates a different dynamic than if you encounter it when it has entered a relatively unfamiliar human zone.

Bear encounters at Point Thomson will often be with animals that are entering or are on the edge of "human habitat", often just out of curiosity of the strange activity or following interesting smells. Those bears should be somewhat wary and more tentative in their approaches. Such bears should react cautiously and retreat if something large, such as a vehicle or piece of heavy equipment, moves towards them. This is especially true of naïve animals that have not had the chance to get accustomed to equipment noise and activity. The exception is an extremely hungry, desperate bear that will probably require serious efforts to chase off.

See Appendix A for Protocols for Bear Hazing.

7.0 ICE ROAD/OFF-SITE OPERATIONS

Reducing the risk to on-site workers and to bears also applies to off-site operations such as surveying, ice road construction, hauling operations, and barge operations. ExxonMobil may construct and operate an ice road from the Endicott causeway to the Point Thomson Central Pad and several onshore ice roads. The currently planned route of the ice road is shown in

Figure 1. This route was chosen to meet the ice road needs of staying close to the coast to avoid deep waters while at the same time avoiding the areas with the higher probability of encountering polar bear dens.

While ExxonMobil is the only company operating at Point Thomson, other companies may be conducting operations in proximity to ExxonMobil's ice roads. This could include other companies that use the ice roads in a shared fashion, companies that cross the ice roads, and companies that operate ice roads in the same general area. In all cases, ExxonMobil will endeavor to cooperate with other companies in the area to reduce the impacts of the individual or combined operations upon polar bears. This will include posting security guards to control access to the ice road at all points of entry and pursuing agreements to allow reciprocal use of the roads in the event a polar bear den(s) is detected within the area impacted by the roads.

If more than one ice road is constructed, a Joint Use Letter of Understanding will be pursued for companies' mutual agreement that if a polar bear den is found on one operator's road, that company can use the other operator's road, provided that they comply with the other operator's road use rules. A Site Security Consultant will be named as the single point of contact regarding bear issues for all companies operating on that road. Regardless of which road ExxonMobil workers are on, they will comply with ExxonMobil protocols.

7.1 BEAR INTERACTION PROCEDURES

When possible, personnel will work in teams of two or more. This will allow for one person to look for bears while the others perform tasks since it is extremely difficult to complete work and watch for approaching bears at the same time. If exceptions to this rule are made, careful consideration must be given to ensure that worker safety is adequately addressed.

Off-site work requires extra caution and vigilance to avoid bear encounters because there is a greater chance of encountering an undetected bear away from more developed sites. Off-site workers and bear monitors must be constantly alert to prevent a surprise encounter. Attentiveness is even more critical during darkness, foggy conditions, blowing snow -- any situation that decreases the ability to detect bears. One person will watch for bears while others are working.

INTERACTION PROCEDURES:

1. Before initially working at a location, scan the surrounding area for evidence of bears. Use vehicle headlights or spotlights to scan the area if it is dark. Check with the bear monitor to make sure no bear sign has been reported. Aircraft can be useful for spotting bears. Helicopters, if practical, can circle and check for bears before dropping off crews at work sites. However, aircraft on routine flights that spot bears will not make low passes for better looks or to take photos. This stresses the animals and is illegal. The surrounding area must be absent of bears prior to initiation of work.
2. The designated bear monitor will maintain watch from the perimeter of the work location(s). Work crews at locations removed from the main work crew will maintain radio contact with the bear monitor. If possible, work crews will maintain a safe retreat area such as a building or vehicle at each work site.
3. Take no food outdoors to avoid attracting bears.

4. In the event a bear is sighted, retreat to a secure location such as a building or vehicle if possible. If possible, workers can sound the air horn. Workers will report all bear sightings to the designated bear monitor and/or on-site Security supervisor as soon as it is safe to do so from a secure location. Do not remain in an unsafe situation to view or photograph a bear.
5. Look outside before leaving any vehicle or building.
6. Use good judgment.
7. If near a snow machine or vehicle and a bear approaches, start the engine and rev it to make the bear aware of your presence. The noise will often cause the bear to move away. Report the encounter immediately.
8. If a bear is seen while in an exposed area, DO NOT YELL OR RUN, a bear cannot be outrun! Back away slowly towards a safe retreat keeping your eyes on the bear. If the bear is approaching, it can be distracted by dropping something such as an item of clothing. If attacked by a bear, fight back with anything at hand, as hard as you can, concentrating on the bear's face and nose.
9. Use at least two vehicles if practical when traveling off-site so that, if one breaks down, the second can be used to shelter or transport personnel to safety rather than having individuals walk long distances.
10. In case of a vehicle breakdown, call for help rather than walking.

7.2 DEN DETECTION TECHNIQUES

During the winter, denning bears should not be disturbed. Although adult males and non-pregnant females may briefly den up during a storm, they do not spend the winter in dens. Pregnant females, however, enter dens in mid-November to mid-December to give birth and nurse cubs until they emerge approximately early March to mid-April. Because of the potential seriousness of disturbing pregnant female bears, or females with newborn cubs, ExxonMobil is committed to locating and avoiding dens.

Detection efforts will use a combination of techniques including:

1. United States Geologic Survey (USGS) satellite-collared bear locations in the project area, especially those of the den sites of radio-collared bears to the extent such information is made available;
2. Denning habitat maps and the USGS polar bear den database, as available
3. FLIR technology available for den detection: aerial surveys under suitable conditions as possible using forward looking infrared (FLIR) camera mounted on rotary aircraft with experienced operator (and agency participation when possible and review of the recordings afterwards)
4. Additional ground-truthing with scent-trained dogs (if available) and hand-held FLIR cameras will also be carried out as necessary

Providing training and directives to field personnel to report any sightings of polar bears or polar bear tracks, especially along the ice road away from the Central Pad

In the Beaufort Sea region, polar bears den along coastal bluffs, riverbanks, and barrier islands that accumulate snowdrifts, as well as on the sea ice. The majority of terrestrial polar bear maternity dens are within 10 kilometers (km) of the coast.

Ongoing winter activity when a bear is seeking a place to den would likely cause the bear to den far enough away from the activity/noise to not be bothered by it, the distance being a function of the individual bear's tolerance for disturbance. However, if a bear dens in an area with minimal or no activity and that area subsequently gets busier and noisier with development activity, the bear cannot avoid the disturbance unless it leaves the den and cub abandonment could result.

The ice road route from the Endicott causeway to Point Thomson is potentially in proximity to suitable denning habitat for polar bears. ExxonMobil, prior to construction of the ice roads, will conduct surveys to identify and avoid bear dens. Locating polar bear dens in areas where winter work will be taking place is an important task. There is no system that is 100 percent effective at finding all bear dens, but many can be detected. In order to do the best possible job, a combination of techniques will be used. An aerial FLIR survey is the most effective and widely used technique but it can produce both false negatives (no indication a den is in an area when it is) and false positives (indication a den is in an area when it is not). Additional follow-ups, ground-truthing and consulting with agency personnel will be used to minimize these errors.

Timing of den surveys is critical. Den surveys ideally will be conducted after all the pregnant polar bears have denned, but ahead of ice road survey and construction. Finding good survey weather in the window between last den entrances and the start of ice road construction can be a challenge. Some bears may not enter dens until mid-December or later, yet activity related to the ice road could start prior to that. If work in potential denning habitat begins before all bears are in dens, an early survey will be conducted where the activity will first occur. This will be followed by another later search for dens in the same area after all bears should be denned up. There will be some flexibility in the actual approach because of yearly variability in weather, timing of ice road work, and other logistics. Detecting and avoiding occupied bear dens will be the goal. ExxonMobil will employ experienced FLIR operators to conduct the surveys. ExxonMobil will have a dedicated FLIR unit and helicopter available as necessary to meet these survey timing objectives. ExxonMobil will coordinate FLIR surveys with other operators and will work with suppliers to make any FLIR equipment under ExxonMobil's control available to other operators.

ExxonMobil is committed to using the best available methods to detect occupied bear dens along proposed ice road routes and other areas of concern. The USFWS will be consulted on an ongoing basis during planning and construction of the ice roads and is welcome to participate in all phases of field operations including conducting FLIR surveys and during any bear den response actions. ExxonMobil will also consult with other producers working in the same area to coordinate on FLIR survey coverage and results. ExxonMobil will cooperate with USFWS to most effectively conduct den surveys. Prior to the start of the FLIR operations, ExxonMobil will work with the USFWS and other operators to hold a workshop to share and refine best practices to be employed in the field.

When a polar bear den is identified, the USFWS will be notified in accordance with the approved LOA, the road will be closed as described in Section 7.3 and Appendices E and F, and the road will be re-routed as necessary to maintain a 1 mile buffer unless otherwise approved by the USFWS. Approval for such routing will be addressed via the Land Use Permits.

In areas with known dens, a flight altitude of at least 1,500 feet will be maintained for all aircraft within 1 mile of an occupied den, and when conditions do not permit flying at or above this altitude, the pilot will alter flight paths to avoid flying within 1 mile of the den. ExxonMobil has designated a helicopter flight path between Deadhorse and Point Thomson that avoids the coast and this will reduce the chances of disturbing polar bears.

7.3 CONTINGENCY PLAN FOR ROAD CLOSURE

One of the highest risks for accidental den disturbance is along ice roads. A bear may den in a remote area, but then be faced later in winter with construction noise and activity that it can only avoid by fleeing its den. An immediate response to potential den disturbance is critical. A rapid, careful, coordinated response lessens the chance of den abandonment. Quickly stopping activity that could disturb a denned bear is a critical part of the plan. Once a den is discovered all of the restrictions of the LOA will apply. Appendix B outlines the emergency response to the discovery of a den/suspected den near the ice road or other industrial activity

ExxonMobil's emergency protocols, as well as coordination and communication among the users and USFWS (including a single point of authority/contact on the industry side – the "Site Security Supervisor") are listed in Appendices E and F. All users of ExxonMobil's ice roads will be required to follow these protocols. Contingency plans to conduct activities in case of an extended ice road closure (up to 3 weeks) between approximately March 1 and April 15 will also be adopted.

Workers using the ice road will be briefed on the importance of not disturbing denning bears, of remaining vigilant for bears and signs of dens, as well as the procedures for reporting sightings and be required to sign a statement confirming their understanding of these protocols. They will also be informed of the emergency road closure protocols so they know what to expect. Contingency plans for getting delayed on the opposite side of the closure will be explained. ExxonMobil will stress that not reporting a bear den for fear of road shutdown is unacceptable, and that early den detection and response is in the best interests of the project.

All supervisory, security, environmental, and safety personnel involved with the ice road will be trained prior to the start of ice road construction in the emergency response protocols, and will clearly understand their responsibilities. In addition, one or more ice road closure drills will take place to ensure the workforce's understanding of the Ice Road Closure Protocols outlined in Appendix C.

Radios (with satellite phones as backup) will be used to ensure proper communication between on-the-ground workers, ExxonMobil and contractor supervisory staff, and agency personnel.

8.0 OIL SPILL RESPONSE PLANS

From a polar bear protection perspective, spill prevention and, in the case of a spill, a rapid response coordinated with State and Federal agencies are critical. In the event of an incident involving the release of oil, ExxonMobil will promptly proceed to:

1). Prevent bears from getting oiled; detect bears in the vicinity of any spill, and keep them away from contact with the oil using trained bear monitors to haze bears from areas with oil, or possibly as a last resort, agency personnel to capture and relocate bears.

2). Ensure the safety of oil spill response crews by using dedicated bear monitors for operations.

3). Respond to oiled bears; agency or appropriately trained and authorized contractors to capture and clean.

Further measures detailing spill prevention and response can be found in ExxonMobil's Oil Discharge Prevention and Contingency Plan (ODPCP). Information related to immediate response actions, receiving environments, spill cleanup mobilization response times and well control are contained in the ODPCP. ExxonMobil is a member of Alaska Clean Seas (ACS) and plans to use ACS as a Primary Oil Spill Response Organization (OSRO).

In addition to the ODPCP, Spill Prevention, Control and Countermeasure (SPCC) Plans govern the handling and storage of fuel in tanks. These plans establish procedures, methods, equipment, and other measures to prevent, control, and counter the discharge of oil into or upon navigable waters of the United States.

9.0 OTHER WILDLIFE INTERACTIONS

Encounters with animals other than polar bears will likely occur. These include several species of birds, foxes, caribou, and grizzly bears. Issues relating to food and garbage management and the feeding ban apply to these animals as well. Dead or injured animals, or any seemingly unnatural behavior will be reported immediately to Security. No attempt should be made to capture or handle animals.

9.1 GRIZZLY BEARS

Grizzly bears on the North Slope are the same species as brown bears in other parts of Alaska, although they are generally smaller because food is less abundant. Grizzly bears hibernate from approximately September/October through April/May. Grizzly bears are potentially dangerous and should always be treated with caution. They are known to frequent the Point Thomson area. Grizzly bears are managed by ADF&G, and other than some legal/regulatory aspects, approaches for avoiding conflicts with polar bears and grizzlies are essentially the same.

Grizzly bears, like polar bears, have a keen sense of smell, can be curious, and are attracted to food sources. Once they find a food, they will often return for more. If they learn to associate humans with food, they will seek out human activity, increasing the chances of conflicts. If a bear is sighted, workers are to keep their distance, look around for other bears (cubs accompanying their mothers) and move to a secure location. Appendix D contains a Grizzly Bear Observation Report Form to be filled out and submitted to ADF&G (Dick Shideler, Contacts 11.0) whenever a grizzly bear is sighted.

The Project has a Public Safety Permit through ADF&G to haze grizzly bears and foxes. The 2010 Public Safety Permit can be found in Appendix E. This permit will be updated annually.

9.2 PACIFIC WALRUS

Walrus range throughout the continental shelf waters of the Bering and Chukchi seas, occasionally moving into the East Siberian Sea and the Beaufort Sea. During the summer months most of the population migrates into the Chukchi Sea. However, several thousand animals, primarily adult males, congregate near coastal haulouts in the Gulf of Anadyr (Bering Sea) and in Bristol Bay. Although the Central and Eastern Beaufort Sea are outside the normal range of the Pacific walrus, they have been sighted as far east as Kaktovik.

Pacific walrus are occasional visitors to the area rather than a common resident, and are not likely to be encountered along the barge route or at the Point Thomson locations. Similar to polar bears, Pacific walrus are protected under the MMPA. In the rare case of walrus traveling through the area, every effort will be made to avoid a “take”, as per the required stipulations in the Project LOA to be applied for and issued annually by the USFWS. Appendix F contains a Walrus Sighting Report form to be filled out and submitted to USFWS whenever a walrus is sighted.

9.3 ARCTIC FOX / RED FOX

Both arctic and red foxes will be encountered in the area. Foxes are found on the North Slope year round. In late March and early April they begin to den and have kits. Creation of artificial den sites will be prevented wherever possible. If foxes are discovered digging a den or scouting den sites in pipe or stored equipment, the digging site will be filled in, pipes closed off or equipment moved to prevent any denning. It is important to find and discourage these activities early in the process before foxes create a den and have kits. Foxes are a major vector for rabies. These two species of foxes constitute about 85 percent of animals submitted for rabies testing in Alaska that test positive. Arctic foxes normally exhibit little fear of humans. However, they must never be fed and anyone caught feeding them will be removed from the Project site. Workers will keep their distance and report aggressive, unusually curious, or overly friendly foxes to the ADF&G (Elizabeth Lenart, Contacts 11.0). Bear monitors are authorized to haze foxes off the Central Pad as needed to ensure worker safety (see ADF&G Public Safety Permit, Appendix E).

9.4 CARIBOU

Two main caribou herds - the Porcupine and the Central Arctic, inhabit the areas around Point Thomson. Caribou use the North Slope coastal plain in summer for calving and insect relief. Their calving season lasts from mid-May to mid-June. From early July to early August, caribou seek relief from mosquitoes near the coast and in elevated areas. If caribou move through the Point Thomson area, they will be given right-of-way and will not be approached or harassed. If caribou move onto the pad, gentle deterrence techniques will be employed under ADF&G guidance (Elizabeth Lenart, Contacts 11.0). Caribou are an important part of the subsistence culture on the North Slope. The Point Thomson area exists on the western edge of what has been a traditional area for subsistence hunting of caribou in the summer season by residents of Kaktovik. The proposed project will be discussed with local area residents to ensure that proposed work and the subsistence needs of Kaktovik do not conflict.

9.5 RODENTS

Rodents are a common North Slope mammal. Hawks, owls, eagles, foxes, wolves and bears prey on rodents. If a feeding ban is strictly enforced, and garbage is not available, rodents are usually not a major problem around facilities. However rodents can attract grizzly bears. If rodent numbers on the pads and around the camp greatly increase, but there are no issues with food and garbage, a permit to trap them will be considered.

9.6 RAVENS AND GULLS

Ravens and gulls are present on the North Slope and may be seen at the Point Thomson locations. They are scavengers that are often attracted to human developments but they are also predators on many other birds so it is important to avoid artificially increasing the populations of ravens and gulls. Typical attractors for ravens and gulls include food items and garbage. The restrictions on feeding and careful food and garbage handling should prevent these birds from becoming problems at Point Thomson. In addition, ravens may try to nest at the facility, and efforts will be made to prevent this. ExxonMobil will discourage use of its telecom and weather towers, as well as other infrastructure as nesting sites for ravens. Ravens are strongly attracted to such potential nesting structures. Options to prevent nesting are limited to building towers in ways that attempt to minimize nest building, blocking off nooks and crannies with fabric/netting, using scare devices to deter the birds when they land in places trying to nest, or knocking the nests down as the birds try to construct them (before they have a chance to lay eggs). As long as there are no eggs in the raven nest, it is acceptable to knock it down, as per USFWS guidance.

9.7 OTHER MIGRATORY BIRDS

In May, vast numbers of birds begin to return to the North Slope for the summer. Migratory birds are protected under the Migratory Bird Treaty Act. Some species, such as spectacled eiders, are protected under the Endangered Species Act. Project field activities will continue through summer and nesting birds may be encountered. Should summer site preparation or other field work (other than surveys) occur prior to 15 July when most arctic nesting birds have hatched, the site and immediate vicinity will be searched for nesting birds by a qualified biologist prior to the start of work. If an active nest of a listed or migratory bird is found, the appropriate USFWS office will be contacted for instructions on how to avoid or mitigate the potential loss of the active nests. In addition, site workers will be made familiar with endangered species identification via posters highlighting protected North Slope bird species.

9.8 SEALS

Three species of seals have the potential to be in the Point Thomson area: bearded seals, ringed seals, and spotted seals. Native subsistence hunters sometimes harvest and clean marine mammals near oil fields. Workers need to be aware that carcasses may attract bears. Workers should never approach or harass seals. If an injured, stranded, or dead seal is observed, workers will notify Security and the field environmental advisor immediately.

10.0 POLAR BEAR REPORTING AND RECORD KEEPING

Polar bear sightings will be recorded in the Bear Monitor's daily log. Bear monitors will complete a polar bear sighting form, which Security personnel will submit to the USFWS for all observations made. Appendix G provides the USFWS Polar Bear Sighting Report (On Land) and Polar Bear Sighting Report (Marine) Forms to be used as appropriate. These observations should be recorded any time a polar bear is sighted, when a polar bear enters the active work area, or when a polar bear is hazed. To the extent that safe observation permits, behavioral data will be collected. Project personnel who sight polar bears or polar bear sign such as tracks, will communicate the details to the bear monitor responsible for maintaining the log. To the extent available, the activity log will record observations such as group size, age, sex, reaction, duration of interaction, and closest approach. Data acquired will be made available to the USFWS as it is generated. Actual time spent observing polar bears will be part of the journal record to assist biologists who are trying to collect accurate information for their studies. Reports will be sent to Craig Perham at USFWS Marine Mammals Management Office (see Section 11.0 Contact Lists below).

All hazing and deterrent actions must be reported immediately to ExxonMobil field environmental advisor and then within 24 hours to the USFWS Marine Mammals Management Office.

11.0 CONTACT LISTS

While different individuals representing ExxonMobil may interact with the USFWS during different stages of the development and implementation of the Polar Bear and Wildlife Interaction Plan, ExxonMobil's Security Advisor (John Murphy) and his field On-Site Security Supervisor(s) (Bill Church and Scott Campbell) will be the designated points of contact with the USFWS and other company operations during response to any polar bear incidents or events.

Contact addresses for the offices with responsibilities related to polar bear and wildlife interactions are:

Craig Perham

United State Fish and Wildlife Service (USFWS) Marine Mammals Management Office

1011 East Tudor Road
Anchorage, Alaska 99503

Fax: (907) 786-3816

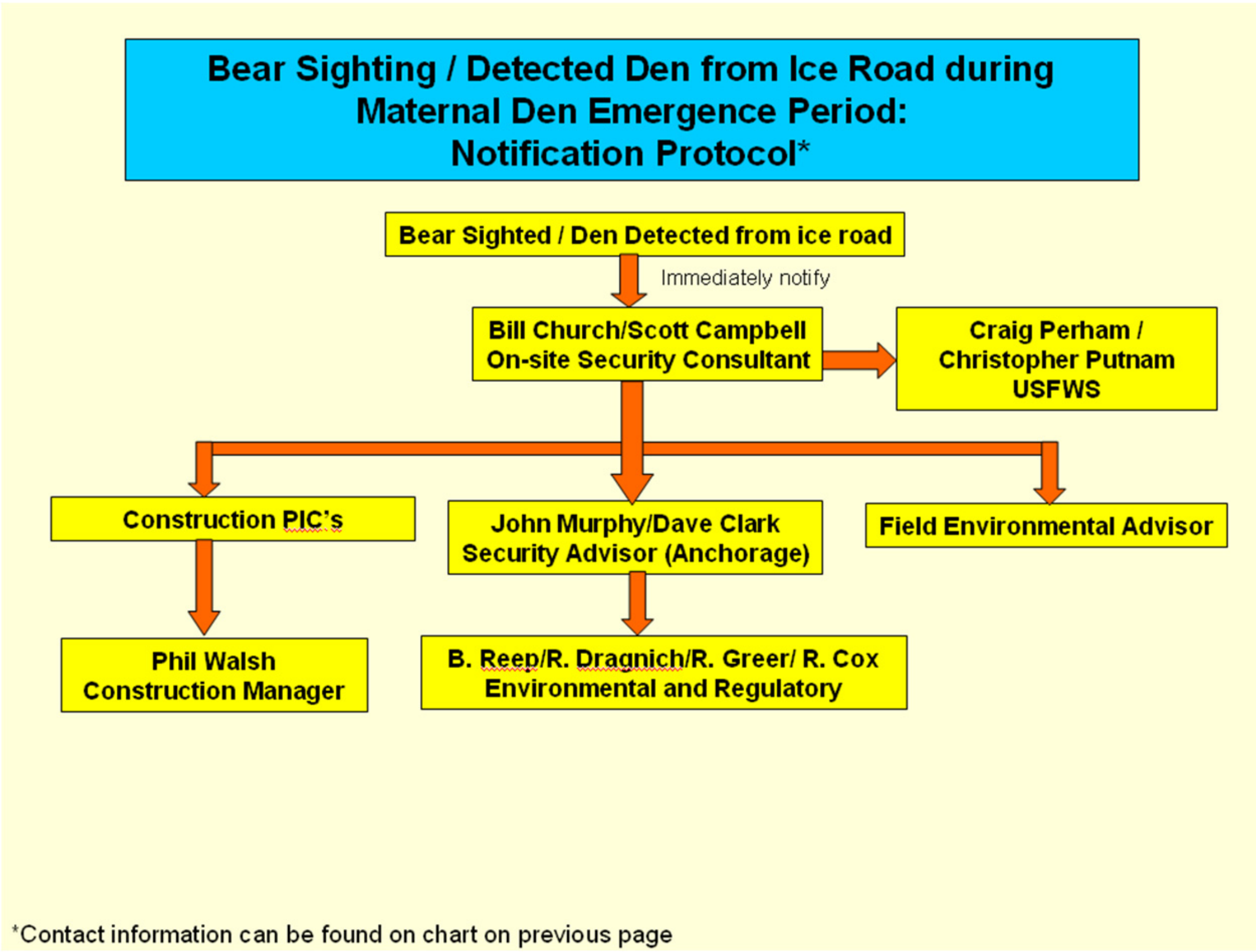
Dick Shideler
Alaska Department of Fish and Game (ADF&G) Habitat Division
1300 College Road
Fairbanks, Alaska 99701
Fax: (907) 459-7332

Brien Reep
ExxonMobil
Point Thomson Project
Environmental and Regulatory Manager
3700 Centerpoint Dr. Ste. 600
Anchorage, AK 99503
Fax: (907) 743-9809

The following contact list provides information for the individuals with responsibilities related to polar bear and wildlife interactions. This list will be checked and updated as necessary.

Name/Position	Company	Office	Cell/Duty	Email
John Murphy, Security Advisor	ExxonMobil	907-564-3604	907-351-9774	john.r.murphy@exxonmobil.com
Bill Church / Scott Campbell, Site Security Consultant	ExxonMobil	907-564-3733	907-223-0588 / 907-223-0487	bill.church@exxonmobil.com / scott.campbell@exxonmobil.com
24-hour Anchorage emergency contact number	ExxonMobil	907-564-3633	n/a	n/a
Brien Reep, Environmental and Regulatory Manager	ExxonMobil	907-564-3617	509-851-8973	brien.reep@exxonmobil.com
John Wilkinson, Compliance Coordinator	ExxonMobil	907-564-3784	908-601-8483	john.wilkinson@exxonmobil.com
Richard Greer, Wildlife Specialist	ExxonMobil	907-564-3619	856-437-9088	richard.greer@exxonmobil.com
Rob Dragnich, Regulatory Advisor	ExxonMobil	907-564-3711	907-830-4796	rob.g.dragnich@exxonmobil.com
Rachel Cox, Environmental and Regulatory Advisor	ExxonMobil	907-564-3737	570-351-2711	rachel.r.cox@exxonmobil.com
Phillip M Walsh, Construction Manager	ExxonMobil	907-564-3680	307-799-5562	phillip.m.walsh@exxonmobil.com
Bob Hill, Point Thomson Construction Supervisor (PIC)	ExxonMobil	907-433-3530	n/a	xsobob@yahoo.ca
Gordon Eastling / Mike Brown, Deadhorse Construction Supervisor (PIC)	ExxonMobil	907-659-2251	n/a	n/a
Leslie Griffiths / Chris Guimond / Carol Klein, Point Thomson Field Environmental Advisor	ExxonMobil	907-433-3513	n/a	ptuenvadvisor.nslope@exxonmobil.com
Craig Perham, Wildlife Biologist	USFWS	907-786-3810	907-602-0040	craig_perham@fws.gov
Christopher Putnam, Wildlife Biologist	USFWS	907-786-3844	n/a	christopher_putnam@fws.gov
Tom Evans, Wildlife Biologist	USFWS	907-786-3814	n/a	thomas_evans@fws.gov
Susanne Miller, Wildlife Biologist	USFWS	907-786-3816	n/a	susanne_miller@fws.gov
Richard Shideler, Wildlife Biologist	ADF&G	907-459-7283	n/a	dick.shideler@alaska.gov
Elizabeth Lenart, Wildlife Biologist	ADF&G	907-459-7242	n/a	Beth.lenart@alaska.gov

If a polar bear is sighted or a den is detected during maternal den emergence time (early March to mid-April), the following notification protocol will be used.



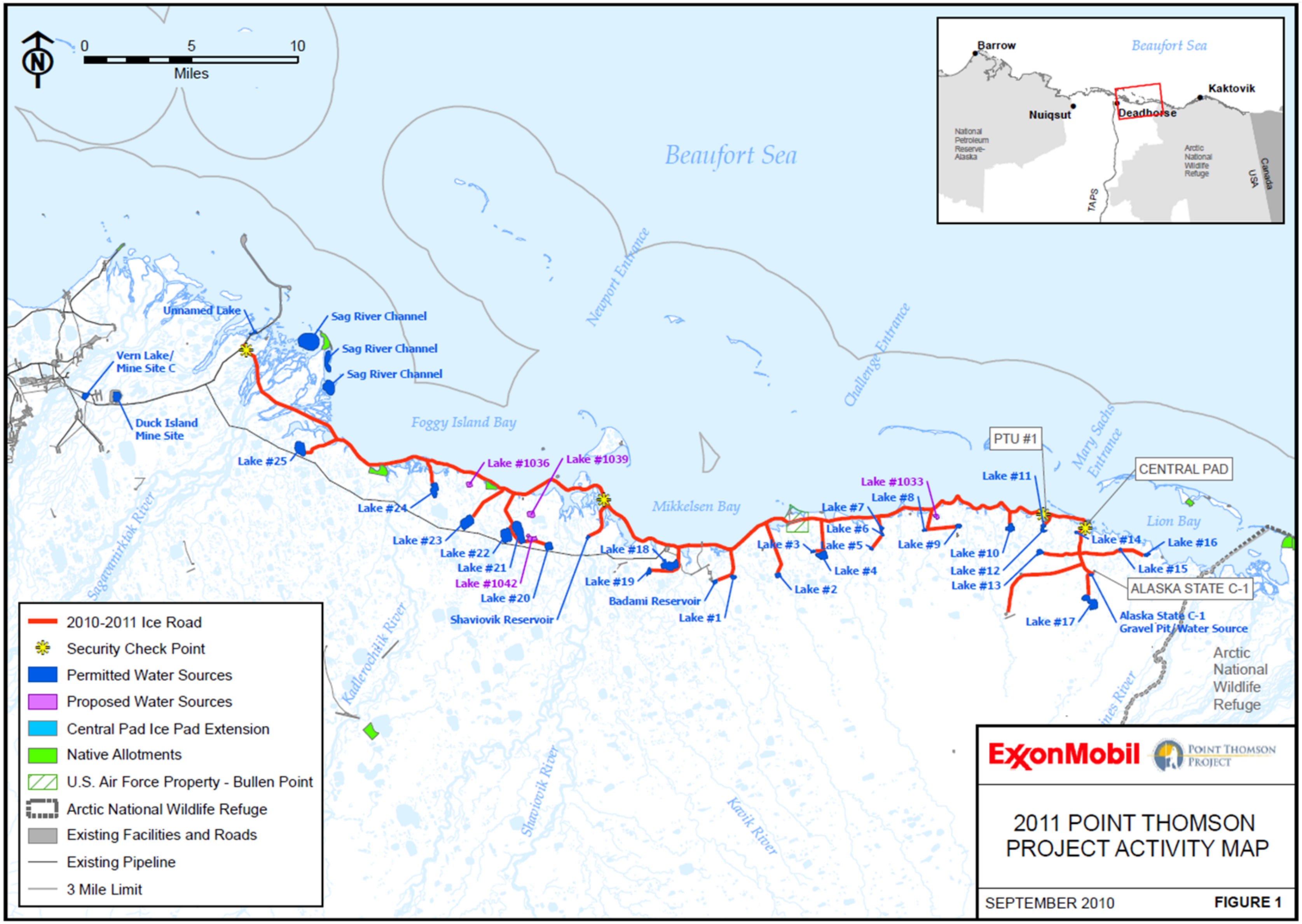
12.0 IMPLEMENTATION/EVALUATION/FEEDBACK

ExxonMobil will ensure that this Polar Bear and Wildlife Interaction Plan is being used at the site and that workers are familiar with it and its procedures. This document will be referred to and its contents reinforced at environmental briefings and other forums where safety is discussed to ensure it is understood and used by personnel at the site. ExxonMobil will also ensure that copies of this document are available on-site.

Periodic hazard assessments and compliance checks will be performed. Site visits by Environmental and Regulatory staff to look at the operations in terms of bear issues will be conducted.

ExxonMobil will evaluate and revise the Polar Bear and Wildlife Interaction Plan yearly or as necessary. ExxonMobil will solicit from its employees and contractors suggestions to improve the plan and its procedures. Often the people most directly impacted by these plans can come up with better ways of achieving the goals. Lessons learned during the drilling phase will also be useful in reducing conflicts as the project progresses.

Figure 1. 2011 Point Thomson Project Activity Map



APPENDIX A: PROTOCOLS FOR BEAR HAZING

1. Bear hazers must use good judgment about the situations involving bear hazing with a deterrent round since it is not possible to provide rules to cover every situation. Careful documentation and accountability for all deterrent rounds used is required.
2. Hazers must have a clear idea of what they are trying to accomplish, and make sure that their actions are appropriate and authorized by the agencies.
3. If a bear is observed moving towards the Point Thomson Central Pad, hazers will be prepared to deter but will first monitor it and give it an opportunity to pass by without any deterrence. Contact the security guard for back-up with lethal rounds.
4. An exhausted bear that swims to shore and rests will not be hazed, but given time to rest and recuperate, while being monitored.
5. If instead of passing through, a bear approaches the facilities or work sites, the bear's actions will be discouraged.
6. Start out with as low intensity as possible, and raise the level of response only to the degree that the bear is being stubborn.
7. Try using vehicles to move a bear before resorting to weapons. It may be relatively easy to move a bear off the pad with a vehicle or a piece of heavy equipment.
8. If the bear is sighted before it enters the Central Pad, employ any number of hazing options. Position a vehicle or piece of heavy equipment in its line of travel to cut it off. Use vehicle movement, horn, and possibly deterrent rounds as a last resort to turn it away.
9. If the bear is already on the pad, make sure everyone is in a safe location before hazing a bear. For most scenarios it is better to wait until people have retreated to safety before hazing. A bear must not be hazed if there is a chance it might run into workers as it flees.
10. Make sure the bear has a clear route to go where you want it to go, and it is best to haze it towards an area it will want to go (e.g. towards the coast or the direction where it came from).
11. Make it as easy as possible for the bear to flee in desired direction, and try to first use finesse rather than large amounts of force and firepower.
12. The exception to the subtle approach is if, in spite of best efforts, a bear gets into food or garbage, the reaction should then be immediate: utilize equipment or bean bag shots. An immediate hazing response lessens the chance of a bear staying to feed or returning.
13. The USFWS has approved the use of helicopters to haze polar bears under the following conditions:
    - Keep a distance of approximately ¼ mile between bear and helicopter, moving the bear in a direction away from people and facilities. It may be necessary to initially approach within the ¼ mile distance (but not aggressively) to get the bear moving, especially if it's resting, and then back off to the ¼ mile distance.
    - Push the bear at a steady walk. A running bear, especially large bears, can rapidly overheat.

- Don't haze a bear with a helicopter when ambient temperature is over 70°F (20°C).
- Don't aggressively push a bear. Bears may hunker down and not move if pushed or chased too aggressively. A slow approach is usually all it takes, especially if hovering near the ground creates a snow cloud due to the prop wash.
- Move the bear at least 2-3 miles from the point of initiation or occupied facilities, as a rule of thumb. This will depend on the situation – location of facilities, bear behavior, weather, and geographic features. The key element is to keep the bear moving on its own.
- Monitor the bear, if possible, to make sure the bear does not return.

The USFWS notes that these criteria are to be used for Bell 212 and 206 helicopters. If an R-44 helicopter is to be used, this helicopter may have to move in much closer to initiate the hazing because these machines are smaller and quieter than the former.

14. Whenever bears are hazed, immediate reporting is necessary.
15. If deterrent attempts fail, or a bear remains in the vicinity of the project location for a prolonged period, Mr. Craig Perham of the USFWS (907-786-3810) will be contacted for advice on deterring the bear from the work area. If Mr. Perham is not available, see alternate USFWS contacts in Section 11.0. In addition to the USFWS, Mr. Dick Shideler of the ADF&G (907-459-7283) may be contacted and informed of the situation if USFWS personnel are unavailable.
16. Every situation is a bit different, and recruiting and training effective bear hazers is crucial. Bear monitors who can make good judgment calls about how much leeway to give a bear before initiating deterrence, who understand bear behavior and motivation, and who can get results with minimum force are most successful.

APPENDIX B: RESPONSE TO DETECTED MATERNAL DEN PROTOCOLS

The following protocols outline the initial response to the discovery of an active maternal polar bear den or suspected den when working on ice roads/pads or via cross country off-road travel away from existing infrastructure (e.g., facilities, causeways, roads, or pads):

1. All workers must be vigilant for any signs of an undetected den in their vicinity. This includes any sighting of polar bears, suspected dens, or tracks. If a bear, suspected den, or tracks are seen within a 1 mile buffer around the work or travel area (e.g. seismic activity, ice roads), or if an active polar bear den is discovered, the ExxonMobil Site Security Consultant will be notified immediately.

2. Upon an initial report of a bear, a suspected den, or tracks, the Site Security Consultant will dispatch a security or bear monitor to try to determine if the bear is associated with a den or if the den is active using FWS protocols. They will also try to determine whether the site is greater or less than 1 mile from the ice road or area of activity. If it is determined that the site is less than 1 mile from the ice road or area of activity, the team will contact the Site Security Consultant, who will then announce the site's location via radio to security checkpoints and all vehicles on the road. Once authorized by the Site Security Consultant or designee, the team will begin monitoring the den while a formal response is initiated.

3. The Site Security Consultant or designee will immediately notify FWS about any confirmed or suspected maternal polar bear den. The Site Security Consultant or designee will be the single point of contact between FWS and the site workers or road users and will keep the FWS informed about the situation via phone and email contact.

4. If a bear is observed near an off-road work site or ice road between approximately March 1st and mid-April, even if a den entrance is not seen, it will be assumed to be associated with a den until it is determined that the bear is not associated with a den. The Site Security Consultant or designee will immediately contact USFWS and assign someone (or multiple staff members) from security or environmental staff to monitor the bear and immediate area.

5. The Site Security Consultant or designee will communicate with other user groups, company staff, and contractors about the situation and keep them informed of any developments. All user groups will comply with directions given by the company in charge of the site or road.

6. If an active maternal den is confirmed to be more than 1 mile away from the ice road or other activity, the den and bears will be monitored as directed by the USFWS. A remote camera may be set up by USFWS personnel, or their representative, to record activity at the den site.

7. If an active maternal den is confirmed to be less than 1 mile away from the ice road or other activity, the Site Security Consultant will immediately initiate a road closure under the direction of USFWS.

APPENDIX C: ICE ROAD CLOSURE PROTOCOLS

The following protocol outlines how an ice road will be closed in the event that an active maternal den is confirmed to be less than 1 mile away from an ice road. These protocols recognize that vehicles already on the road may still need to pass through the 1 mile buffer zone to return to base camp. It is expected that all users of the ice road will be made aware of the maternal den and any closure activities by the company in charge of the ice road. Similarly, it is the responsibility of all road users to comply with the directions given by the company in charge of the ice road.

1. Mobile security monitor(s) will be positioned on the road near the den site as directed by USFWS and the Site Security Consultant or designee, where practicable (i.e. unless weather or other safety concerns prohibit driving). Security will deploy these mobile monitor(s) as soon as is practicable and advise the Traffic Control Check Points on either side of the road to keep any new traffic from entering the road. Monitoring and traffic control check point staff will need to change out periodically for health and safety reasons (at least twice per day).

2. A 24-hour bear monitor/response team will be posted in a position that allows clear viewing of the den without disturbing it. A video camera may also be placed on the opposite side of the road by USFWS or USFWS designated representative to simultaneously record the den site and road activity, where practicable. The bear monitor/response team will:

    a. Communicate with the guards at the traffic control points on both ends of the road.
    b. Observe and log all traffic, as well as polar bear activity.
    c. Immediately notify nearest security personnel and the Site Security Consultant of any polar bear emergence from the den.
    d. Park vehicles in an area that allows clear viewing of the den without creating a disturbance or potential obstruction to the sea ice for the polar bears.
    e. At least one bear monitor will remain at the polar bear den site until USFWS determines a bear monitor is no longer needed. For health and safety reasons, bear monitors will change shifts as necessary.

3. The den location will be provided to non-commercial aircraft operators contracted or chartered by ExxonMobil with instructions to fly at altitudes above 1,500 feet if passing over the one mile buffer zone or to divert aircraft around the 1 mile den buffer zone.

4. Notification updates will be given by radio to all vehicles by the Site Security Consultant.

5. Road Closure signs and barriers will be placed at each traffic control point to prevent any access to the road. If approved by USFWS, essential traffic (including essential traffic still on the pad needing to return to base camp) may be allowed to form a caravan of vehicles to get to the appropriate home side of the road. This caravan of vehicles will be escorted by security personnel designated to do so, and:

    a. all vehicles must maintain a maximum speed of 10 mph;
    b. no use of horns or other loud devices;

c. no stopping or backing up;
d. no photographs; and
e. no road maintenance activities.

All other personnel or equipment needing transport will use either aircraft or an alternative land route, unless specifically given permission by USFWS to do otherwise.

6. Any vehicle requesting limited access to the road during road closure will require explicit approval from the appointed Site Security Consultant (if practicable in consultation with USFWS). Examples of limited essential traffic may include transportation of materials or personnel critical to process or personnel safety, environmental emergencies, or life-support equipment or medicines that can not access the remote site by other means.

7. If the ice road is shut down for an extended period and caravanning of vehicles is not approved by USFWS, company staff and contractors will, depending on the exact site, timing and circumstances, re-route traffic, using a new ice road route, or employ tundra travel and/or airlifts to support activity at the remote location(s).

8. Guards at either end of the road, hired by the company in charge of the ice road will stop all traffic until given approval from USFWS to re-open the road or caravan vehicles. The Site Security Consultant, or designee, will communicate with the USFWS on the status of the female bear, cubs, maternal den site and any traffic at least two times per day or as needed unless USFWS determines that it is not necessary. If a request is made to enter the road, only the Site Security Consultant can allow access to the road with permission from USFWS. If USFWS staff cannot be reached in an emergency situation, the Site Security Consultant is the only one who can allow access (with agreement from ExxonMobil Management).

9. It is the responsibility of ExxonMobil to ensure its road remains closed to all traffic and USFWS is kept informed of the situation.

10. Contingency Plan for Continuing Operations:
    a. Reinstate approved tundra travel program.
    b. Immediately assess the need for ice road by-pass construction.
    c. Increase use of air traffic for transportation use.

11. Only when USFWS approves (verbally or written) re-opening of the road, such as when the sow and cubs leave the den permanently, will approval will be given to resume road use.

12. This document will be revised and updated as needed.

APPENDIX D: GRIZZLY BEAR OBSERVATION REPORT FORM

Bear ID# (ADF&G use)______ 7/09 rev.

OILFIELD GRIZZLY OBSERVATION FORM

OBSERVER______________________________ COMPANY/**AGENCY**________________

OBSERVATION DATE________________ **TIME**: Start________ Stop___________________

OBSERVATION FROM: Vehicle_____ Ground_____ Building_____ Other______________

OBSERVER DISTANCE FROM BEAR________________________meters

GENERAL LOCATION: Deadhorse___ EOA___ WOA___ Kuparuk___ Endicott_____

Milne_____ Badami___ Alpine____ Pt. Thomson___ TAPS (MP #)_____

Other (latitude/longitude if known)____

SPECIFIC LOCATION [*Example: 500 meters N of DS 14*]: _______________________meters

__________[direction] of ____[facility name]

DUMPSTER PRESENT? Yes___________ No_________ Unknown__________

WEATHER: ________°F Wind direction____________ at _______________mph

Clear/partly cloudy______ rain_______ fog_______ snow_______

BEAR IDENTIFICATION: EAR FLAG COLOR [***Note***: *right & left of bear, not observer*]

_____________Color right _____________Color left NATURAL MARKINGS [scars, torn ears, ETC.]____

OTHER BEARS PRESENT? None_____ No. of new cubs_________ No. of yearlings______

No. of 2 year olds________ Number of other adults___________ No. unknown________

BEAR ACTIVITY WHEN FIRST SEEN: Resting____ Feeding (natural food) ______

Feeding (garbage)______ Traveling______ Traveling/feeding_______

Other [describe]:____

BEAR REACTION TO OBSERVER: Ignore_____ Approach_____ Avoid________

Were other people in area (not with observer)? Yes_____ No______ Unknown______

BEAR REACTION TO OTHER PEOPLE: Ignore_____ Approach_____ Avoid_________

REACTION COMMENTS____

____

DETERRENCE ACTION TAKEN? YES___________ NO____________

If yes, did you use: Horn_____ Siren_____ Rubber slug_____ Bean bag_____

Cracker shell_______ Other [describe] ____

BEAR'S REACTION TO DETERRENT: Ignore____ Approach_____ Withdrew_______

ADDITIONAL REMARKS____

____

____

Dick Shideler, Alaska Dept. Fish & Game; FAX 907-459-7332, or email dick.shideler@alaska.gov

APPENDIX E: ADF&G PUBLIC SAFETY PERMIT

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
P.O. Box 115526
JUNEAU, ALASKA 99811-5526

Permit No. 10-022

Expires: 1/31/2011

PUBLIC SAFETY PERMIT

This permit authorizes Brien E. Reep, Exxon-Mobil Corp.
(person, agency or organization)
of PO Box 196601, Anchorage, AK 99519 to conduct the following
(address)
activities from January 19, 2010 to January 31, 2011 in accordance with AS 16.05.930.

Authority is granted the permittee and subpermittees to haze (using nonlethal methods only) brown bears away from work sites associated with the Point Thomson exploratory drilling program and transit and exploratory work between Deadhorse and Pt. Thomson. Prior to hazing bears the permittee and subpermittees shall attend bear hazing training provided by the Alaska Department of Fish and Game (Contact Dick Shideler, 459-7283) or US Fish and Wildlife Service, Marine Mammals Management (786-3810). Brown bear observations and hazing events shall be recorded on Oilfield Grizzly Bear Observation Forms. Persistent bears that pose an imminent threat to human life or property may be taken (i.e. killed). Before killing any bear all attractants shall be removed and every effort shall be made to haze bears away from the site using non-lethal methods. Bears shall only be killed as a last resort after other options have been exhausted.

If the permittee or subpermittees take a brown bear, they shall; 1.) report the take to ADF&G area management biologist, Beth Lenart (459-7242) or Dick Shideler, by the next business day, 2.) ensure the hide is removed from the bear so that claws remain attached to the hide and the skull is separated from the hide, 3.) ensure the hide is preserved and within 7 days transfer the hide, skull, and any ear tags or radio collars to ADF&G for sealing and final disposition, 4.) dispose of the carcass in a way that will not create a threat to public safety, and 5.) within 15 days of the incident complete a Defense of Life and Property Game Animal Kill Report (attached) (http://www.wc.adfg.state.ak.us/license_form/forms/dlp.pdf) and schedule a debriefing session with Ms. Lenart or her designee.

Authority is granted the permittee and subpermittees to haze foxes as necessary and to lethally take up to ten (10) at work sites associated with the Point Thomson exploratory drilling program and transit and exploratory work between Deadhorse and Pt. Thomson.

Foxes that have bitten someone or are suspected of being rabid should not be shot in the head. Carcasses of foxes that have bitten someone shall be shipped to the Alaska State Virology Lab (Louisa Castrodale, Veterinary Epidemiologist, 907-269-8000). Foxes that are found dead or are killed because of behavior consistent with rabies infection shall be shipped to Dr. Kimberlee Beckmen with ADF&G in Fairbanks (459-7313 or after hours 322-2384). All other fox carcasses should be donated to a public museum or scientific or educational institution.

The primary permittee may designate subpermittees to conduct activities authorized by this permit. The primary permittee is responsible for the actions of all subpermittees and for ensuring their compliance with the conditions of this permit. All subpermittees must complete bear hazing training prior to conducting activities authorized by this permit. Persons conducting activities authorized by this permit are exempt from fish and game licensing requirements of AS 16.05.330.

An annual report must be submitted electronically on a form provided by the department by the date specified below. Forms are available on the ADF&G website or by contacting the Permits Section (dfg.dwc.permits@alaska.gov or 465-4148). The report must include the following: (1) a daily summary of the number of foxes and bears hazed or killed, the method of hazing or take, and the disposition of all carcasses; and (2) a complete list of subpermittees.

A COPY OF THIS PERMIT MUST BE IN POSSESSION WHILE CONDUCTING AUTHORIZED ACTIVITIES.

REPORT DUE January 20, 2011 **. The report shall include the information specified above.**

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. **This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.**
2. **No specimens taken under authority hereof may be sold or bartered. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.**

3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until detailed reports, as specified above, have been received by the department.
5. **UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE** the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

[signature]
Division of Wildlife Conservation

January 19, 2010
Date

APPENDIX F: PACIFIC WALRUS SIGHTING REPORT FORM

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Road
Anchorage, Alaska 99503-6199

PACIFIC WALRUS SIGHTING REPORT

Date:__________ Observer name:________________________________
Time:__________ Contact number/email:___________________________

Location: ____
____

Latitude:____________________ Longitude______________ Datum:_________

Weather conditions: Fog_____ Snow_____ Rain_____ Clear_____ Temperature______F/C

Wind speed______mph/kts Wind direction__________ Visibility: Poor ________
Fair __________
Good __________
Excellent__________

Total number of walrus: ____ Adult; _____Sub-adult; _____Unknown

Estimated distance (meters) of walrus(es) from location:____________________________

Walrus behavior (initial contact): Resting (hauled out)_____ Swimming_____ Other__________

Walrus behavior (after contact): Resting (hauled out)_____ Swimming_____ Other__________

Duration of encounter:_________min or hour

Description of encounter:____
____
____
____
____

Agency contacts/ Time of Contact:
USFWS: Craig Perham (907)-786-3810 (phone); 786-3816 (FAX)
Time_______ Date__________

APPENDIX G: POLAR BEAR SIGHTING REPORT FORMS

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
1011 E. Tudor Road
Anchorage, Alaska 99503-6199

ON LAND POLAR BEAR SIGHTING REPORT

Date:__________ Observer Name:_____________________________
Time:__________ Contact number/email:________________________

Location____
____
Latitude:________________ Longitude______________ Datum__________________

Weather conditions: Fog_____ Snow_____ Rain____ Clear_____ Temperature____F/C

Wind speed______mph/kts Wind direction__________ Visibility: Poor
Fair
Good
Excellent

Number of bears:
_____ Adult M/F ________ Sow/cub(s)
_____ Sub-adult ________ Sow/yearling(s)
_____ Unknown ________ Sow/2YO(s)

Estimated distance of bear(s) from personnel_____ (meters) and facility:___ (meters)
closest point) (closest point)
Possible attractants present:____

Bear behavior: ____

Description of encounter:____
____
____
____

Duration of encounter:____

Deterrents used/distance: ______Vehicle ______Bean bag ______Other
______Crackershell ______Horn/siren
______Rubber bullet ______Spotlight/Headlight

Agency/Contacts:
USFWS_Craig Perham (786-3810) (FAX 786-3816)___ Time_______Date__________
ADF&G_Dick Shideler (459-7283) (FAX 459-7332)___ Time_______Date_________

APPENDIX G: POLAR BEAR SIGHTING REPORT FORMS

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
1011 E. Tudor Road
Anchorage, Alaska 99503-6199

MARINE POLAR BEAR SIGHTING REPORT

Date:__________ Observer Name:____________________________
Time:__________ Contact number/email:_______________________

Location____
____

Latitude:________________ Longitude______________ Datum__________________

Weather conditions: Fog_____ Snow_____ Rain____ Clear_____ Temperature____F/C

Wind speed______mph/kts Wind direction__________ Visibility: Poor
Fair
Good
Excellent

Number of bears:
_____ Adult M/F ________ Sow/cub(s)
_____ Sub-adult ________ Sow/yearling(s)
_____ Unknown ________ Sow/2YO(s)

Estimated distance of bear(s) from vessel or location_____ (meters)

Bear behavior (Initial Contact): Curious_____ Swimming_____ Resting_____
Hunting ____ Walking______ Other______

Bear behavior (After Contact): Curious_____ Swimming_____ Resting_____
Hunting ____ Walking______ Other______

Description of encounter:________________________________
____
____

Duration of encounter:______ **Possible attractants present:**__________________

Agency/Contact:
USFWS-Craig Perham (786-3810) (FAX: 786-3816)_______ Time______Date_________
(craig_perham@fws.gov)

APPENDIX B

Point Thomson Project
Log of Polar Bear Sightings

30 January 2009 through 28 October 2010

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Appendix B Point Thomson Project, log of polar bear sightings 30 January 2009 through 28 October 2010.

Appendix B. Point Thomson Project
Log of Polar Bear Sightings,
30 January 2009 through 28 October 2010

Date	Time	Observer Location	Bear Location	Description	Hazed Yes/No	Hazing Method
3/27 –4/1/09	--	Mile 14.7 Ice Road	100 yards south of Mile 14.7 ice road	Occupied polar bear den detected; mitigating and monitoring measures implemented in cooperation and coordination with USFWS; sow and 2 cubs departed area for sea ice on 4/1/2009	No	Not applicable
6/28/09	1:30	Central Pad	1.25 mile north of pad	Adult bear walking and stopping on sea ice	No	Not applicable
7/15/09	22:30	Central Pad	0.5 mile south of pad	Lone adult bear walked around south side of pad, rested, moved on	No	Not applicable
7/16/09	10:35	Central Pad	East of PT on Flaxman Island	Lone adult bear	No	Not applicable
7/25/09	7:30	Central Pad	North of PT on Barrier Island	Adult bear walking east	No	Not applicable
7/26/09		Barge	Point Hopson	Adult bear on shore	No	Not applicable
7/26/09	21:16	Central Pad	¼ mile west of pad on beach	Unknown bear swam heading northwest	No	Not applicable
8/3/09	20:58	West Dock	West Side of Causeway	Adult bear sleeping/resting	No	Not applicable
8/7/09	9:20	Central Pad	¾ mile west of Point Thomson	Adult female bear resting on beach; heard helicopter and moved west	No	Not applicable
8/7/09	18:00	Central Pad	1.5 miles west of Point Thomson	Adult bear approached Central Pad from shoreline; swims north into fog	Yes	Vehicle Horn
8/14/09	5:42	Barge	West of Point Thomson	Bear on shore walking east	No	Not applicable
8/14/09	6:45	Central Pad	¼ mile west of Point Thomson	Bear moved within ¼ mile of Central Pad, traveled SSE, circling pad around to the south	Yes	Bear Alarm at Pad
8/21/09	6:28	Central Pad	90 ft west of pad	Bear near pad, 1 cracker shell deployed, bear headed south until out-of-sight	Yes	Cracker shell
8/21/09	21:21	Crew Boat	Stump Island west of West Dock	1 sow and 2 cubs running along coast of island	No	Not applicable

Appendix B. Point Thomson Project
Log of Polar Bear Sightings,
30 January 2009 through 28 October 2010

Date	Time	Observer Location	Bear Location	Description	Hazed Yes/No	Hazing Method
8/22/09	10:55	Cross Island	Cross Island	1 male, 2 sows, 4 cubs, 2 subadult bears	No	Not applicable
8/24/09	19:25	Barge	Close to Tigvariak Island	Bear swimming close to island	No	Not applicable
8/27/09	N/A	Central Pad	3 miles northwest of pad	Sow and cubs walking, resting on barrier island	No	Not applicable
8/29/09	18:20	Central Pad	1 mile west of pad	Subadult passed by south side of pad; camp food possible attractant	No	Not applicable
9/3/09	19:15	Central Pad	3 miles west of pad	Sow and 2 cubs walking/swimming east	No	Not applicable
9/5/09	2:15	Central Pad	50 meters north of pad	Sow and 2 cubs walking east on beach, rested on islands behind camp	No	Not applicable
9/8/09	17:30 9 hrs	Central Pad	Bears in dumpster	Sow & yearlings; deployed cracker shell(s); bears headed NE to Flaxman Island, then returned and slept on south side of pad	Yes	Cracker Shell, Bean Bag
9/10/09	18:00	Central Pad	2 miles northwest of pad	Sow and cubs resting throughout the day	No	Not applicable
9/13/09	18:00	Central Pad	North of Point Thomson	Bear swimming east island-to-island	No	Not applicable
9/13/09	18:00	Central Pad	Alaska Island	Adult bear resting on island	No	Not applicable
9/15/09	22:30	Central Pad	50 meters northwest of pad	Adult bear walking on beach to northeast of pad, turned south behind pad and continued south	Yes	Vehicle, Spotlight/ headlight
9/20/09	13:30	Central Pad	1500 ft northwest of pad	Polar bear heading south	No	Not applicable
9/29/09	8:30	Central Pad	1.5 mile west of pad	1 sow and 2 cubs heading east on shoreline, turned around heading west	No	Not applicable
9/30/09	20:00	Central Pad	1.5 mile west of pad	1 sow and 2 cubs heading east to within 70 yards of pad; changed direction south away from pad	No	Not applicable
10/3/09	12:15	Central Pad	1/4 mile west of pad	1 sow and 2 cubs heading east to within 40 yards of pad; changed direction south and out of sight	No	Not applicable
10/26/09	18:00	Central Pad	250 yards east of pad	1 sow and 2 cubs heading east of pad	No	Not applicable
11/30/09	2:10	Central Pad	¼ mile north of pad on sea ice	Sow and 2 cubs walking east on sea ice	No	Not applicable

Appendix B. Point Thomson Project
Log of Polar Bear Sightings,
30 January 2009 through 28 October 2010

Date	Time	Observer Location	Bear Location	Description	Hazed Yes/No	Hazing Method
4/3/10	12:10	Mile 27.5 Ice Road	South at distance from ice road	Single bear observed traveling south at distance from ice road	No	Not applicable
4/18/10	9:55	Mile 36.5 Ice Road	Crossing ice road	Sow and 2 cubs observed crossing ice road south to north; ice road closed	No	Not applicable
4/18/10	17:15	Mile 36.1 Ice Road	North of ice road	Sow poked her head several times over bluff north of ice road	No	Not applicable
4/18 –4/23/10	continu ous	Mile 36.1 Ice Road	Den located 65 meters north of ice road Mile 36.1	Sow and cubs in and out of den; 24-hour monitoring team in place (including USFWS representative)	No	Not applicable
7/7/10	14:50	PTU Central Pad	~4 miles SW of Central Pad	2 adult bears foraging at distance	No	Not applicable
9/9/10	6:10	PTU Central Pad	15-30 ft off east side of pad	Single adult bear swam to shore in lagoon; walked south along shore. Bear Monitor parked Kubota at NE corner of pad; bear changed direction to SE	Yes	Kubota vehicle
9/9/10	20:40	PTU Central Pad	½ mile north of shore	Single unknown bear swimming east	No	Not applicable
9/24/10	5:55	PTU Central Pad	75 yards north of Central Pad	Single adult bear heading east past landing/boat dock	No	Not applicable
9/29/10	8:37	PTU Central Pad	~3 miles NW of Central Pad	Single adult bear foraging at distance	No	Not applicable
9/29/10	22:10	PTU Central Pad	60 yards north of Central Pad	Sow and 1 yearling bear traveling & curious	No	Not applicable
9/30/10	7:40	PTU Central Pad	100 yards west of Central Pad	Sow and 1 yearling bear traveling east & curious	No	Not applicable
9/30/10	10:02	PTU Central Pad	~1 miles NW of Central Pad on shoreline	Sow and 1 yearling bear traveling east	No	Not applicable
10/10/10	15:58	PTU Central Pad	~1.5 miles N of Central Pad on ice	Single adult bear hunting seals on sea ice near Mary Sachs Island	No	Not applicable

Appendix B. Point Thomson Project
Log of Polar Bear Sightings,
30 January 2009 through 28 October 2010

Date	Time	Observer Location	Bear Location	Description	Hazed Yes/No	Hazing Method
10/11/10	9:45	PTU Central Pad	~1.5 miles N of Central Pad on ice	Single adult bear walking/hunting back and forth along ice edge	No	Not applicable
10/11/10	14:20	PTU Central Pad	~1.5 miles N of Central Pad on ice	Single adult bear laying down and/or hunting seals on sea ice	No	Not applicable
10/12/10	8:41	PTU Central Pad	~1.5 miles N of Central Pad on ice	Single adult bear wandering/hunting then headed north until beyond sight	No	Not applicable
10/14/10	15:40	PTU Central Pad	800 yards N of Central Pad on ice	Single adult male bear hunting/walking east then north until beyond sight	No	Not applicable
10/18/10	10:20	PTU Central Pad	~4 miles NE of Central Pad on ice	Sow & cub traveling west on ice, cub occasionally resting, cub dove into water once	No	Not applicable
10/20/10	9:50	PTU Central Pad	200 meters NE of Central Pad on beach	Single adult male bear approaching from NE sniffing the air, traveled NW after LRAD siren was deployed	Yes	LRAD Siren
10/20/10	10:20	PTU Central Pad	120 yards NE around Central Pad	Sow & cub approaching from NE, circled pad around south, and traveled away to the NW; cub was playfully running around and laying down	No	Not applicable
10/22/10	13:51	PTU Central Pad	100-150 yards around Central Pad	Sow & cub approaching from west, circled pad around south, and traveled away to the east; bears were sniffing the air; cub was digging/playing	No	Not applicable
10/24/10	12:48	PTU Central Pad	2 miles NE of pad on sea ice	Sow & cub traveling NE to NW on sea ice	No	Not applicable

APPENDIX C

Oil Spill Preparedness

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ExxonMobil

POINT THOMSON PROJECT

Oil Spill Preparedness

June 17, 2011

Oil Spill Preparedness

Table of Contents

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.

[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.

REFERENCES

ADEC 2010. Spill sites database. Available online at: http://dec.state.ak.us/spar/perp/search. Accessed 2010.

ExxonMobil Corporation. 2009. Point Thomson Project Environmental Report (November 2009). ExxonMobil Corporation, Anchorage, AK. 796 pp.NRC 2003

Mach, J.L., R.L. Sandefeur, and J.H. Lee. 2000. Estimation of Oil Spill Risk from Alaska North Slope, Trans-Alaska Pipeline, and Arctic Canada Oil Spill Data Sets. Final Report for Mineral Management Service under contract No. 01-99-PO-16128. 149 pp.

Maxim, L.D., and R.W. Niebo. 2001a. Analysis of Spills Associated with Alaska North Slope (ANS) Exploration and Production (E&P) Activities. Draft. Prepared by Everest Consulting Associates, Cranbury, NJ, for TAPS Owners Alaska, Anchorage.

Maxim, L.D., and R.W. Niebo. 2001b. Appendix B. Oil Spill Analysis for North Slope Oil Production and Transportation Operations. Environmental Report for TAPS Right-of-Way Renewal. Draft. [Online] Availablehttp://tapseis.anl.gov/documents/report.cfm.

Maxim, L.D., and R.W. Niebo. 2001c. Water Spills on the Alaska North Slope. Prepared by Everest Consulting Associates, Cranbury, NJ, for Alaska Oil and Gas Association, Alaska, Anchorage.

NRC 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Research Council of the National Academies. Washington DC: National Academic Press. 288 pp.

APPENDIX D

Historical and Current Human Activity in the Point Thomson Action Area

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Appendix D. Historical and current human activity in the Point Thomson Action Area.

OIL DEVELOPMENT HISTORY

Although oil from seepages was used as fuel by Inupiat people prior to western contact, the first modern program of oil and gas exploration on the North Slope was conducted by the U.S. Navy and the United States Geological Survey (USGS) during the 1940s and 1950s. Federal leasing on the North Slope began in 1958 and led to several industry-sponsored exploration programs. The discovery of oil at Prudhoe Bay in 1968, followed by discoveries at Kuparuk, West Sak, and Milne Point in 1969, marked the beginning of commercial oil development in the region (NRC 2003). Completion of the Trans-Alaska Pipeline System (TAPS) in 1977 allowed year-round transport of North Slope oil to the marine terminal in Valdez and efficient export to market. Leasing of state and federal offshore continental shelf (OCS) areas began in 1979, and offshore discoveries were made at Endicott, Sag Delta, Point McIntyre, Niakuk, and Northstar (NRC 2003). The Point McIntyre and Niakuk pools, as well as the more recently discovered Liberty field, are located mostly in the offshore area, but their production facilities are located onshore (MMS 2008). Several additional developments including Eider, Northstar, and Oooguruk operate in nearshore areas of the Beaufort Sea. TAPS throughput peaked in 1988, at nearly 2.1 million barrels per day, but has since declined to about 630,000 barrels per day in 2011 (Alyeska 2011). Currently there are thirty-five fields and satellites producing oil on the North Slope and in nearshore areas of the Beaufort Sea, and additional discoveries are currently under development. Prudhoe Bay and several projects potentially within the Point Thomson action area are described below.

Prudhoe Bay—Commercial oil exploration started in the Prudhoe Bay region in the 1960s and the Prudhoe Bay oil field was discovered in 1968 by the Atlantic Richfield Company (ARCO) and Exxon. Commercial production from Prudhoe Bay began after construction of the Trans Alaska Pipeline System (TAPS) was completed in 1977. Production increased rapidly until the field's maximum rate of 1.5 million barrels per day was reached in 1979. By the mid-1980s, Prudhoe Bay was supplying about a quarter of U.S. oil production, and operations in the area led to the discovery of additional recoverable oil. Prudhoe Bay is the largest oil field in the United States, covering approximately 213,543 acres, and originally containing approximately 25 billion barrels of oil. **Point Thomson** —As the unit operator, ExxonMobil drilled several exploration wells between 1977 and 1982 from remote locations throughout the Point Thomson area. Two wells were drilled by BP and Chevron in the 1990s and several other wells were drilled by other producers on lands inside and outside the unit boundary beginning in 1970. In all, a total of 21 exploration wells have been drilled in and around the Point Thomson area (including the 2 wells drilled by ExxonMobil in 2009 and 2010), both onshore and on the barrier islands. ExxonMobil began the current development project by drilling 2 producer/injector wells at the Central Pad during 2009 and 2010. These 2 wells are part of the current Project designed to bring the Thomson Sand reservoir into production. There are plans to drill 3 additional wells. This recent drilling activity was supported as a remote facility using an existing pad (PTU #3) at the location of the Project's Central Pad, and using a sea ice road connecting to the road network at Prudhoe Bay during the winter, coastal barging for resupply in the summer, and helicopters year-round.

Endicott — The BP-operated Endicott offshore oil field is located about 10 miles northeast of Prudhoe Bay. It came online in 1987 and consists of 2 man-made gravel islands connected by a 1.6-mile man-made gravel causeway. The operations center and processing facilities are located on the 18-hectare main production island. Processed oil is sent via a 24-mile pipeline to join the TAPS for onward export to Valdez and shipment to international markets.

Badami — The Badami oil field, located approximately 35 miles east of Prudhoe Bay along the Beaufort Sea coast, was discovered in 1990 by Conoco. The Badami lease was subsequently acquired by BP Exploration Alaska in 1994, and a 25-mile pipeline was constructed to connect the Badami oil field with the TAPS. BP brought the Badami field online in 1998, making it the farthest east unit on the North Slope in operation at that time. Production was suspended in 2003 due to low production rates, and resumed for several months in 2005. Most recently, production from Badami restarted in November 2010 after drilling 2 new wells.

Liberty — The Liberty oil field is located 4 miles offshore of the Beaufort Sea coast in Foggy Island Bay. Ultra-extended reach drilling, extending over horizontal distances of 34,000 to 44,000 feet, will be used to access the Liberty reservoir from BP's Endicott satellite drilling pad. Up to 6 development wells are planned. Oil produced from the Liberty field is planned to be transferred to the TAPS through the Endicott sales-oil pipeline.

OTHER DEVELOPMENT

Bullen Point Short-range Radar Station (SRRS) — The Bullen Point SRRS, formerly known as POW-3, is located approximately 37 miles east of Prudhoe Bay along the Beaufort Sea coast. The installation occupies 620 acres of low-lying tundra on the coastline. It was operated as an auxiliary Distant Early Warning (DEW) System station between 1953 and 1971 when it was deactivated. The station was converted to a SRRS in 1994, consisting of a new radar system, a support building, and a helicopter landing area. The upgraded SRRS operated from 1994 until 2007. Inactive structures were removed from the Site in 2007 as part of the U.S. Air Force's Clean Sweep Program. The Bullen Point site is currently managed by the U.S. Air Force and has a gravel airstrip and a small radar system.

SUBSISTENCE USE OF THE ACTION AREA

Subsistence Use of the Action Area – Descriptions of subsistence use patterns for those communities whose residents regularly use the Project Area and its environs are provided in IAI 1990a, b, MMS 2003, and SRBA 2010. Unless otherwise noted, information on subsistence is excerpted from these documents.

"Subsistence" encompasses a wide-range of activities, and for some groups and individuals is a shorthand expression for the most central and important aspects of their lives. The most visible and easily documented component of this complex of subsistence activity is the actual harvest of subsistence resources. Broad community discussions of selected aspects of subsistence resource harvest activities are provided below, followed by summary descriptive information for Kaktovik and Nuiqsut (the 2 communities closest to the Project Area) based on the most recent information available.

In general, communities harvest the subsistence resources most available to them, concentrating their efforts along rivers and coastlines and at particularly productive sites. Determining when and where a subsistence resource will be harvested is a complex activity due to variations in seasonal distribution, migration, and extended cyclical variation in animal populations. Human factors such as timing constraints (due to employment or other responsibilities), adequate equipment (or the lack of it) to participate, and hunter preference for one resource over another or one sort of subsistence activity over another, are also important components in determining the overall community pattern of subsistence resource harvest and use. Resources that comprise relatively little of the overall total harvested or consumed, and areas that are only infrequently used for subsistence activities can both be important components of the overall pattern (MMS 2003). For example, waterfowl represent only a small part of the total wild food consumed by the residents of Kaktovik and Nuiqsut, but is only seasonally available and is avidly anticipated in the spring and fall as a fresh change in the diet. Duck and other waterfowl soup is an almost mandatory part of the first course served at *Nalukataq*, and one of the tasks of the crew members of a successful captain is to ensure that he has enough ducks and geese for *Nalukataq*. Similarly, although most subsistence activities are guided by experience and expectations of where these resources are most likely to be found, variability is also part of the pattern. Animals may not be encountered in "normal" locations, so that subsistence users must search areas in addition to those where animals have been found in the past.

Two broad subsistence-resource niches occur on the North Slope, but these are more useful as conceptual or analytical categories than as explanations for community (or individual) subsistence resource patterns. They are basically summaries of how resources co-occur:

- Coastal/marine: harvesting of whales, seals, waterfowl, fish, and other marine species
- Terrestrial/aquatic: harvesting of caribou, fish, moose, grizzly bears, other terrestrial animals, and edible roots and berries.

Kaktovik and Nuiqsut both depend on resources from each of these resource constellations, with marine mammals (and especially bowhead whales, due to their size), caribou, and fish as the primary resources harvested. The communities differ in the overall composition of their subsistence harvests, however. Kaktovik, located on Barter Island and with no nearby rivers that are navigable for any great distance, has much more of a maritime orientation (a reliance on marine mammals, but also coastal access to caribou). As discussed in more detail in a later section, 59–68% of the community's total subsistence harvest has historically consisted of marine mammals, 17–30 percent consisted of terrestrial mammals, and 8–13% consisted of fish. Kaktovik is also located nearer to the mountains than other coastal North Slope communities, and its residents incorporate snow machine trips to the mountains to harvest Dall sheep and caribou. They fish at named fishing locations on the Hulahula River and other locations. Resources harvested by Kaktovik residents in the project vicinity include caribou, seal, walrus, polar bear, fish, waterfowl, and furbearers. Caribou is by far the most intensively harvested resource by Kaktovik residents in the Project Area.

Nuiqsut, located about 20 km (12 mi) inland on the Colville River, which is navigable for a relatively large distance, has more of an "inland" orientation. The river also provides access to the ocean, however, and Nuiqsut's residents also rely on the harvest of marine mammals. Their overall total subsistence harvest is almost equally divided among marine mammals, terrestrial mammals, and fish — 32, 33, and 34 percent respectively in 1993, with 1–2 percent in birds, eggs, and vegetation. Very little of Nuiqust's harvest of any resource is obtained in the Project Area, as it is relatively far from the community. However, Nuiqsut whalers base their hunt from Cross Island, about 72 km (45 mi) west of Point Thomson.

Kaktovik hunters use a very large range for subsistence activities, including the coast between Bullen Point and Demarcation Point; inland around Hulahula, Sadlerochit, Jago, and Okpilak Rivers; and offshore up to 40 km (25 mi). Caribou are taken all along the coast (including the Project Area) as far west as Bullen Point or beyond. However, the coast east of the Project Area (Brownlow Point and east) is more intensively used to look for caribou than is the coast from Point Brownlow to Bullen Point, and relatively few hunters venture further east than Bullen Point. The main locations for caribou harvest nearest the Project Area are Brownlow Point, the Canning River delta, Point Thomson, and Bullen Point (Pedersen and Coffing 1984, Coffing and Pedersen 1985, Pedersen 1990). The most important, in terms of the number of animals taken and the regularity of the harvest, are Brownlow Point and the Canning River delta, east of the Project Area. Bullen Point is well west of the Project Area, and Point Thomson itself represents a small part of the total Kaktovik caribou harvest.

Nuiqsut residents also use a very wide area for subsistence activities. These activities are concentrated in the Colville River delta and along the Colville, Anaktuvuk, and Chandler Rivers, as well as in an overland area south and west of the community. Less frequent use is made of an area extending as far east as Kaktovik. Offshore hunting areas extend between Harrison Bay and Camden Bay. Although they do not harvest caribou in the Project Area, Nuiqsut residents rely heavily on their yearly harvest of caribou, which may migrate through the Project Area. In addition, Arctic cisco pass the Project Area while migrating from the Mackenzie River delta in Canada to the Colville River, where Nuiqsut residents harvest this species.

Bowhead whales are the resource most intensively harvested by Nuiqsut residents near the Project Area. Whaling crews travel to Cross Island, about 72 km (45 mi) west of Point Thomson, and look for whales up to 30 miles seaward from Cross Island, and east of Cross Island as far as Flaxman Island (Galginaitis 2009).

REFERENCES

Alyeska (Alyeska Pipeline Service Company). (2011). Low Flow Impact Study Final Report. Prepared by the Low Flow Study Project Team. 15 June 2011. Anchorage, AK. 50pp. http://www.alyeska-pipe.com/Inthenews/LowFlow/LoFIS_Summary_Report_P6%2027_FullReport.pdf.

Coffing, M. W. and S. Pedersen. 1985. Caribou hunting: land use dimensions, harvest level, and cultural of the regulatory 1983–1984 in Kaktovik, Alaska. Report by the Alaska Department of Fish and Game, Division of Subsistence, Fairbanks. Technical Paper No. 120. 38 p.

Galginaitis, M. 2009. Annual assessment of subsistence bowhead whaling near Cross Island, 2001–2007. Final report for Canimida Task 7, OCS Study MMS 2009-038. Prepared for the USDOI, Minerals Management Service, Alaska, Outer Continental Shelf: Anchorage, AK.

IAI (Impact Assessment Inc.). 1990a. Subsistence resource harvest patterns: Kaktovik. Special Report No. 8. OCS Study MMS 90-0038. Prepared by Impact Assessment Inc. for the United States Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region,: Anchorage, AK.

MMS (Minerals Management Service). 2003. Beaufort Sea lease sales 186, 195, and 202 Final Environmental Impact Statement. EIS/EA MMS 2003-001. U.S. Department of Interior, MMS, Alaska Outer Continental Shelf Region, Anchorage, AK.

MMS. (2008). Beaufort Sea and Chukchi Sea Planning Areas, Oil and Gas Lease Sales 209, 212, 217, and 221, Draft Environmental Impact Statement. OCS EIS/EA MMS 2008-0055.

NRC (National Research Council). 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press, Washington, D.C. 288 pp.

Pedersen, S. 1990. Caribou hunting: land use dimensions, harvest level, and selected aspects of the hunt during regulatory year 1987–88 in Kaktovik, Alaska. Technical Paper No. 172.

Pedersen, S. and M. Coffing. 1984. Caribou hunting: land use dimensions and recent harvest patterns in Kaktovik, Northeast Alaska. Report by Alaska Department of Fish and Game, Division of Subsistence, Fairbanks. Technical Paper No. 92. 54 p.

SRBA (Stephen R. Braund & Associates). 2010. Subsistence mapping of Nuiqsut, Kaktovik, and Barrow. MMS OCS Study Number 2009-003. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage, AK.

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