POINT THOMSON PROJECT EIS

Draft Environmental Impact Statement

Appendices L-P

VOLUME 7

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US Army Corps of Engineers

POINT THOMSON PROJECT EIS

Appendix L

Bird Nesting/Breeding Tables

Table 1: Summary of Migratory Bird Nesting Habitat Use in the Point Thomson Study Area

Habitat Code	Habitat Description	Mapped Area (acres)	Mapped Area (%)	Waterfowl and Loon Nests	Shorebird Nests	Landbird Nests	Total Nests	Total Nests (%)
Ia	Water and Associated Barrens	18,354	28.5	4	1	0	5	1
IIb	Aquatic Graminoid Tundra	369	0.6	0	0	0	0	0
IId	Water/Tundra Complex	235	0.4	0	1	0	1	< 1
IIIa	Wet Sedge Tundra	3,829	6.0	0	7	1	8	2
IIIb	Wet Saline Graminoid Tundra	548	0.9	0	0	0	0	0
IIIc	Wet Sedge/Water Complex	691	1.1	–	–	–	–	–
IIId	Wet Sedge/Moist Sedge, Dwarf Shrub Tundra Complex	12,339	19.2	3	51	36	90	22
IIIe	Wet Sedge/Moist Sedge/Barren Complex	332	0.5	0	10	4	14	3
IVa	Moist Sedge, Dwarf Shrub/Wet Graminoid Tundra Complex	10,719	16.7	6	79	75	160	39
Va	Moist Sedge, Dwarf Shrub Tundra	12,494	19.4	1	56	46	103	25
Vb	Moist Tussock Sedge, Dwarf Shrub Tundra	260	0.4	–	–	–	–	–
Vc	Dry, Dwarf Shrub, Crustose Lichen Tundra	741	1.2	1	5	5	11	3
Vd	Dry , Dwarf Shrub, Fruticose Lichen Tundra	567	0.9	–	–	–	–	–
Ve	Moist Graminoid, Dwarf Shrub Tundra/Barren Complex	1,406	2.2	0	7	8	15	4
IXb	Dry Barren/Dwarf Shrub, Forb Grass Complex	363	0.6	0	0	0	0	0
IXc	Dry Barren/Forb Complex	52	0.1	–	–	–	–	–
IXe	Dry Barren/Grass Complex	10	<0.1	–	–	–	–	–
IXf	Dry Barren/Dwarf Shrub Grass Complex	2	<0.1	–	–	–	–	–
IXh	Wet Saline Barren/Wet Sedge Tundra Complex	262	0.4	0	0	0	0	0
IXi	Dry Saline Barren/Forb, Graminoid Complex	1	1.2	0	1	0	1	< 1
Xa	Barren River Gravels	984	1.5	–	–	–	–	–
Xc	Barren Gravel Outcrops	6	<0.1	–	–	–	–	–
Xe	Barren Gravel Roads and Pads	193	0.3	–	–	–	–	–
XIa	Barren Wet Mud	326	0.5	0	0	0	0	0
XIc	Barren Peat	14	<0.1	–	–	–	–	–
Totals		64,356	100.0	14	218	175	408	100
Nest Density (Nests per acre)		.006		5	78	63	147	

Point Thomson Project Draft EIS
Tables of Bird Nesting and Breeding in the Point Thomson Study Area

Table 2: Summary of Bird Nest Density and Estimated Total Bird Nests in and Near the Point Thomson Study Area				
Region[a] Group or Name	Badami Sample Area 1994 nests/mi²	Point Thomson Sample Area 2000-2003 nests/mi²	Canning River Delta Sample Area 2002-2006 nests/mi²	Point Thomson Region Population Estimate (375 mi²)[b]
Geese and Swans				
Cackling Goose		<1		143
Dabbling Ducks				
Northern Pintail		<1	1	143
Diving Ducks[c]				
Common Eider			<1	0
King Eider	2	3	3	889
Long-tailed Duck	<1	<1	<1	284
Spectacled Eider	<1[d]	0[e]	--	72
Loons[f]				
Pacific Loon		<1	3	72
Red-throated Loon	<1		1	141
Waterfowl and Loon Total	4	5	9	1,744
Seabirds				
Parasitic Jaeger			<1	0
Shorebirds				
American Golden Plover	7	5	<1	2,164
Baird's Sandpiper	3			458
Black-bellied Plover	<1			141
Buff-breasted Sandpiper		2	0	358
Dunlin	9	7	11	2,786
Long-billed Dowitcher	2	2	<1	675
Pectoral Sandpiper	23	29	38	9,828
Red-necked Phalarope	3	1	17	744
Red Phalarope	6	6	23	2,273
Semipalmated Sandpiper	41	26	37	12,518
Stilt Sandpiper	3	1	10	814
Shorebird Total	98	79	137	32,759
Waterbird Total	102	84	146	34,503
Ptarmigan				
Rock Ptarmigan	<1	<1	<1	213
Songbirds				
Lapland Longspur	91	63	60	28,431
Landbird Total	92	63	60	28,644
All Bird Total	194	147	206	63,073

Sources: TERA 1995; Rodrigues 2002a, b; Kendall et al. 2007; Liebezeit et al. 2009

[a] Sample area: Badami – 1.16 mi², Point Thomson – 2.78 mi², Canning River Delta – 3.28 mi². For bird count data, all numbers are rounded to closest whole number; subtotals may reflect rounding errors.

[b] Point Thomson Region Estimate calculated based on 53% Point Thomson nest density plus 47% Badami nest density multiplied by 375 mi² or the approximate land area within 2.5 miles of gravel and ice components for all alternatives.

[c] No Steller's eiders have been reported nesting in the Point Thomson study area.

[d] Average nest density value based on ground level survey values for the 1994 Badami and Kadleroshilik study areas (TERA 1995) and aerial-based breeding pair value for the 1993 Kuvlum Corridor Stratum 1 survey area (Byrne et al. 1994).

[e] Average breeding pair density based on the 1993 Kuvlum Corridor Stratum 2 survey area (Byrne et al. 1994) and the Point Thomson area surveys in 1998, 1999, 2000, 2001 (TERA 2002) and 2010 (Johnson et al. 2011).

[f] No yellow-billed loons have been reported nesting in the Point Thomson study area.

Table 3: Arctic Coastal Plain (ACP) Breeding Bird Population Indices and Estimated Coastal Bird Abundance in the Western Beaufort Sea and in the Point Thomson Study Area							
	2008 ACP Survey[a]		1992-2008 ACP Survey		Population Growth Rate (1999-2008)[b]	Abundance Estimate (1999-2009)	
	Observed Population Index	Observed Population Range (95% CI)	Mean Population Index	Mean Density birds/mi^2		Beaufort Sea Coast	Point Thomson Study Area Coast[c]
Geese and Swans							
Brant	12,247	6,091-18,402	6,870	<1	1.14	2413	47
Cackling Goose	3,304	2,155-4,452	7,827	<1	0.98	794	33
Gr. White-fronted Goose	152,634	132,938-172,331	84,004	7	1.08	1092	21
Snow Goose	7,938	762-15,114	6,786	<1	1.23	897	116
Tundra Swan	10,575	8,368-12,783	6,558	<1	1.05	88	8
Dabbling Ducks							
American Wigeon	901	232-1,570	390	<1	0.94	2	0
Mallard	47	0-141	201	<1	0.98		
Northern Pintail	59,450	49,215-69,685	49,558	4	0.91	1162	25
Northern Shoveler	172	30-314	205	<1	1.04	< 1	0
Diving Ducks							
Black Scoter	0	0-0	113	<1	1.12	109	7
Common Eider	340	0-851	388	<1	1.11	2524	328
Greater Scaup	11,468	4,768-18,168	4,671	<1	1.13	684	36
King Eider	16,230	13,819-18,641	13,421	1	1.03	2846	158
Long-tailed Duck	33,345	27,945-38,745	30,530	3	0.98	5372	531
Red-breasted Merganser	591	144-1,038	477	<1	1.08	647	36
Spectacled Eider	6,207	5,047-7,368	6,635	<1	0.99	25	< 1
Steller's Eider	25	0-70	168	<1	0.96	2	0
Surf Scoter						3882	422
White-winged Scoter	186	0-443	340	<1	1.02	1087	19
Loons							
Pacific Loon	21,315	18,086-24,544	20,909	2	1.01	402	26
Red-throated Loon	1,996	1,277-2,715	2,578	<1	1.01	141	5
Yellow-billed Loon	1,235	813-1,658	1,119	<1	1.05	50	2
Cranes							
Sandhill Crane	214	21-407	128	<1	1.01	1	0
Seabirds							
Arctic Tern	13,119	10,227-16,011	10,611	<1	1.01	972	33
Black Guillemot						80	0
Glaucous Gull	15,346	12,955-17,738	12,580	1	1.03	4359	266
Parasitic Jaeger						25	< 1
Pomarine Jaeger						3	< 1
All Jaegers	4,630	3,225-6,035	4,184	<1	1.02	31	< 1
Sabine's Gull	9,901	7,698-12,104	7,050	<1	1.07	310	12
Shorebird	47,663	31,624-63,702	43,964	4	0.98	31	3

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	2008 ACP Survey[a]		1992-2008 ACP Survey		Population Growth Rate (1999-2008)[b]	Abundance Estimate (1999-2009)	
	Observed Population Index	Observed Population Range (95% CI)	Mean Population Index	Mean Density birds/mi^2		Beaufort Sea Coast	Point Thomson Study Area Coast[c]
Raptors and Owls							
Golden Eagle	56	10-102	45	<1	1.11	< 1	0
Rough-legged Hawk						< 1	< 1
Short-eared Owl	45	11-80	81	<1	0.91		
Snowy Owl	188	0-427	851	<1	1.12	19	8
Songbirds							
Common Raven	114	0-340	60	<1	0.94	2	0
Total Birds	596,402		323,302			30,053	2,143

Sources: ACP aerial waterfowl survey (Larned et al. 2009) and Beaufort Sea coastal surveys (Dau and Bollinger 2009). For bird count data, all numbers are rounded to closest whole number; subtotals may reflect rounding errors.

[a] Observed population index presented for consistency with mean population index (duck estimates were not adjusted with visibility correction factors). Indices based on eider survey strata. CI = Confidence Interval. Sample area = 4% (539.4 mi^2) of 11,762.6 mi^2 survey area for 2008.

[b] Average annual population index growth rates: Values >1 indicate population growth; values <1 indicate population decline.

[c] Point Thomson coastal area totals include the mean number of birds on shoreline transects 20 and 21, and barrier island transects 203, 204, 205, 206, 207, 211, 212, 213, 214 (data for all island transects not available for each year) (Dau and Bollinger 2009). Survey area = 972 linear miles, with about 75 linear miles for the Point Thomson area.

Table 4: Post-breeding (Brood-rearing, Molting and/or Staging) Bird Density and Abundance in the Coastal Lagoon and Tundra and Nearshore Western Beaufort Sea and in the Point Thomson Study Area

	Lagoon and Onshore—Tigvariak to Brownlow					
Species	Barrier Island Density (Birds/mi²) (1998-2002)	Mid-Lagoon Density (Birds/mi²) (1998-2002)	Shoreline Density (Birds/mi²) (1998-2002)	Tundra Density (Birds/mi²) (1998-2002)	Nearshore-Lagoon Bird Estimate (375 mi²)[b]	Tundra Bird Estimate (375 mi²)[c]
Geese and Swans						
Brant	< 1		< 1	< 1	60	349
Cackling Goose		< 1	2	4	197	1,451
Gr. White-fronted Goose			1	11	101	4,271
Snow Goose			2		146	0
Tundra Swan			< 1	< 1	5	214
Dabbling Ducks						
Northern Pintail	< 1	< 1	< 1	< 1	81	129
Diving and Sea Ducks						
Black Scoter	< 1	< 1	< 1	< 1	40	11
Common Eider	20	16	10	< 1	5,908	4
Greater Scaup			< 1		2	0
King Eider	< 1	< 1	< 1	< 1	49	33
Long-tailed Duck	338	55	285	2	59,131	918
Red-breasted Merganser	< 1	< 1	1	< 1	59	26
Surf Scoter	< 1	5	1		1,297	0
White-winged Scoter	< 1	1	< 1		230	0
Loons						
Pacific Loon	< 1	< 1	1	1	140	404
Red-throated Loon	< 1	< 1	< 1	< 1	55	61
Yellow-billed Loon	< 1	< 1	< 1		8	0
Cranes						
Sandhill Crane				< 1	0	44
Seabirds						
Arctic Tern	1		< 1	< 1	57	24
Black-legged Kittiwake	< 1				2	0
Glaucous Gull	3	1	5	< 1	896	135
Long-tailed Jaeger				< 1	0	2
Parasitic Jaeger	< 1	0	0	< 1	2	7
Pomarine Jaeger				< 1	0	7

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Species	Lagoon and Onshore—Tigvariak to Brownlow					
	Barrier Island Density (Birds/mi²) (1998-2002)	Mid-Lagoon Density (Birds/mi²) (1998-2002)	Shoreline Density (Birds/mi²) (1998-2002)	Tundra Density (Birds/mi²) (1998-2002)	Nearshore-Lagoon Bird Estimate (375 mi²)[b]	Tundra Bird Estimate (375 mi²)[c]
All Jaegers	< 1	< 1	< 1	< 1	3	22
Sabine's Gull	< 1			< 1	5	2
Shorebirds						
Small shorebirds	2	1	1	1	488	294
Medium shorebirds	< 1		1	< 1	60	87
Phalaropes	1			1	82	214
Raptors and Owls						
Northern Harrier				< 1	0	2
Rough-legged Hawk				< 1	0	9
Short-eared Owl				< 1	0	4
Songbirds						
Common Raven				< 1	0	2
Snow Bunting				< 1	0	4
Ptarmigan				< 1	0	11
All Birds[a]	370	84	314	25	47,649	4,873

Sources: Noel et al. 1999; Noel et al. 2000; Noel et al. 2002a,b; Fischer and Larned 2004; Johnson et al. 2005. For bird count data, all numbers are rounded to closest whole number; subtotals may reflect rounding errors.

[a] Densities and bird estimates include additional birds not identified to species.

[b] Nearshore-Lagoon Bird Estimate is a compilation of 20% (75 mi²) Barrier Islands, 60% (225 mi²) Mid-Lagoon, and 20% (75 mi²) Shoreline densities multiplied by 375 mi² or the approximate of the combined extents for barrier islands, lagoon, and shoreline areas from the Sagavanirktok River delta to the Canning River delta.

[c] Tundra Bird Estimate multiplied by 375 mi² or the approximate land area within 2.5 miles of gravel and ice components for all alternatives.

Appendix M

Biological Assessments

DRAFT

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

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for

URS Corporation

Anchorage, AK

October 2011

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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.

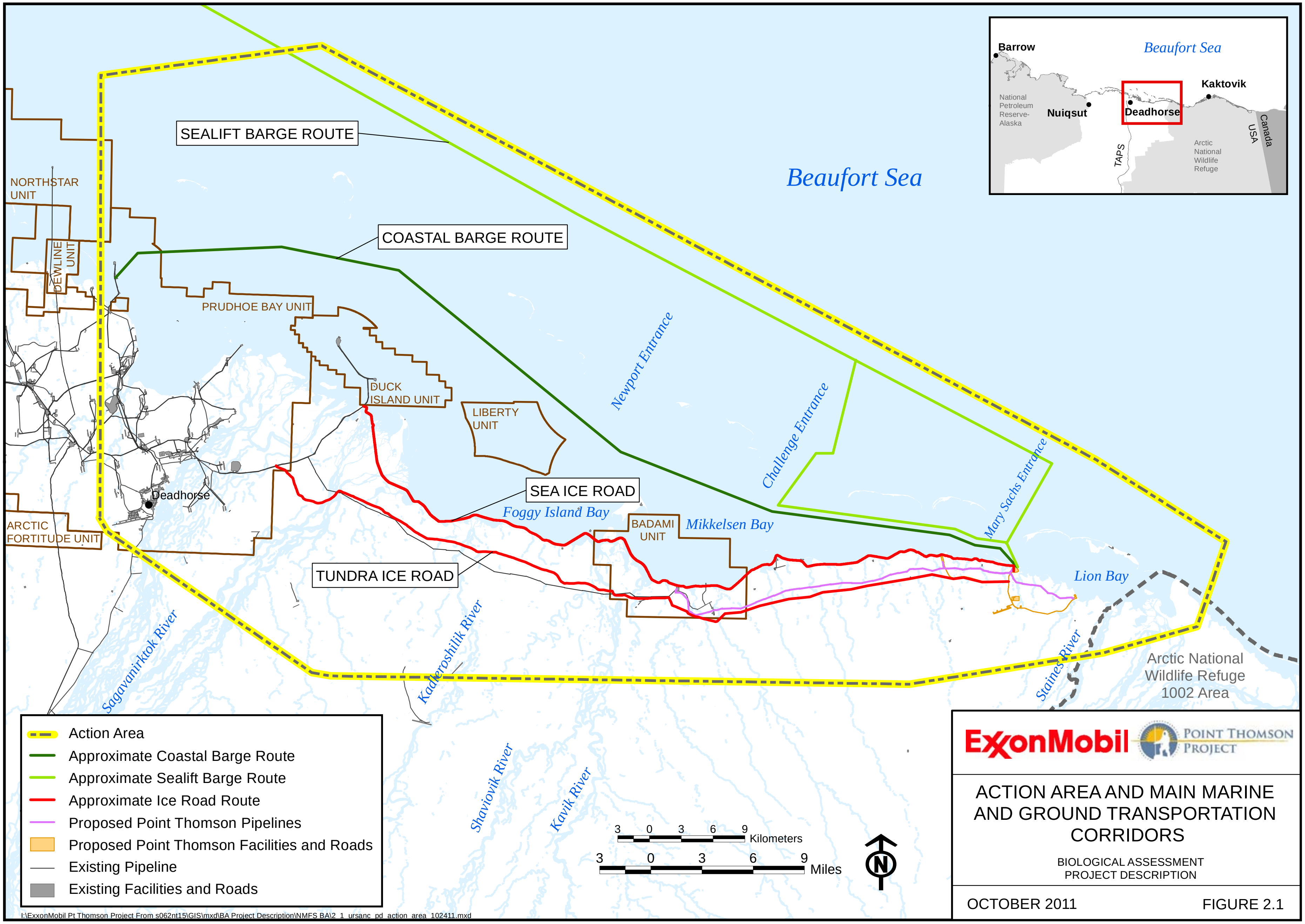
December 10, 2010 – NMFS proposes to list both the ringed and bearded seal as threatened.

Month XX TBD, 2011 – 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.



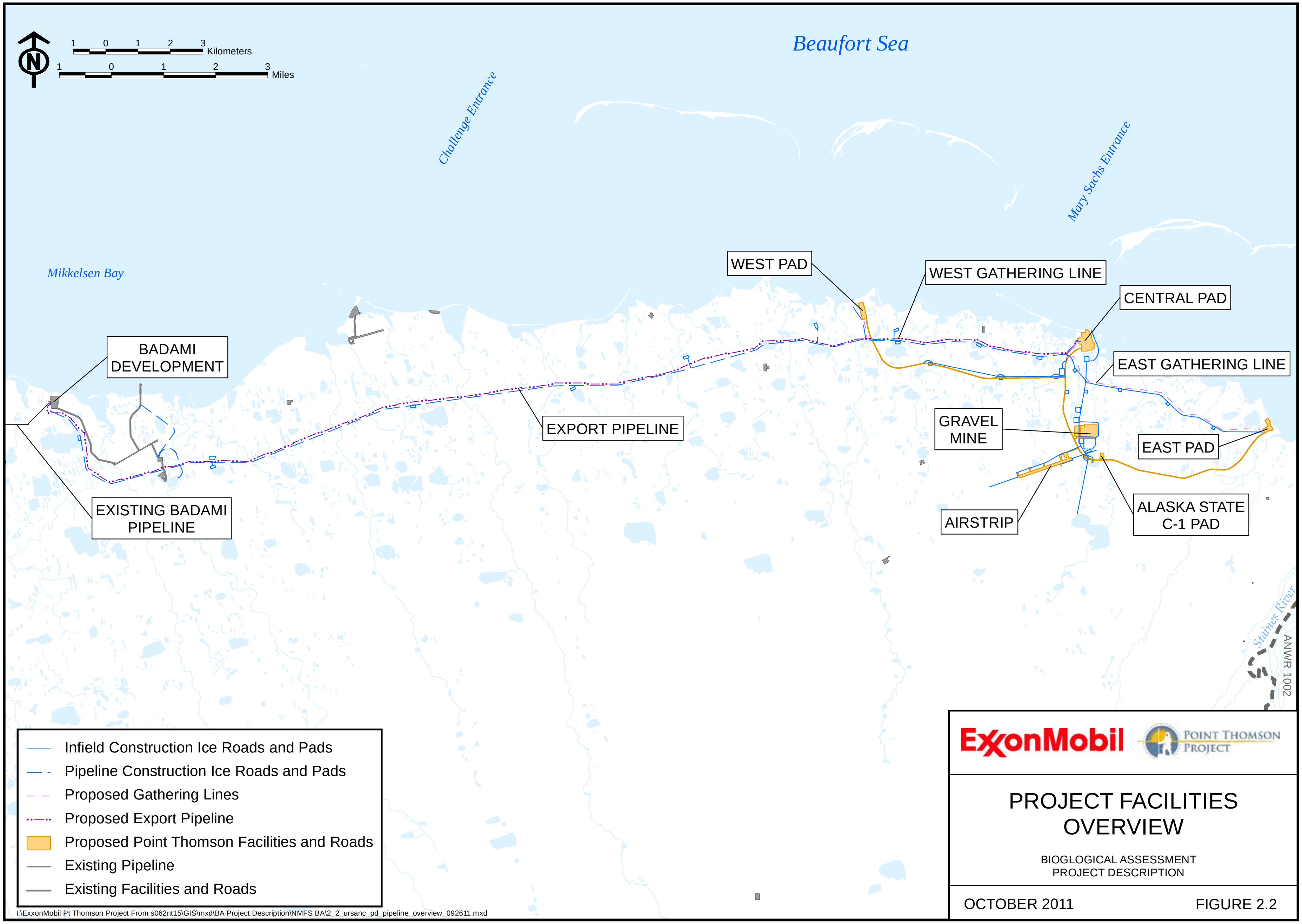
ExxonMobil Point Thomson Project

ACTION AREA AND MAIN MARINE AND GROUND TRANSPORTATION CORRIDORS

BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION

OCTOBER 2011

FIGURE 2.1



PROJECT FACILITIES OVERVIEW

BIOGLOGICAL ASSESSMENT
PROJECT DESCRIPTION

OCTOBER 2011

FIGURE 2.2

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.

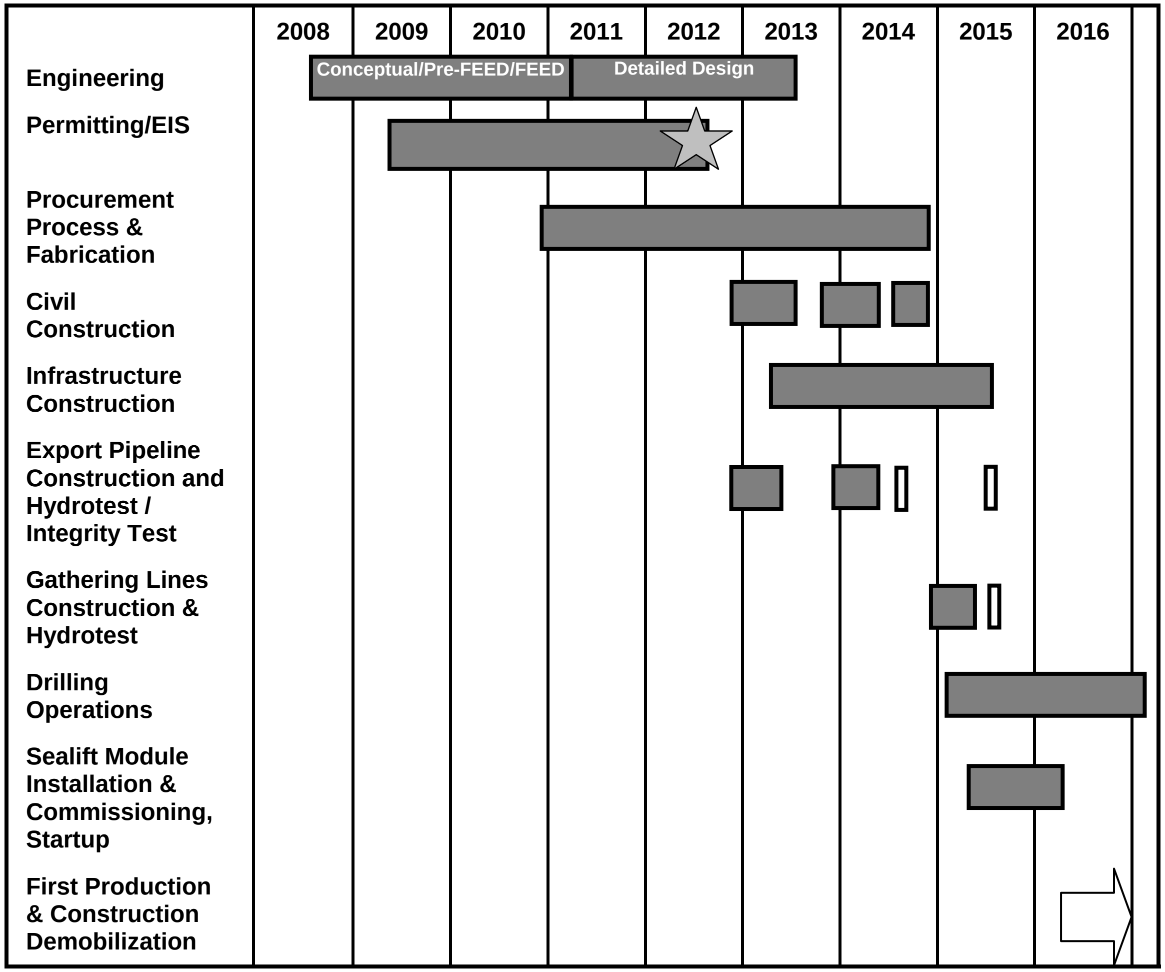
The design life of Project facilities is predicted to be approximately 30 years. Detailed facility abandonment procedures will be developed prior to terminating the operations.

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

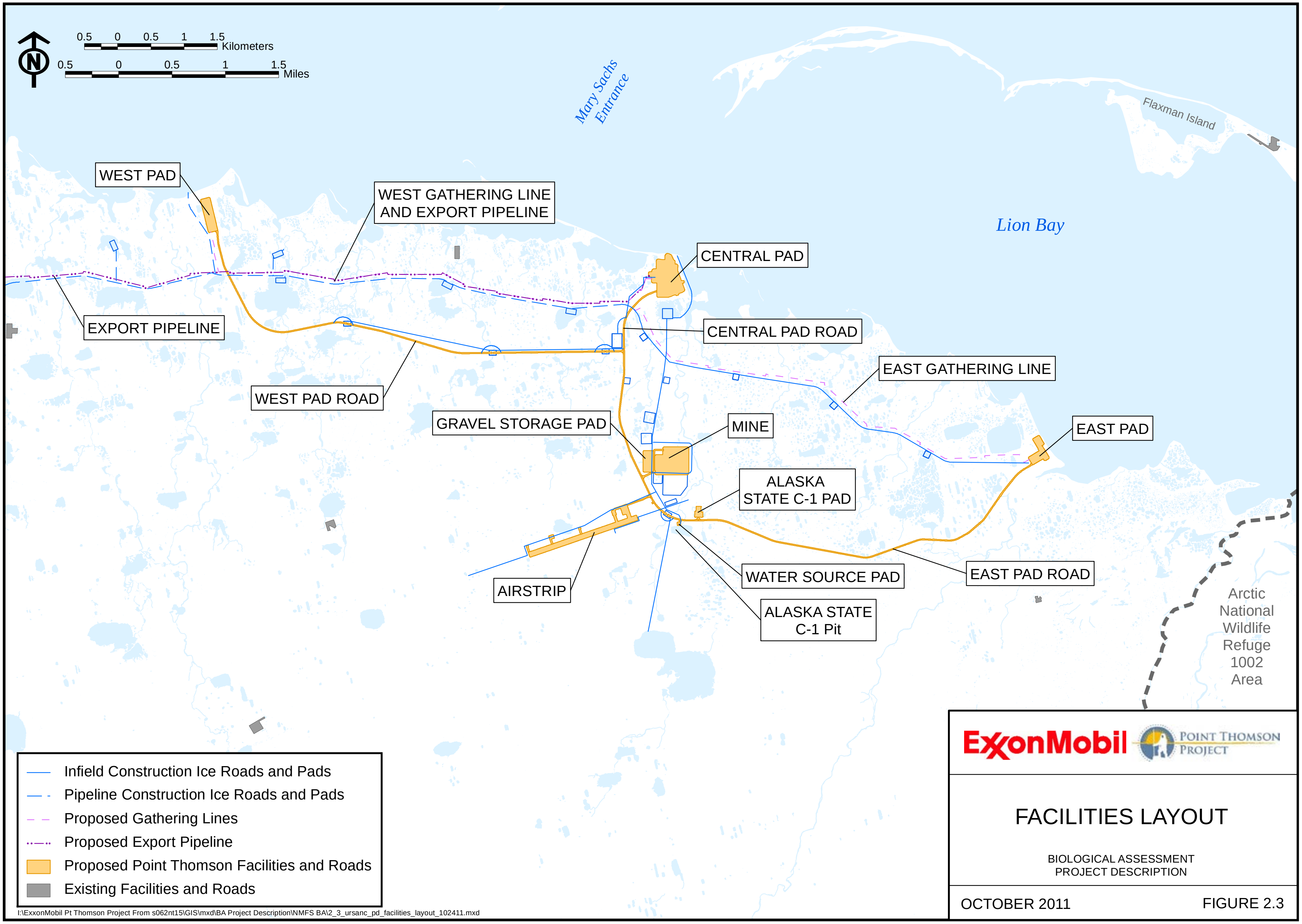
Notes:

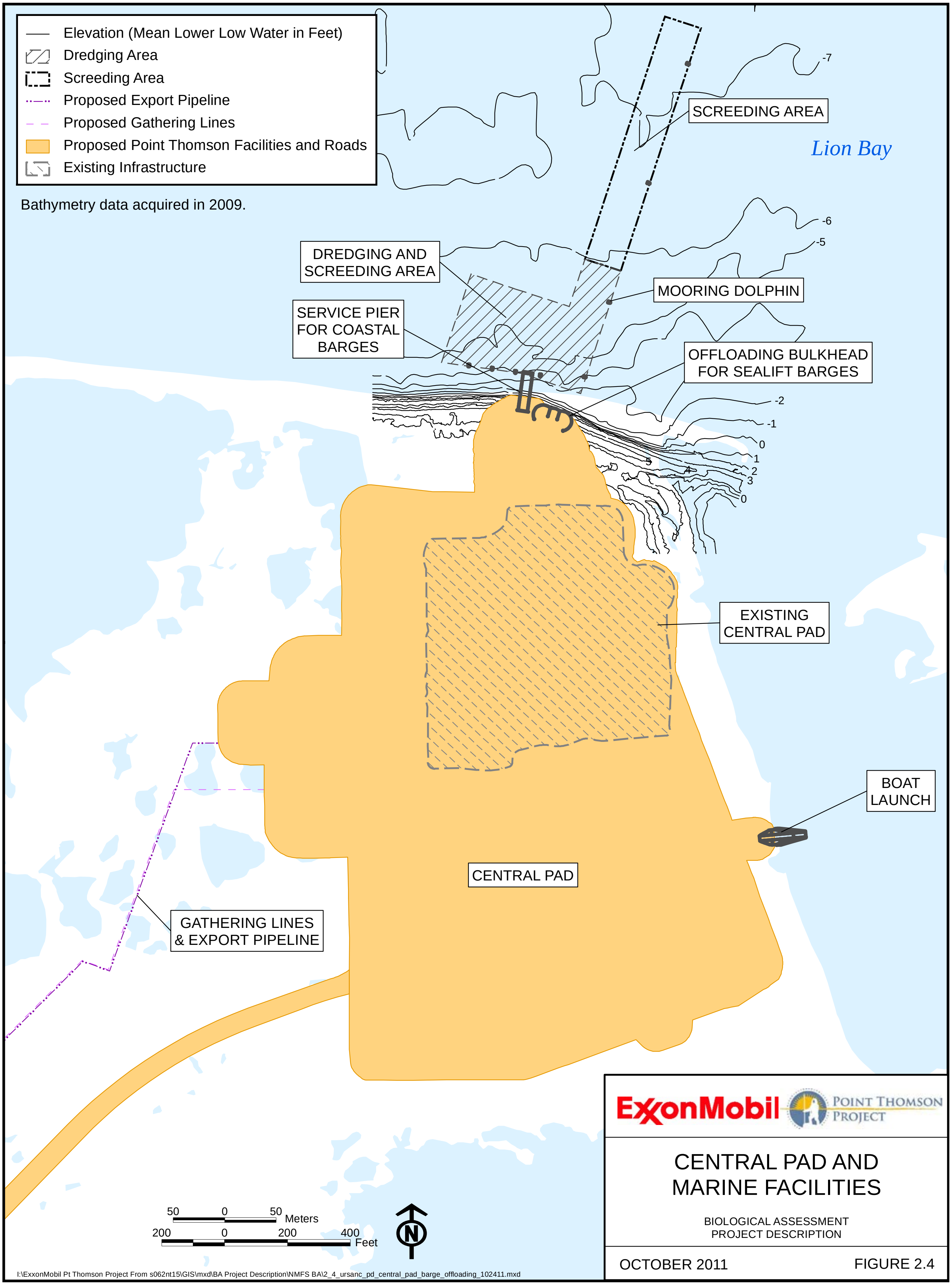
1. Depending on timing and certainty of expected permit acquisition, some items may be mobilized in advance of permit issue to allow maximum work to be accomplished during the limited winter construction seasons. Such mobilization would utilize existing gravel pads or seasonal ice roads and ice pads, 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.


0.5 0 0.5 1 1.5 Kilometers
0.5 0 0.5 1 1.5 Miles
Mary Sachs Entrance
Flaxman Island
Lion Bay
WEST PAD
WEST GATHERING LINE AND EXPORT PIPELINE
CENTRAL PAD
EXPORT PIPELINE
CENTRAL PAD ROAD
EAST GATHERING LINE
WEST PAD ROAD
GRAVEL STORAGE PAD
MINE
EAST PAD
ALASKA STATE C-1 PAD
AIRSTRIP
WATER SOURCE PAD
EAST PAD ROAD
ALASKA STATE C-1 Pit
Arctic National Wildlife Refuge 1002 Area
Infield Construction Ice Roads and Pads
Pipeline Construction Ice Roads and Pads
Proposed Gathering Lines
Proposed Export Pipeline
Proposed Point Thomson Facilities and Roads
Existing Facilities and Roads
ExxonMobil
POINT THOMSON PROJECT
FACILITIES LAYOUT
BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION
OCTOBER 2011
FIGURE 2.3
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\2_3_ursanc_pd_facilities_layout_102411.mxd



ExxonMobil
Point Thomson Project

CENTRAL PAD AND MARINE FACILITIES

BIOLOGICAL ASSESSMENT
PROJECT DESCRIPTION

OCTOBER 2011

FIGURE 2.4

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).

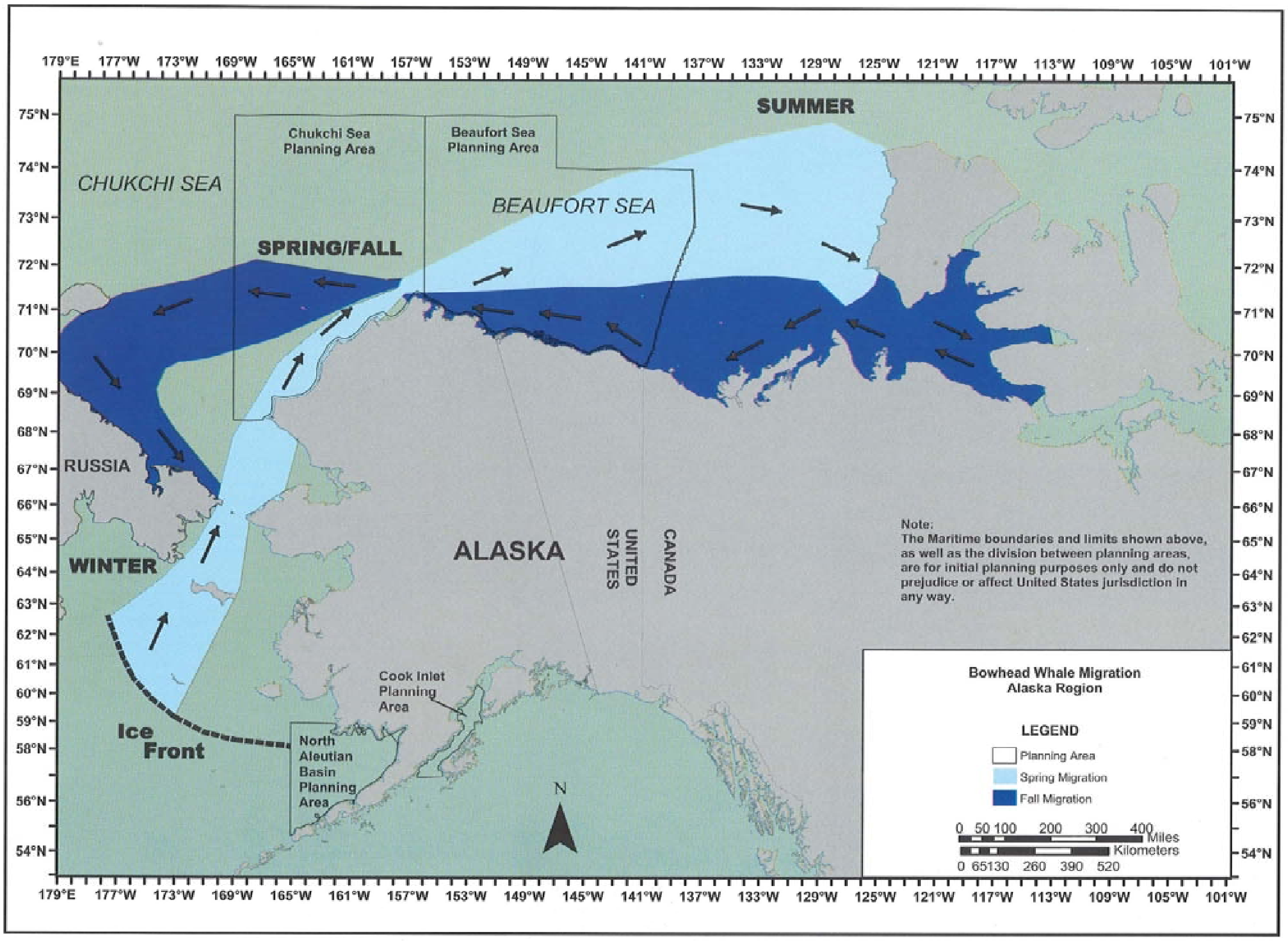
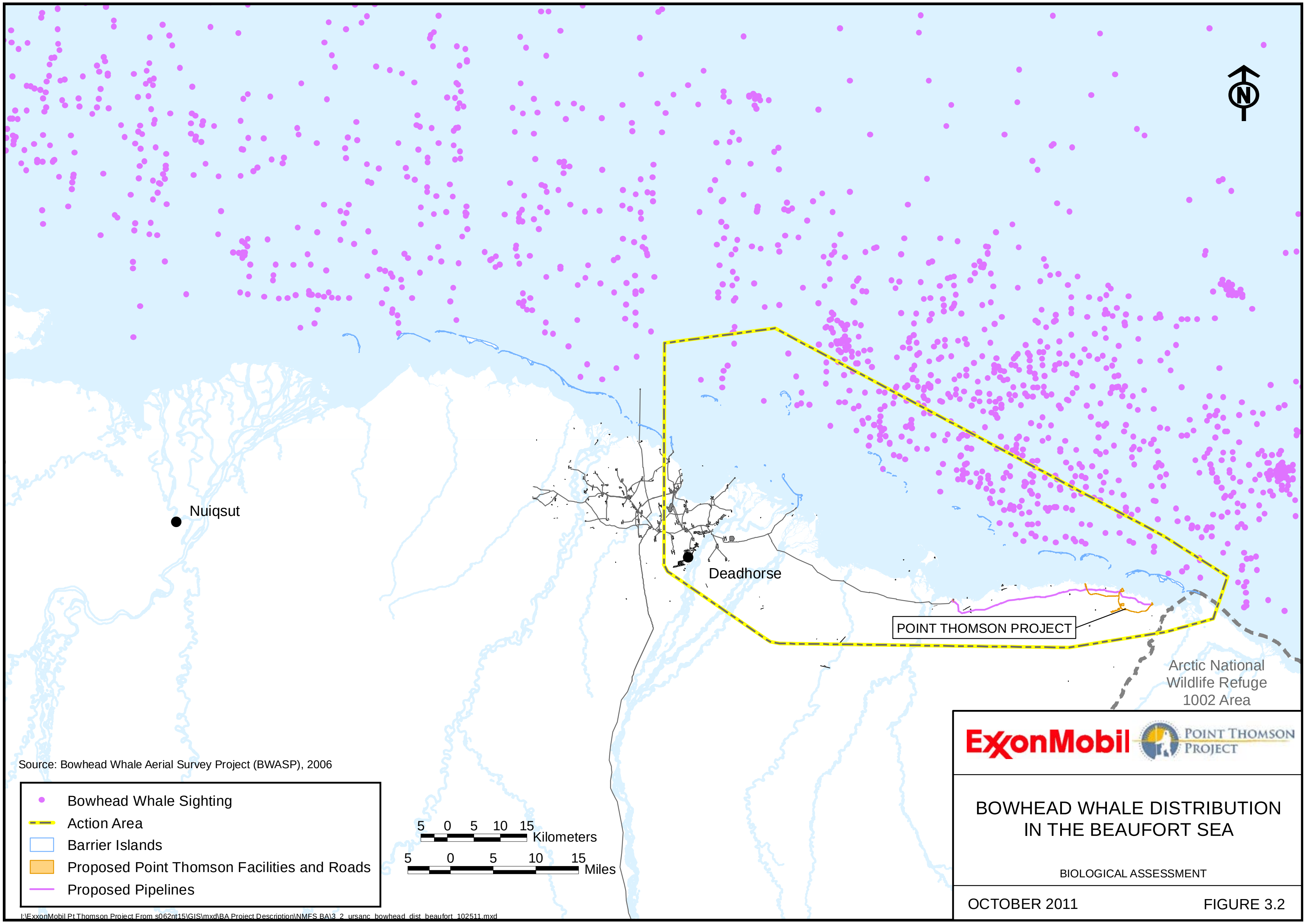


Figure 3.1 Bowhead Fall Migration Routes (reproduced from U.S. Department of Interior 2006)

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.

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).


Nuiqsut
Deadhorse
POINT THOMSON PROJECT
Arctic National
Wildlife Refuge
1002 Area
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ExxonMobil
POINT THOMSON PROJECT
BOWHEAD WHALE DISTRIBUTION
IN THE BEAUFORT SEA
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.2
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
I:\ExxonMobil Pt Thomson Project From s062nt15\GIS\mxd\BA Project Description\NMFS BA\3_2_ursanc_bowhead_dist_beaufort_102511.mxd

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.

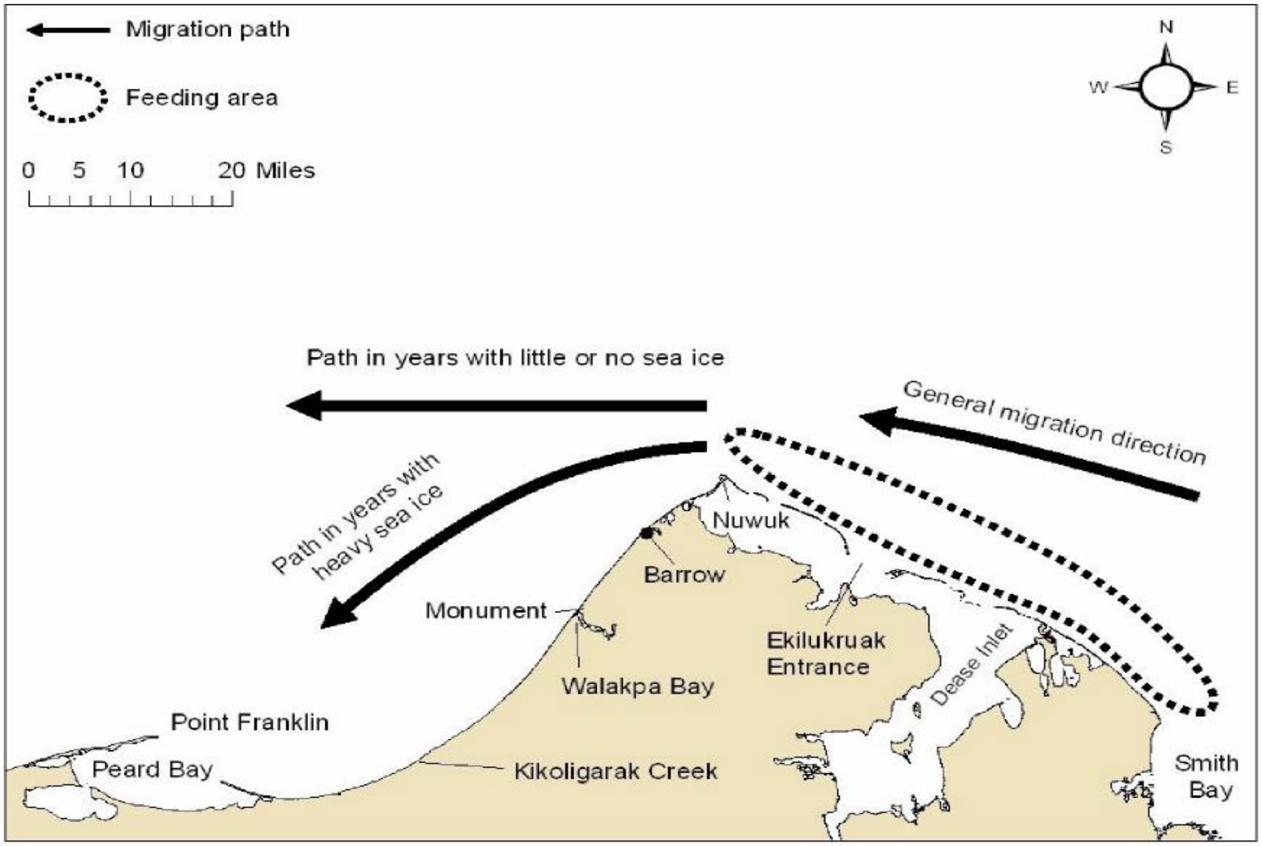


Figure 3.3 Bowhead Fall Migration Routes Based on Traditional Eskimo Knowledge (map taken from Huntington and Quakenbush 2009)

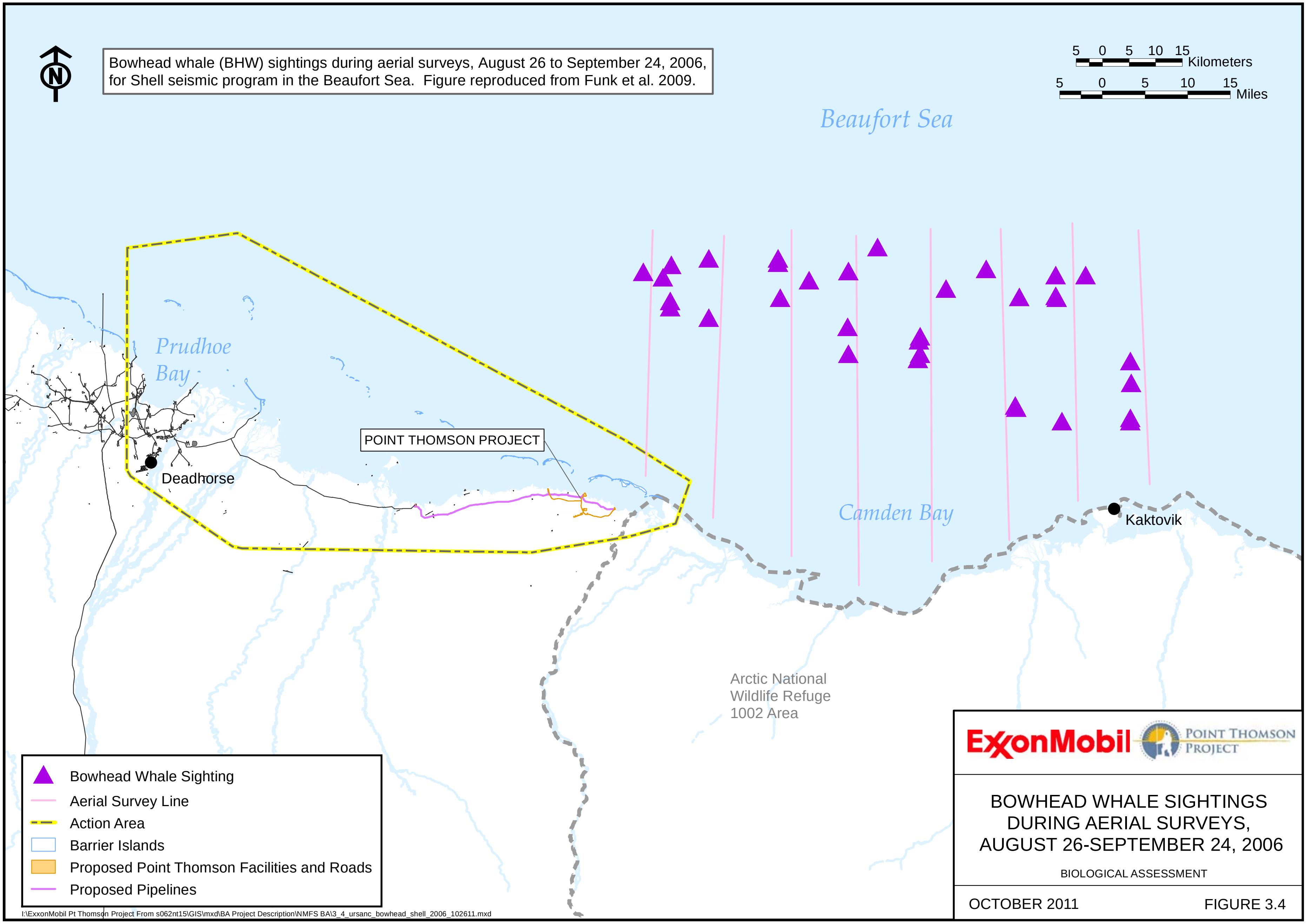
Examination of stomach contents from whales taken in the Iñupiat subsistence harvest indicates that bowhead whales feed on a variety of invertebrates and some fishes, which vary somewhat geographically (Lowry 1993). Recent analysis of stomachs collected from harvested whales found mainly copepods in 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).

3.1.4 Communication and Hearing

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

3.1.5 Scientific Studies in Action Area

Broad-scale aerial surveys in the Beaufort Sea conducted by Shell Exploration and Production Company (Shell) and BOEMRE overlapped the Action Area. Aerial surveys conducted by Shell Western between 2006 to 2008 show bowheads occur north of the barrier islands near the Project area from late August to early October, with most whales reported in September at locations shown in Figures 3.4 and 3.5 (Figure for 2008 not available, Funk et al. 2009). Survey effort did not extend south of the barrier islands to the shoreline but whales were observed near the barrier islands, although most were much farther north (offshore). Aerial surveys conducted annually by BOEMRE during late summer through fall from 1982 to 2010 similarly show bowheads north but not inside of the barrier islands near Point Thomson (Figure 1, Treacy et al. 2006). More bowheads would likely occur closer but still considerably north of the barrier islands during light ice years than heavy ice years as mentioned earlier. Their occurrence would be highest during September and October, when most bowheads migrate westward across the Beaufort Sea; the spring migration is far offshore in ice leads. During both aerial survey programs bowheads were observed feeding, but neither study identified the specific locations. Satellite tagging studies of bowhead whales and acoustic studies of their vocalizations show seasonal movements occur outside of the barrier islands in the Beaufort Sea (Quakenbush et al. 2009, 2010; and Blackwell et al. 2007).

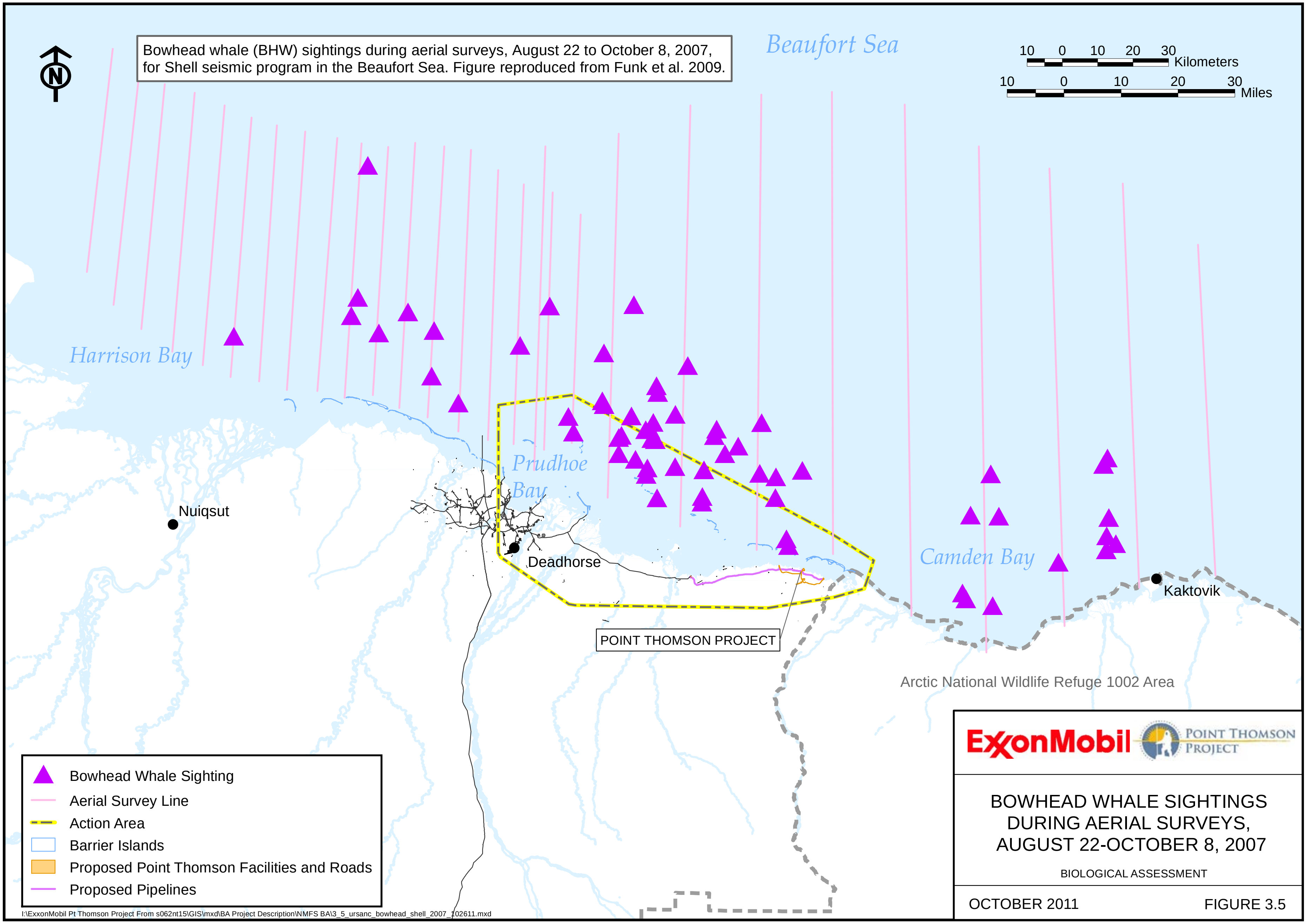


BOWHEAD WHALE SIGHTINGS DURING AERIAL SURVEYS, AUGUST 26-SEPTEMBER 24, 2006

BIOLOGICAL ASSESSMENT

OCTOBER 2011

FIGURE 3.4



ExxonMobil POINT THOMSON PROJECT

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

BIOLOGICAL ASSESSMENT

OCTOBER 2011

FIGURE 3.5

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/km² 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/km². 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. 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 for bowhead whales and seals (see Section 5.2 for discussion of take threshold levels). Consequently, underwater noise from barges is not expected to have a significant effect on bowhead whales or seals.

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

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

4.1.1.4 Aircraft Traffic

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

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

4.1.2 Subsistence Harvest

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

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

Ringed and bearded seals are harvested year-round, but primarily from spring to fall (Allen and Angliss 2010; and Bacon et al. 2009). Information on recent numbers of ringed and bearded seals harvested each year by hunters from each community is poorly documented (Allen and Angliss 2010). The most recent estimate of the number of ringed seals harvested for subsistence is for 2000, when 9,500 seals were taken by all of the communities in Alaska; harvest was not broken down by community (Allen and Angliss 2010). The most recent harvest estimates (from 2003) for bearded seals cover only communities in the NSB, and suggest that a minimum of 1,545 bearded seals were taken from the eastern Chukchi and western Beaufort seas, including 32 seals from Point Lay, 729 from Wainwright, 776 from Barrow, and 8 from Kaktovik (Bacon et al. 2009). The actual number of seals taken during the hunt is higher since an estimated 25 to 50 percent of the seals struck are lost (Bacon et al. 2009). Currently, there is no comprehensive effort to quantify harvest levels of seals in Alaska (Allen and Angliss 2010). Seal hunting primarily occurs near the villages, which are a considerable distance (greater than 60 mi) from the Project area. There are no published records of seals harvested near the Project area.

4.1.3 Commercial Harvest

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

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

4.2. Existing Habitat Conditions and Species Trends

4.2.1 Existing Habitat Conditions

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

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

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

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

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

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

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

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

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

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

4.2.2 Species Trends

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

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

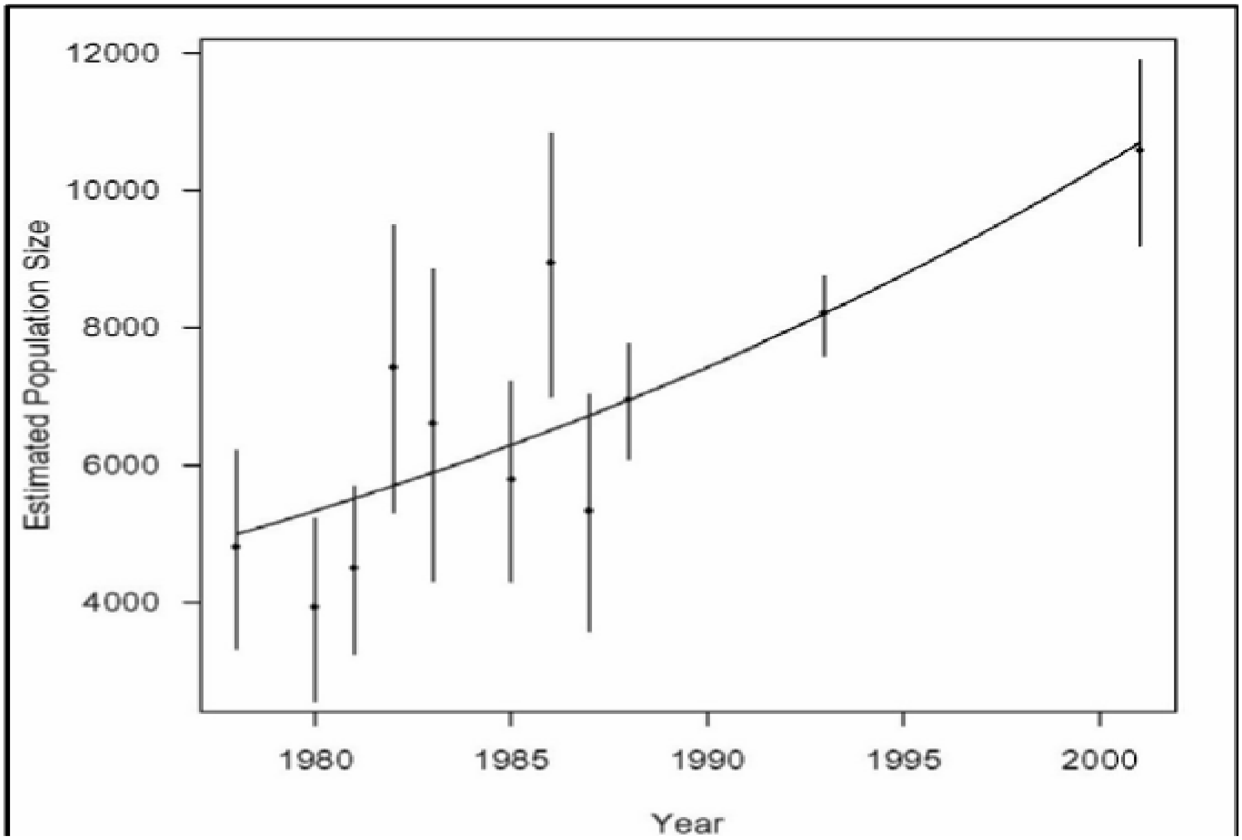


Figure 4.1 Abundance Estimates and Standard Deviation for the Bering-Chukchi-Beaufort Sea bowhead Whale Stock (Zeh and Punt 2005). Error bars show +/- 1 standard error. (Figure taken from Allen and Angliss 2010).

5.0 EFFECTS OF THE ACTION

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

5.1 Definition of Terms

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5.2 Applicable Noise Criteria

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

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

5.3 Effects Analysis

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

5.3.1 Drilling

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

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

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

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

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

5.3.2 Construction

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

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

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

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

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

5.3.3 Operations

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

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

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

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

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

5.3.4 Cumulative Effects

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

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

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

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

6.0 DETERMINATION OF EFFECTS

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

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

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

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

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No personnel communications were made in preparing this BA.

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:

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

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

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

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

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

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

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

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

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

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

- Properly staffed and trained teams
  - Onsite Spill Response Team (SRT)
  - Incident Management Team (IMT)
  - ExxonMobil's internal spill response organization, the North American Regional Response Team (NARRT)
- Contract with ACS as the primary Oil Spill Removal Organization (OSRO) and Response Action Contractor (RAC) for Point Thomson
- Participation in the North Slope Operator's Mutual Aid Agreement for Oil Spill Response

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

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

RESPONSE CAPABILITIES

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

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

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

- Point Thomson site SRT with approximately 10 personnel.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. PIPELINE SPILL PREVENTION AND CONTROL MEASURES

SUMMARY

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

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

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

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

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

DESIGN MITIGATION MEASURES

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

CORROSION CONTROL

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

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

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

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

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

OTHER MEASURES

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

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

OPERATIONAL CONTROLS

CORROSION MONITORING

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

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

SURVEILLANCE

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

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

HYDROSTATIC TESTING

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

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

LEAK DETECTION

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

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

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

The main functions of the above system are to provide:

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

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

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

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

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

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

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

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

LOSS OF CONTAINMENT CALCULATION

EXPORT PIPELINE

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

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

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

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

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

Four leak scenarios were investigated:

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

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

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

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

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

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

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

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

EAST AND WEST GATHERING LINES

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

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

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

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

3. DRILLING PREVENTION MEASURES

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

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

The primary drilling related oil spill prevention measures include:

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

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

TRAINING

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

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

WELL PLANNING

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

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

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

DRILLING RIG AND WELL CONTROL/BLOWOUT PREVENTION EQUIPMENT

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

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

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

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

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

WELL CONTROL WHILE DRILLING BELOW THE SURFACE HOLE

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

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

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

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

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

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

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

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

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

4. SPILL RISKS AND POTENTIAL SPILL SCENARIOS

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

POTENTIAL FOR SPILLS ON THE NORTH SLOPE

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

In this analysis potential spills are categorized as follows:

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

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

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

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

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

USFWS SPILL ANALYSIS FOR POLAR BEAR INCIDENTAL TAKE RULE

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

- Assumptions in the model used (Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE)):
  - The constituents of large spills do not weather. However, Point Thomson produces light condensate, much of which would be lost to evaporation. This is not the case for crude oil.
  - Cleanup scenarios are not simulated. In the model, oil spill trajectories move as though no response action was taken. When response actions such as booming, mechanical recovery, and burning are taken, they will limit the residence and potential for further oil movement in the environment.
- Developments targeted by the analysis were offshore while Point Thomson is onshore.
- The analysis states that to date no major offshore oil spills have occurred in the Alaska Beaufort Sea and, although it is reasonable to assume the chances of one or more large spills occurring is low, for the purposes of the analysis a large spill was assumed.

POTENTIAL FOR SPILLS AT POINT THOMSON

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

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

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

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

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

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

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

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

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DRAFT

Draft 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

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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 km (50 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 [km²] 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 kilometers (km) (11.4 miles [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 3 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 3 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

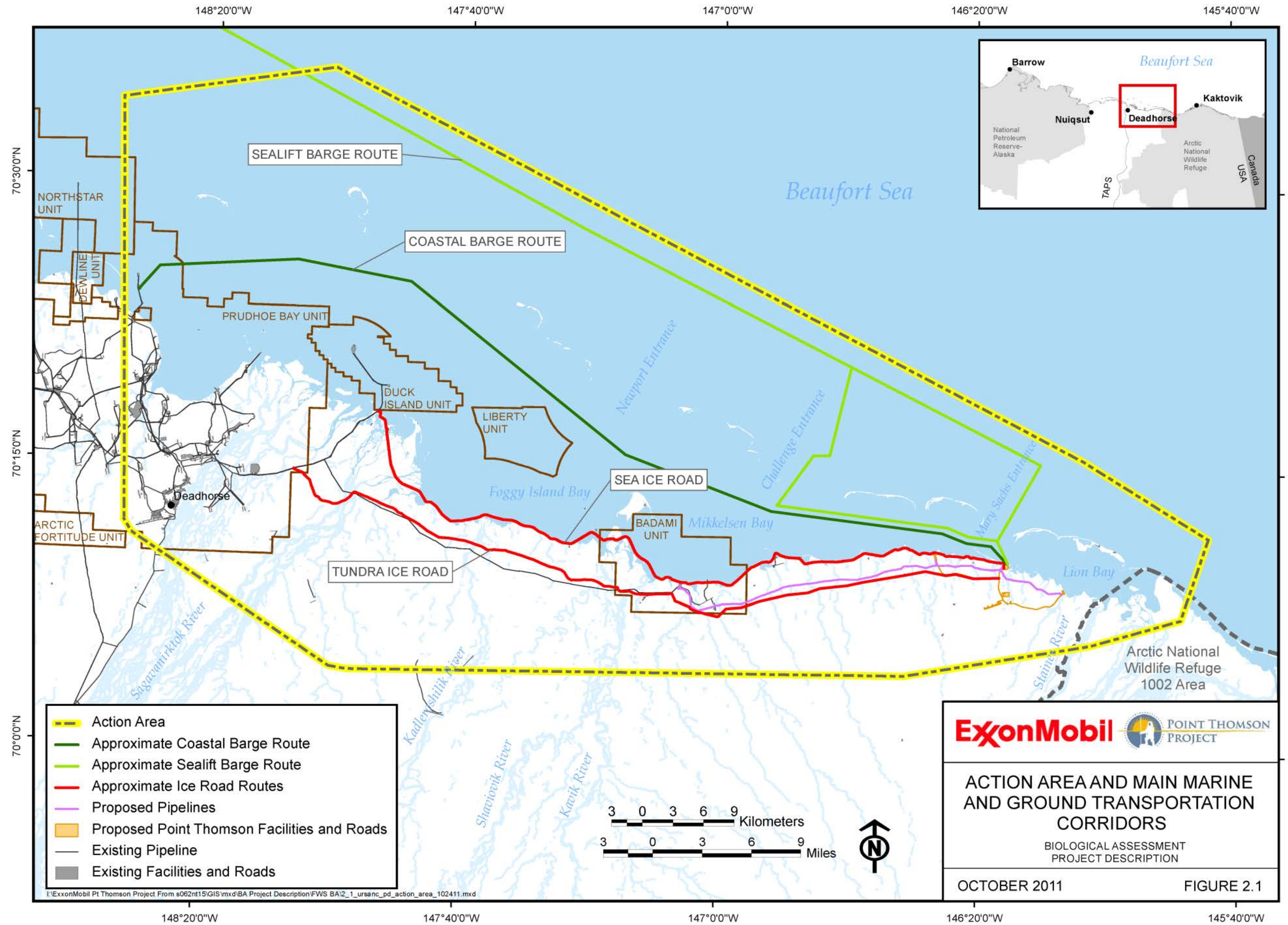
2.0 PROJECT DESCRIPTION

ExxonMobil is proposing to initiate hydrocarbon production from the Thomson Sand reservoir on the Arctic Coastal Plain (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 3 species are listed as threatened under the Endangered Species Act (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 the Yellow-billed Loon occurs 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 4 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.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70°0'0"N
Barrow
Beaufort Sea
Kaktovik
Nuiqsut
Deadhorse
National Petroleum Reserve-Alaska
Arctic National Wildlife Refuge
TAPS
Canada
USA
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
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Newport Entrance
Challenge Entrance
Mary Sachs Entrance
Sagavanirktok River
Kadleroshilik River
Shaviovik River
Kavik River
Staines River
Arctic National Wildlife Refuge 1002 Area
Action Area
Approximate Coastal Barge Route
Approximate Sealift Barge Route
Approximate Ice Road Routes
Proposed Pipelines
Proposed Point Thomson Facilities and Roads
Existing Pipeline
Existing Facilities and Roads
3 0 3 6 9 Kilometers
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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

- 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.
- XX Month TBD 2011—ESA Section 7 consultation is initiated with the submittal of the BA to USFWS.

2.1 Location/Action Area

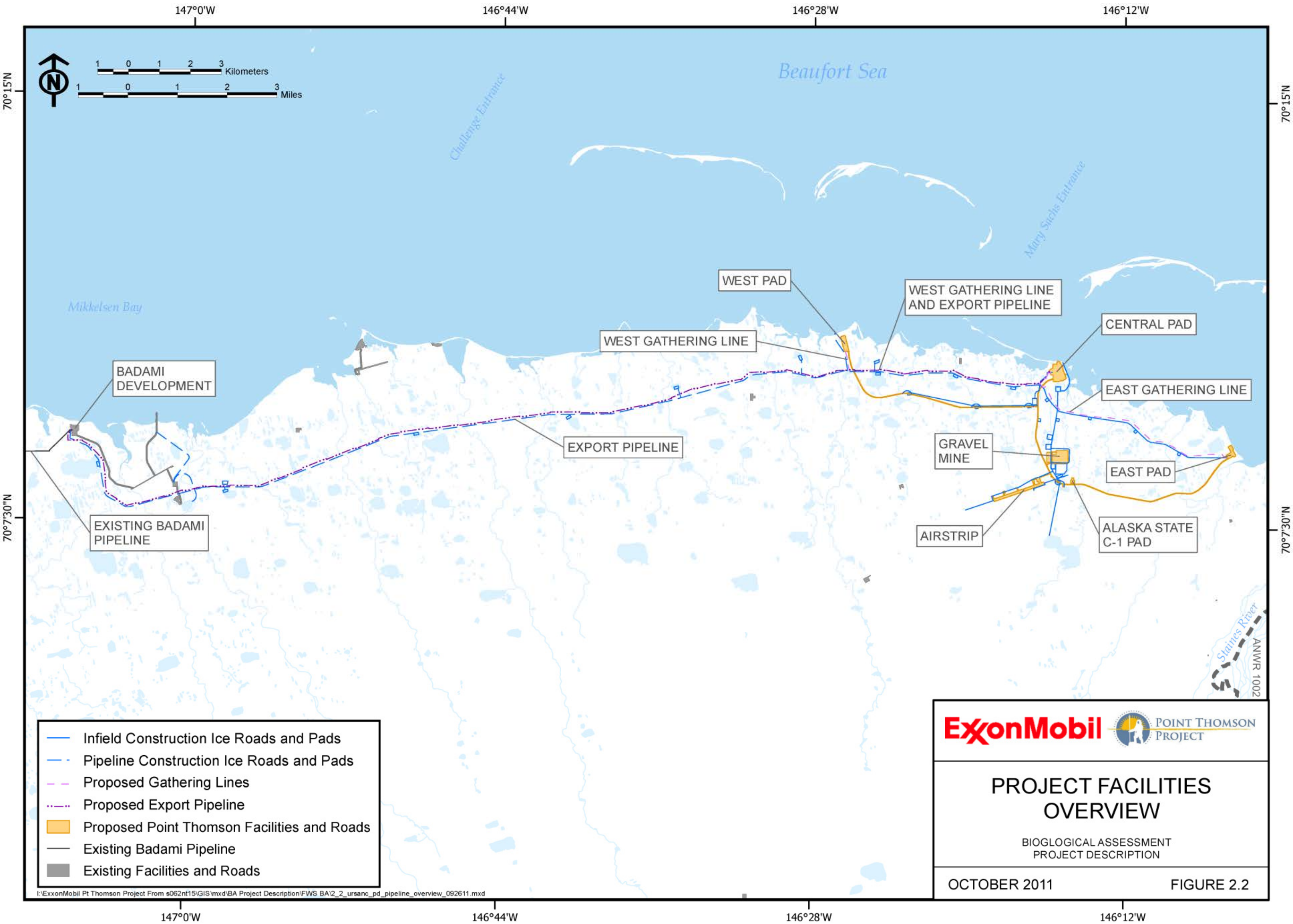
The Point Thomson Project Action Area will be located along the Beaufort Sea coast, on the eastern North Slope of Alaska in an area generally between the Staines River on the east and Prudhoe Bay on the west, and from 10 km (6 mi) seaward side of the barrier islands to a point inland of the proposed 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 and commercial hydrocarbon production of the Point Thomson Unit. 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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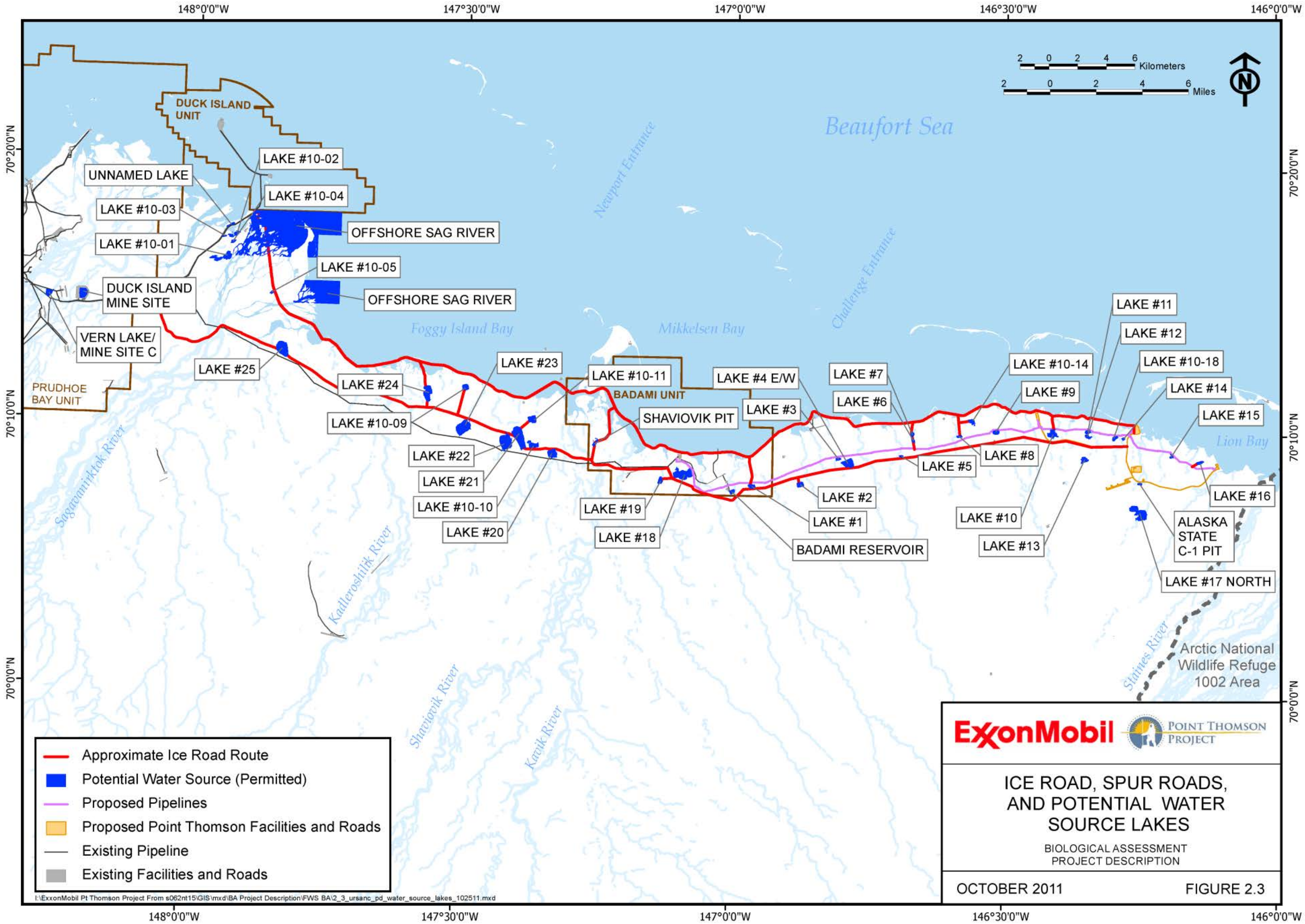
Kilometers
Miles
Beaufort Sea
Challenge Entrance
Mary Sachs Entrance
Mikkelsen Bay
WEST PAD
WEST GATHERING LINE AND EXPORT PIPELINE
CENTRAL PAD
WEST GATHERING LINE
EAST GATHERING LINE
BADAMI DEVELOPMENT
EXPORT PIPELINE
GRAVEL MINE
EAST PAD
AIRSTRIP
ALASKA STATE C-1 PAD
EXISTING BADAMI PIPELINE
Staines 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


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
LAKE #25
PRUDHOE BAY UNIT
LAKE #24
LAKE #23
LAKE #10-11
BADAMI UNIT
LAKE #4 E/W
LAKE #7
LAKE #6
LAKE #3
SHAVIOVIK PIT
LAKE #10-09
LAKE #22
LAKE #21
LAKE #10-10
LAKE #20
LAKE #19
LAKE #18
LAKE #2
LAKE #1
BADAMI RESERVOIR
LAKE #5
LAKE #8
LAKE #10
LAKE #13
LAKE #10-14
LAKE #9
LAKE #11
LAKE #12
LAKE #10-18
LAKE #14
LAKE #15
LAKE #16
ALASKA STATE C-1 PIT
LAKE #17 NORTH
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Newport Entrance
Challenge Entrance
Sagavanirktok River
Kadleroshilik River
Shaviovik River
Kavik River
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Arctic National Wildlife Refuge 1002 Area
148°0'0"W
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146°0'0"W
70°20'0"N
70°10'0"N
70°0'0"N
Kilometers
Miles
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

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.

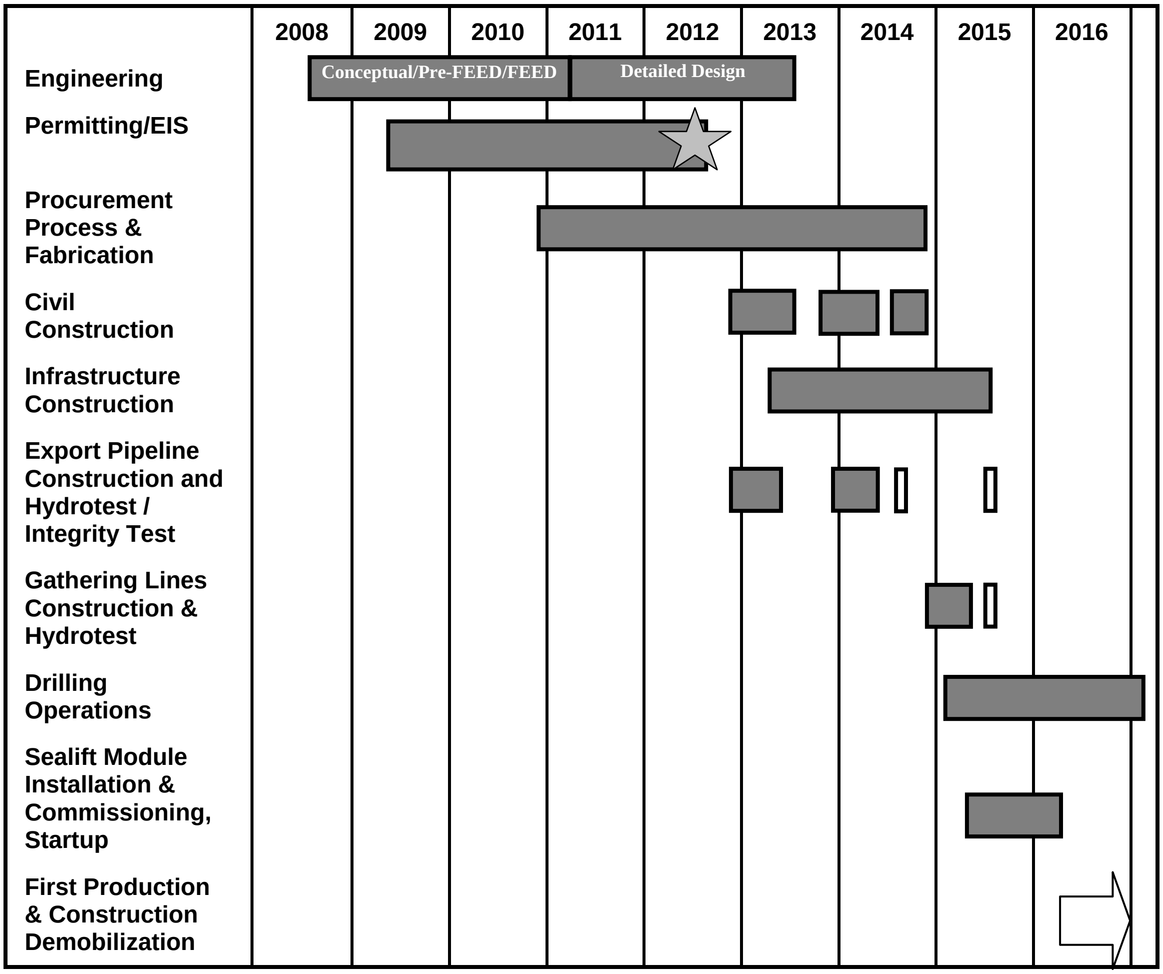
From the CPF facilities, stabilized hydrocarbon liquids will be transported through the approximately 35-km (22-mi) long Export Pipeline to existing common carrier pipelines for delivery to the TAPS. The Export Pipeline will be supported on approximately 2,200 Vertical Support Members (VSMs) from the 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.

Project Element	Estimated Time Frame	Description
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	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 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 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.

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.

Transporation 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.

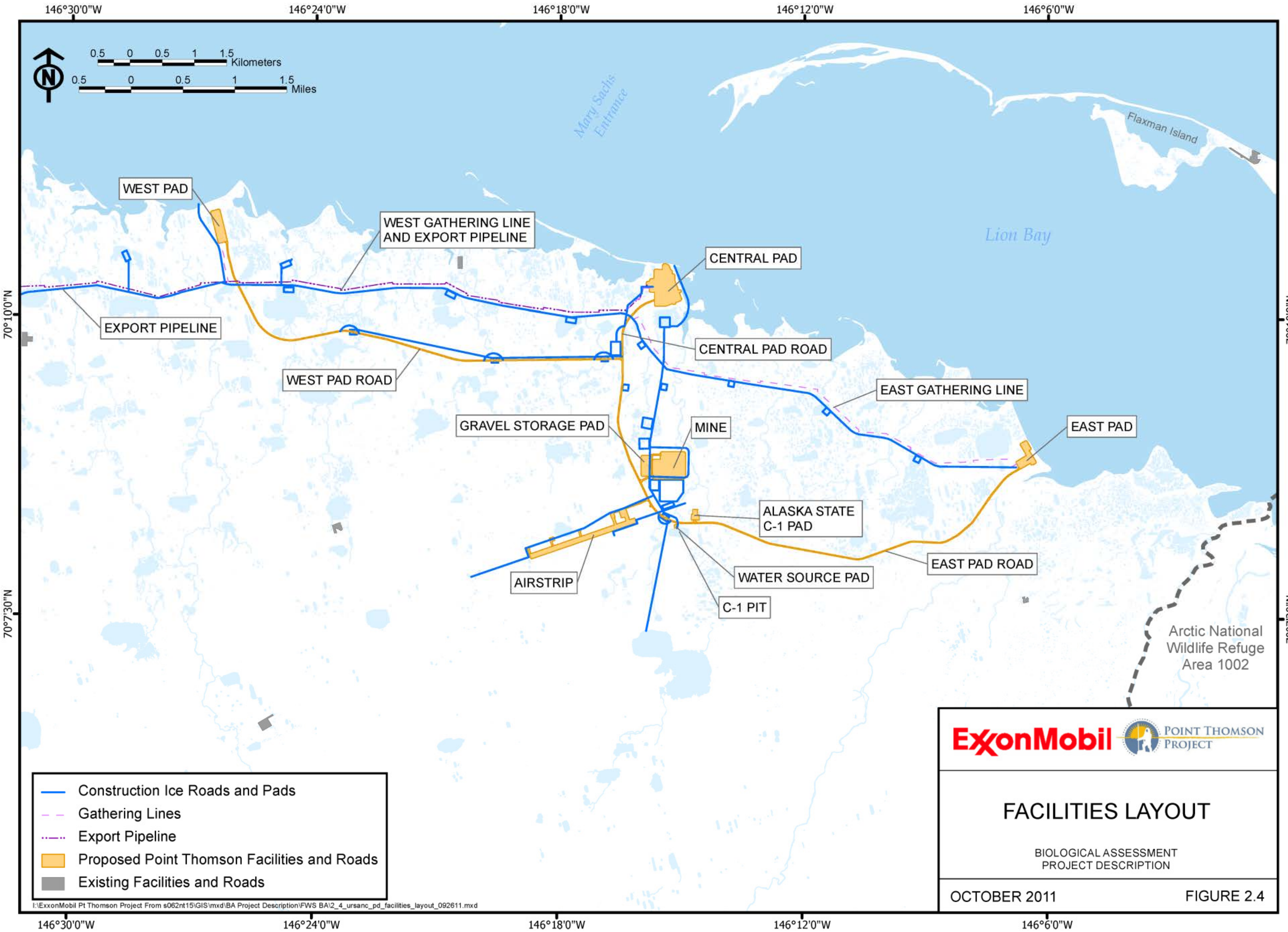
Gravel structures will be constructed primarily in the winter using standard North Slope equipment and methods. Gravel placement for some structures will also occur during the summer but no direct placement of gravel on tundra during the summer is planned.

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 9 small tundra streams, with bridges or culverts being installed at these crossings. Bridges will be constructed during the first 2 winter construction seasons. With the exception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EAST GATHERING LINE
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MINE
EAST PAD
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

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 2 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.

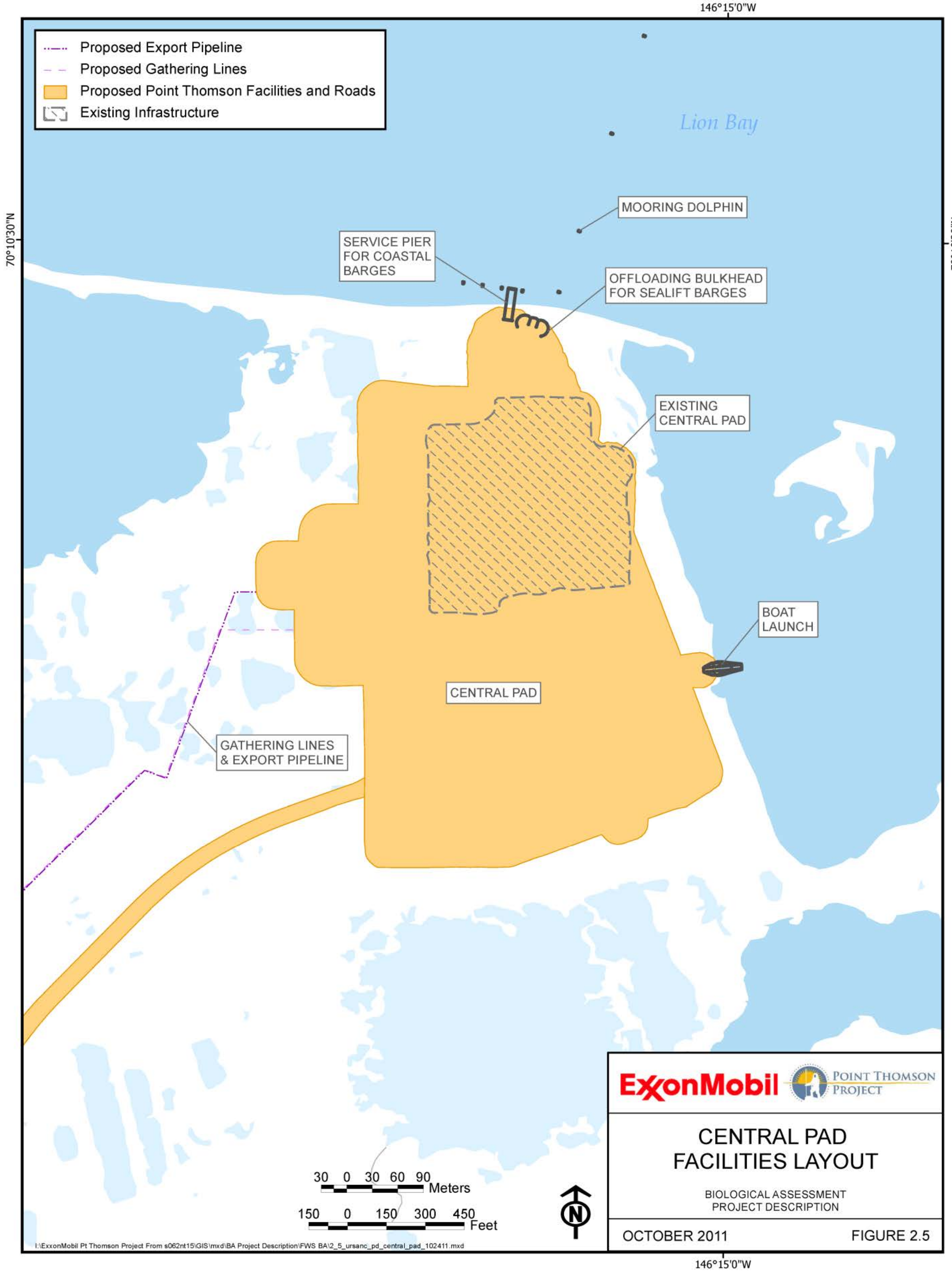
A flare system will be used to safely burn natural gas that occasionally needs to be released when pipelines and facilities are depressurized for maintenance, during a process upset, or in an emergency situation. High-pressure (HP) and low-pressure (LP) system flares will be combined into a single flare 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
70°10'30"N
MOORING DOLPHIN
SERVICE PIER FOR COASTAL BARGES
OFFLOADING BULKHEAD FOR SEALIFT BARGES
EXISTING CENTRAL PAD
BOAT LAUNCH
CENTRAL PAD
GATHERING LINES & EXPORT PIPELINE
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.

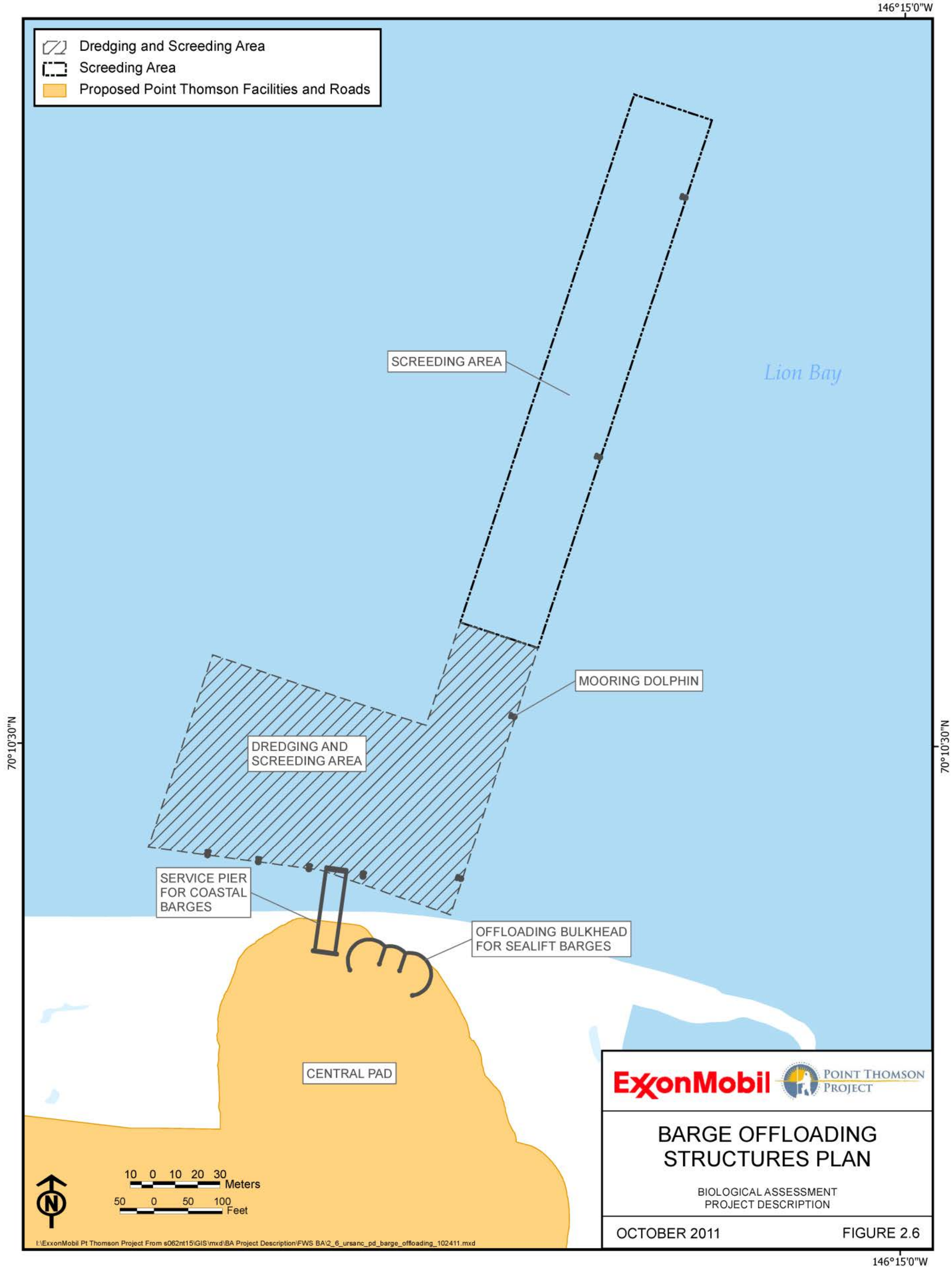
2.5.7 Marine Facilities

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 6 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 9 vertical piles (6 offshore and 3 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
70°10'30"N
DREDGING AND SCREEDING AREA
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 aaproval 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.

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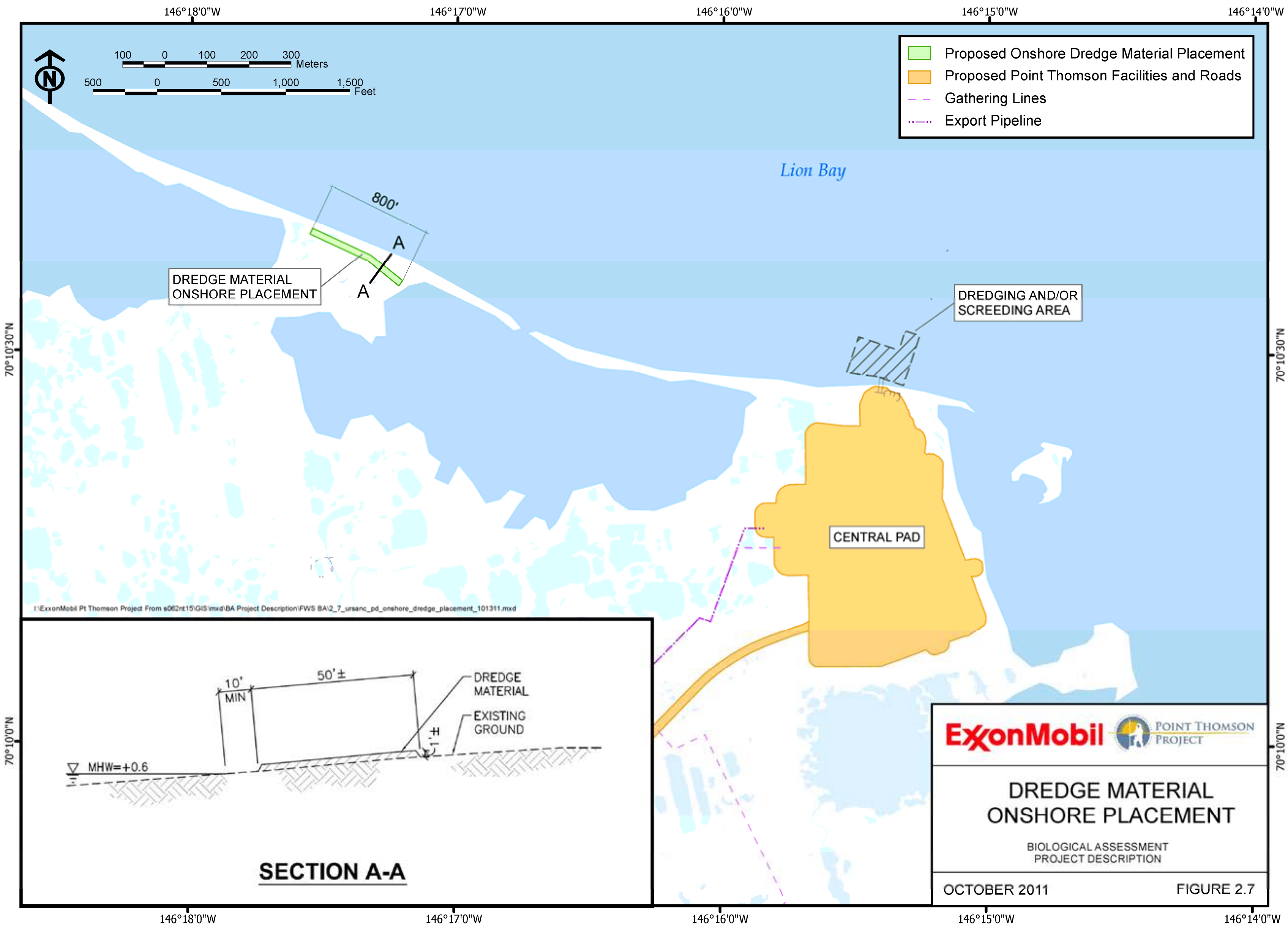
146°18'0"W
146°17'0"W
146°16'0"W
146°15'0"W
146°14'0"W
70°10'30"N
70°10'0"N
100 0 100 200 300 Meters
500 0 500 1,000 1,500 Feet
Proposed Onshore Dredge Material Placement
Proposed Point Thomson Facilities and Roads
Gathering Lines
Export Pipeline
Lion Bay
800'
A
A
DREDGE MATERIAL ONSHORE PLACEMENT
DREDGING AND/OR SCREEDING AREA
CENTRAL PAD
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

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, 4 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 minimizekeep 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.

<u>Ice Roads</u>

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.

<u>Project Construction, Drilling, and Operations</u>

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 study area appears to be low (USFWS 2011a). This species is not discussed further in this Draft 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 and have been observed occasionally in the general vicinity, but there is no evidence of Yellow-billed Loon breeding. 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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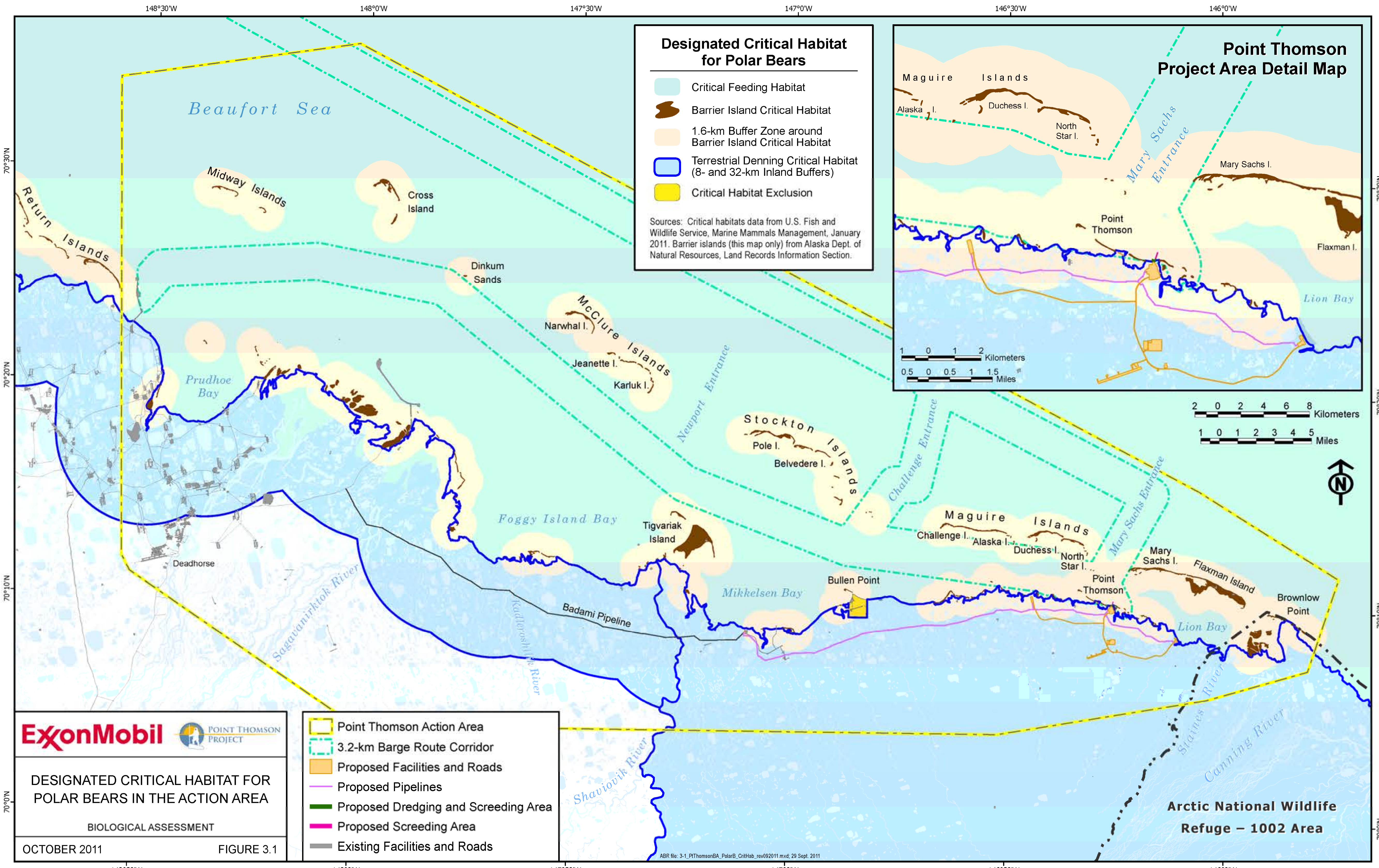
Designated Critical Habitat for Polar Bears
Critical Feeding Habitat
Barrier Island Critical Habitat
1.6-km Buffer Zone around Barrier Island Critical Habitat
Terrestrial Denning Critical Habitat (8- and 32-km Inland Buffers)
Critical Habitat Exclusion
Sources: Critical habitats data from U.S. Fish and 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
Cross Island
Return Islands
Dinkum Sands
McClure Islands
Narwhal I.
Jeanette I.
Karluk I.
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
Brownlow Point
Lion Bay
Prudhoe Bay
Foggy Island Bay
Tigvariak Island
Mikkelsen Bay
Bullen Point
Deadhorse
Badami Pipeline
Sagavanirktok River
Kadleroshilik River
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- to 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 2 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 3 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 er 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 km^2 [4.4 mi^2], or 0.18%) of potential habitat in a 6,335 km^2(2,446 mi^2) study area between the Colville and Tamayariak rivers (Durner et al. 2001) and 3,621 km (2,250 mi) (23.2 km^2 [9.0 mi^2], or 0.29%) in a 7,994-km^2 (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] (km^2)	Total Area [c] (km^2)
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.

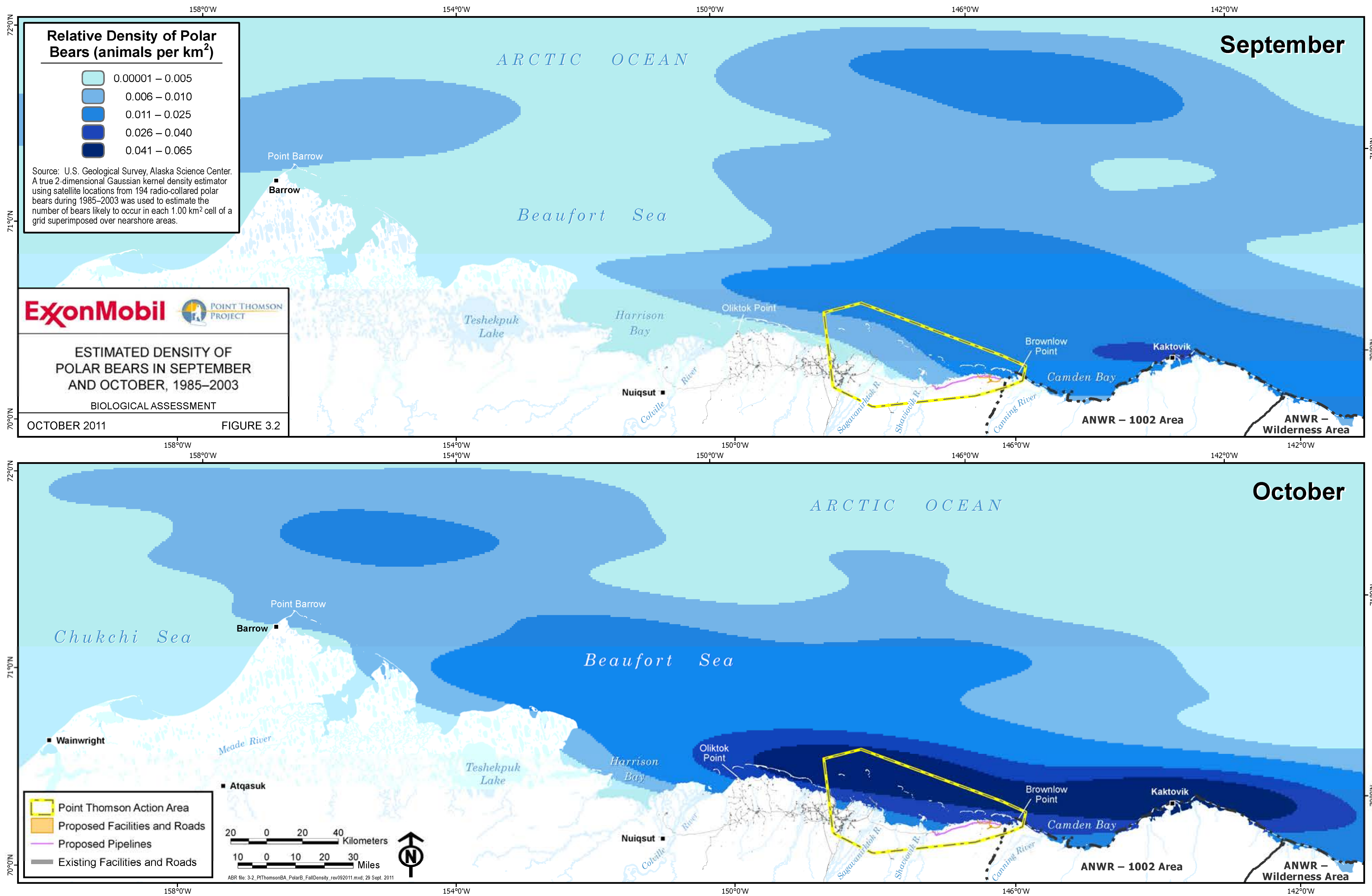
Considering dens on all substrates, Amstrup and Gardner (1994) concluded that denning and cub births in the Beaufort Sea region were sufficient to account for the estimated size of the SBS population at that time: approximately 140 dens per year in a population estimated at 1,500 to 1,800 animals. By 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).

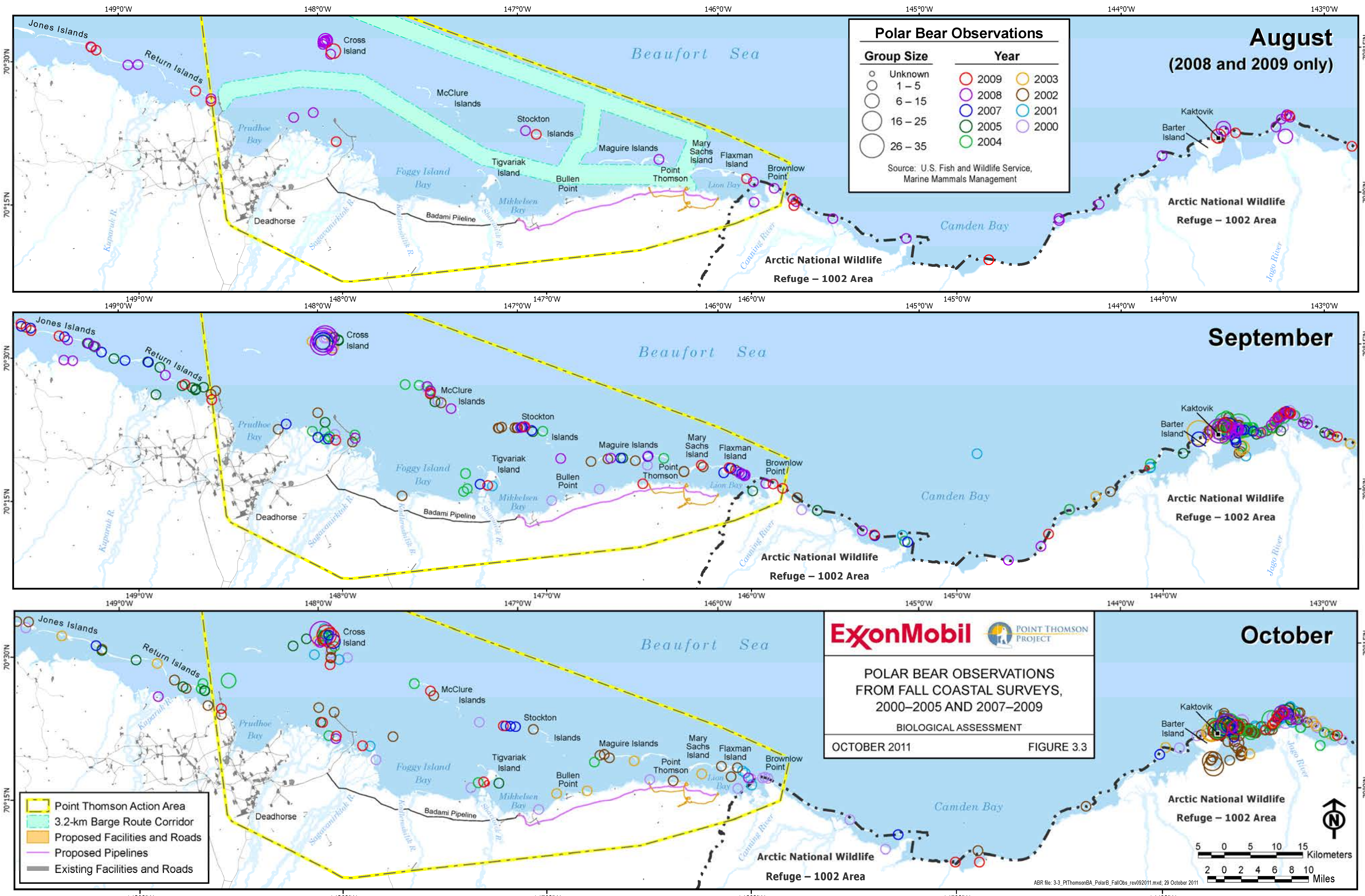
3.1.6 Movements

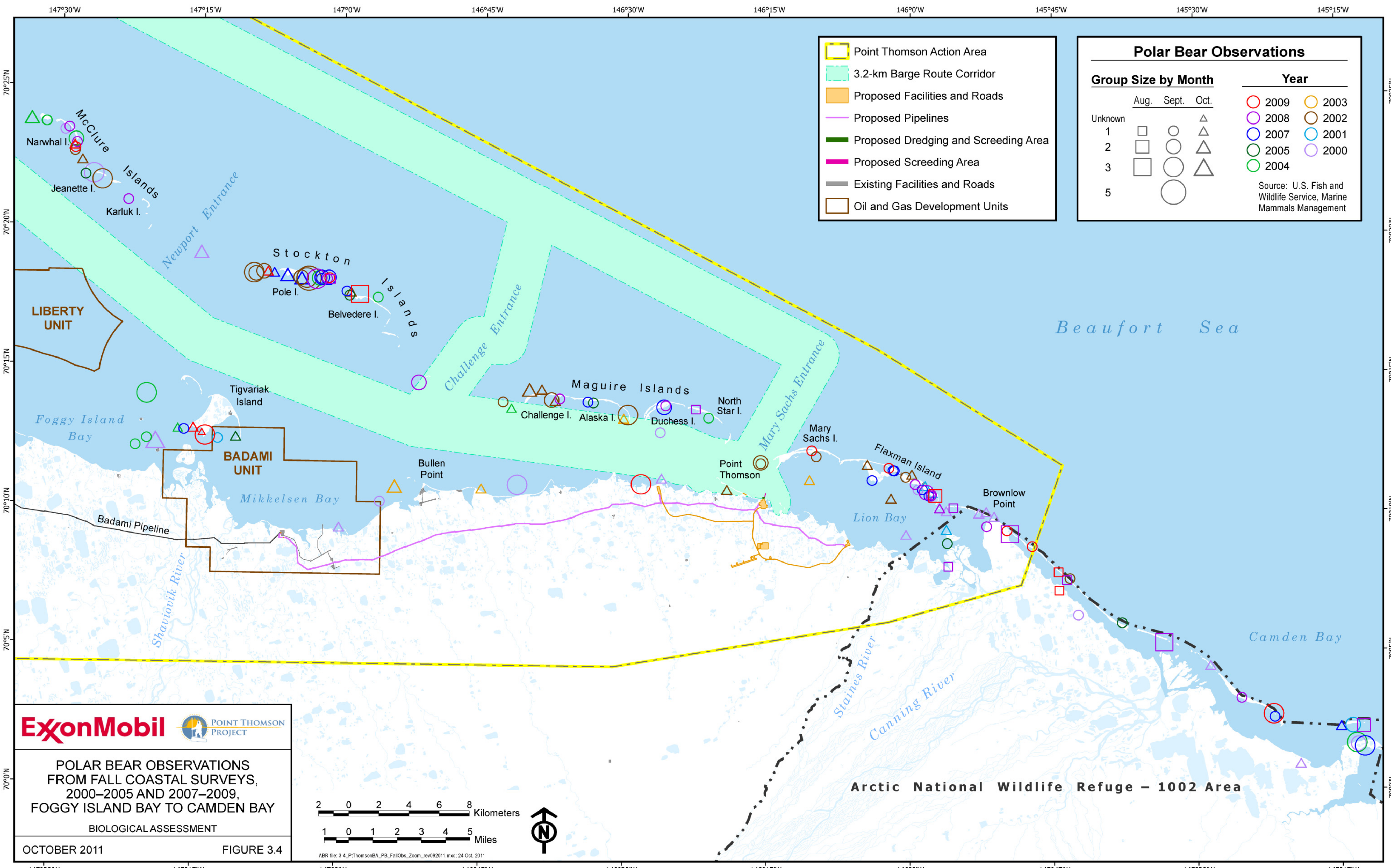
Polar bears of the SBS stock range over large areas during the year, with total annual movements ranging from 1,406 to 6,203 km (874 to 3,854 mi) and covering annual activity areas of 7,264 to 596,800 km² (2,805 to 230,436 mi²) (Amstrup et al. 2000). Monthly movements ranged from 79 to 420 km (49 to 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 increasing numbers in August, during the open-water period; by the time of minimal ice extent in mid- to 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


September
ARCTIC OCEAN
Beaufort Sea
Relative Density of Polar Bears (animals per km²)
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 km² cell of a grid superimposed over nearshore areas.
Point Barrow
Barrow
Teshekpuk Lake
Harrison Bay
Oliktok Point
Nuiqsut
Brownlow Point
Kaktovik
Camden Bay
ANWR – 1002 Area
ANWR – Wilderness Area
ExxonMobil
POINT THOMSON PROJECT
ESTIMATED DENSITY OF POLAR BEARS IN SEPTEMBER AND OCTOBER, 1985–2003
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.2
October
ARCTIC OCEAN
Chukchi Sea
Beaufort Sea
Wainwright
Meade River
Atqasuk
Point Thomson Action Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Kilometers
Miles
158°0'W
154°0'W
150°0'W
146°0'W
142°0'W
72°0'N
71°0'N
70°0'N


Polar Bear Observations
Group Size
Unknown
1 – 5
6 – 15
16 – 25
26 – 35
Year
2009
2008
2007
2005
2004
2003
2002
2001
2000
Source: U.S. Fish and Wildlife Service, Marine Mammals Management
August
(2008 and 2009 only)
September
October
Beaufort Sea
Jones Islands
Return Islands
Cross Island
McClure Islands
Stockton Islands
Maguire Islands
Mary Sachs Island
Flaxman Island
Brownlow Point
Point Thomson
Bullen Point
Tigvariak Island
Prudhoe Bay
Foggy Island Bay
Mikkelsen Bay
Lion Bay
Camden Bay
Deadhorse
Badami Pipeline
Kaktovik
Barter Island
Arctic National Wildlife Refuge – 1002 Area
Point Thomson Action Area
3.2-km Barge Route Corridor
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
ExxonMobil
POINT THOMSON PROJECT
POLAR BEAR OBSERVATIONS FROM FALL COASTAL SURVEYS, 2000–2005 AND 2007–2009
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.3
Kilometers
Miles


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
Oil and Gas Development Units
Polar Bear Observations
Group Size by Month
Aug. Sept. Oct.
Unknown
1
2
3
5
Year
2009 2003
2008 2002
2007 2001
2005 2000
2004
Source: U.S. Fish and Wildlife Service, Marine Mammals Management
Beaufort Sea
McClure Islands
Narwhal I.
Jeanette I.
Karluk I.
Newport Entrance
Stockton Islands
Pole I.
Belvedere I.
LIBERTY UNIT
Challenge Entrance
Maguire Islands
Challenge I.
Alaska I.
Duchess I.
North Star I.
Mary Sachs Entrance
Mary Sachs I.
Tigvariak Island
Foggy Island Bay
BADAMI UNIT
Bullen Point
Point Thomson
Flaxman Island
Brownlow Point
Lion Bay
Mikkelsen Bay
Badami Pipeline
Shaviovik River
Staines River
Canning River
Camden Bay
Arctic National Wildlife Refuge – 1002 Area
ExxonMobil
POINT THOMSON PROJECT
Kilometers
Miles
POLAR BEAR OBSERVATIONS FROM FALL COASTAL SURVEYS, 2000–2005 AND 2007–2009, FOGGY ISLAND BAY TO CAMDEN BAY
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.4

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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 3 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 3 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's 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 on the YKD in western Alaska where it 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.

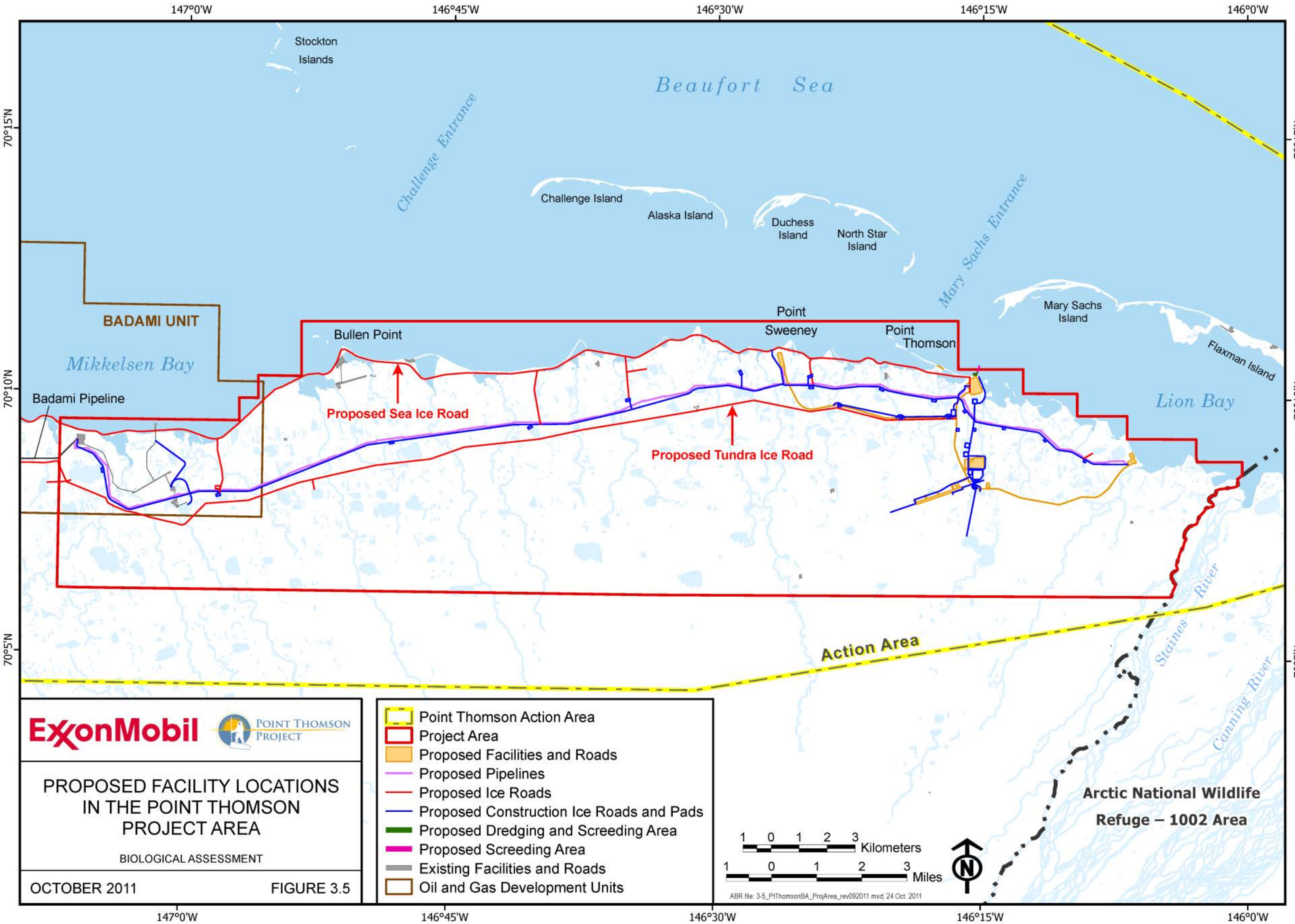
3.2.4 Critical Habitat

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 2 open water habitats preferred on the Colville River delta during 8 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


147°0'W
146°45'W
146°30'W
146°15'W
146°0'W
70°15'N
70°10'N
70°5'N
Stockton Islands
Beaufort Sea
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
Mary Sachs Island
Flaxman Island
Point Sweeney
Point Thomson
Bullen Point
BADAMI UNIT
Mikkelsen Bay
Badami Pipeline
Proposed Sea Ice Road
Proposed Tundra Ice Road
Lion Bay
Action Area
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
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
1 0 1 2 3 Kilometers
1 0 1 2 3 Miles
N

the primary sources of Project-related disturbance and change outside the Project Area in the larger Action Area.

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 km² (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 km² [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 9 different habitats, but most broods were seen in 3 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

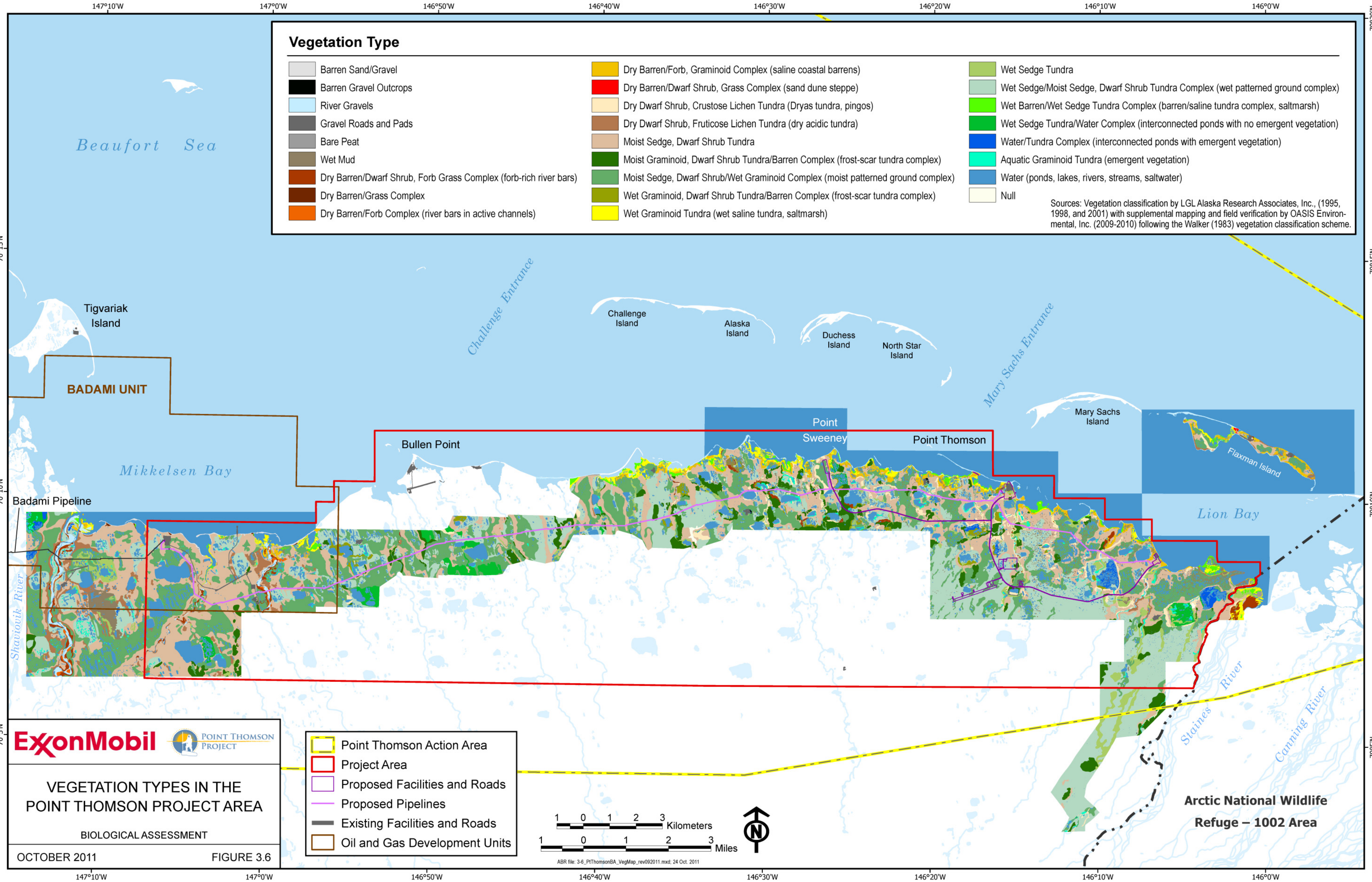

Vegetation Type
Barren Sand/Gravel
Barren Gravel Outcrops
River Gravels
Gravel Roads and Pads
Bare Peat
Wet Mud
Dry Barren/Dwarf Shrub, Forb Grass Complex (forb-rich river bars)
Dry Barren/Grass Complex
Dry Barren/Forb Complex (river bars in active channels)
Dry Barren/Forb, Graminoid Complex (saline 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.
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
Beaufort Sea
Tigvariak Island
BADAMI UNIT
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
Mary Sachs Island
Flaxman Island
Point Sweeney
Point Thomson
Bullen Point
Mikkelsen Bay
Badami Pipeline
Lion Bay
Shaviovik River
Staines River
Canning River
Arctic National Wildlife Refuge – 1002 Area
ExxonMobil
POINT THOMSON PROJECT
VEGETATION TYPES IN THE POINT THOMSON PROJECT AREA
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 3.6
Point Thomson Action Area
Project Area
Proposed Facilities and Roads
Proposed Pipelines
Existing Facilities and Roads
Oil and Gas Development Units
1 0 1 2 3 Kilometers
1 0 1 2 3 Miles
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	

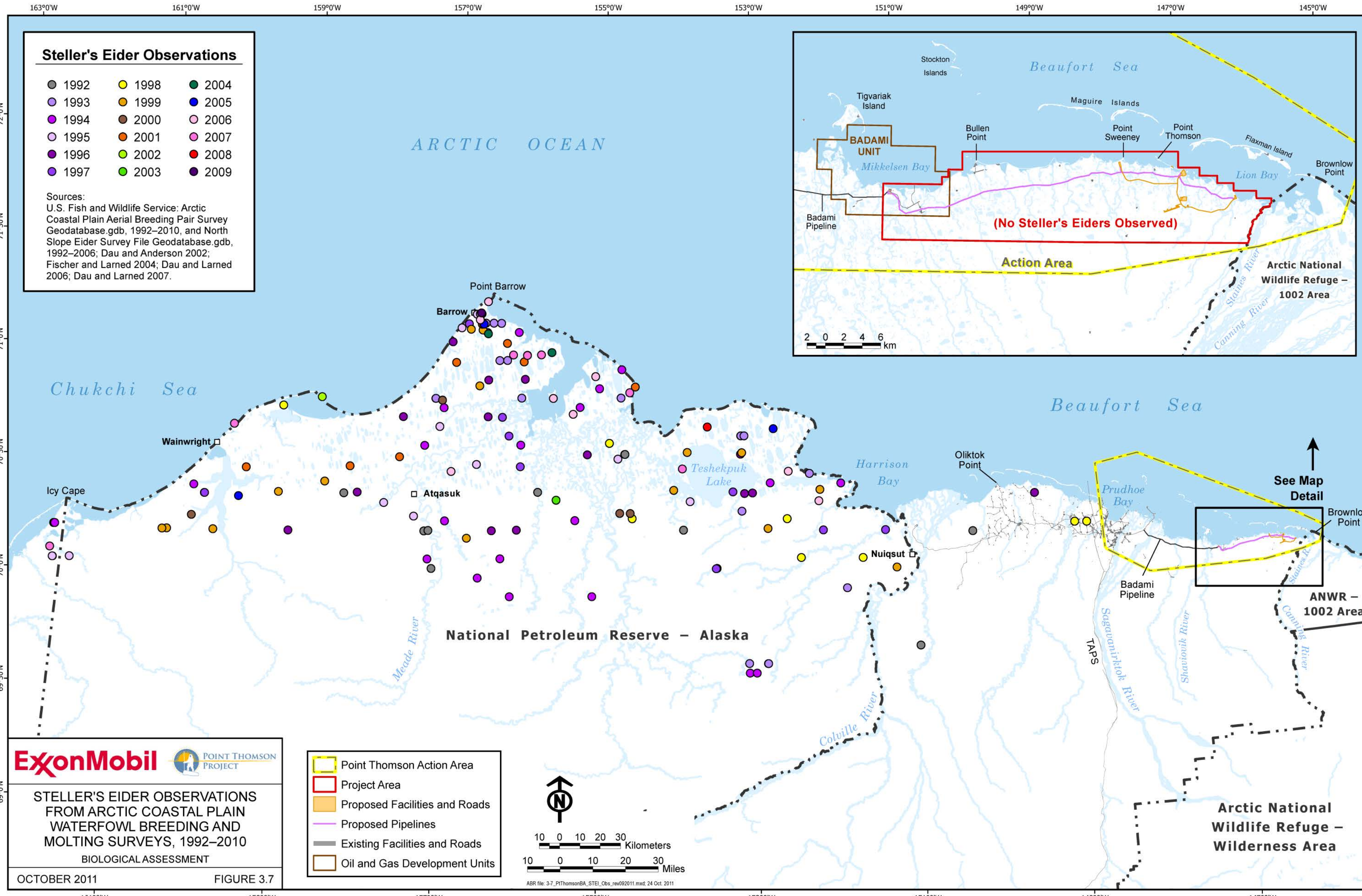
unknown, predation, ingestion of lead shot (in heavily hunted areas), and changes in the marine environment may have played roles in range reductions. The Russian populations are not currently listed as threatened or endangered.

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 3 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 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


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
Brownlow Point
See Map Detail
Badami Pipeline
TAPS
ANWR – 1002 Area
National Petroleum Reserve – Alaska
Meade River
Colville River
Sagavanirktok River
Shaviovik River
Canning River
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
2 0 2 4 6 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
N
10 0 10 20 30 Kilometers
10 0 10 20 30 Miles

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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 3 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.

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 3 weeks (USFWS 2008). 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 2006). 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 2006). 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 2 eggs and after hatch raise broods on the lakes where they nest or on adjacent lakes (North 1986, 1994, Johnson et al. 2010a).

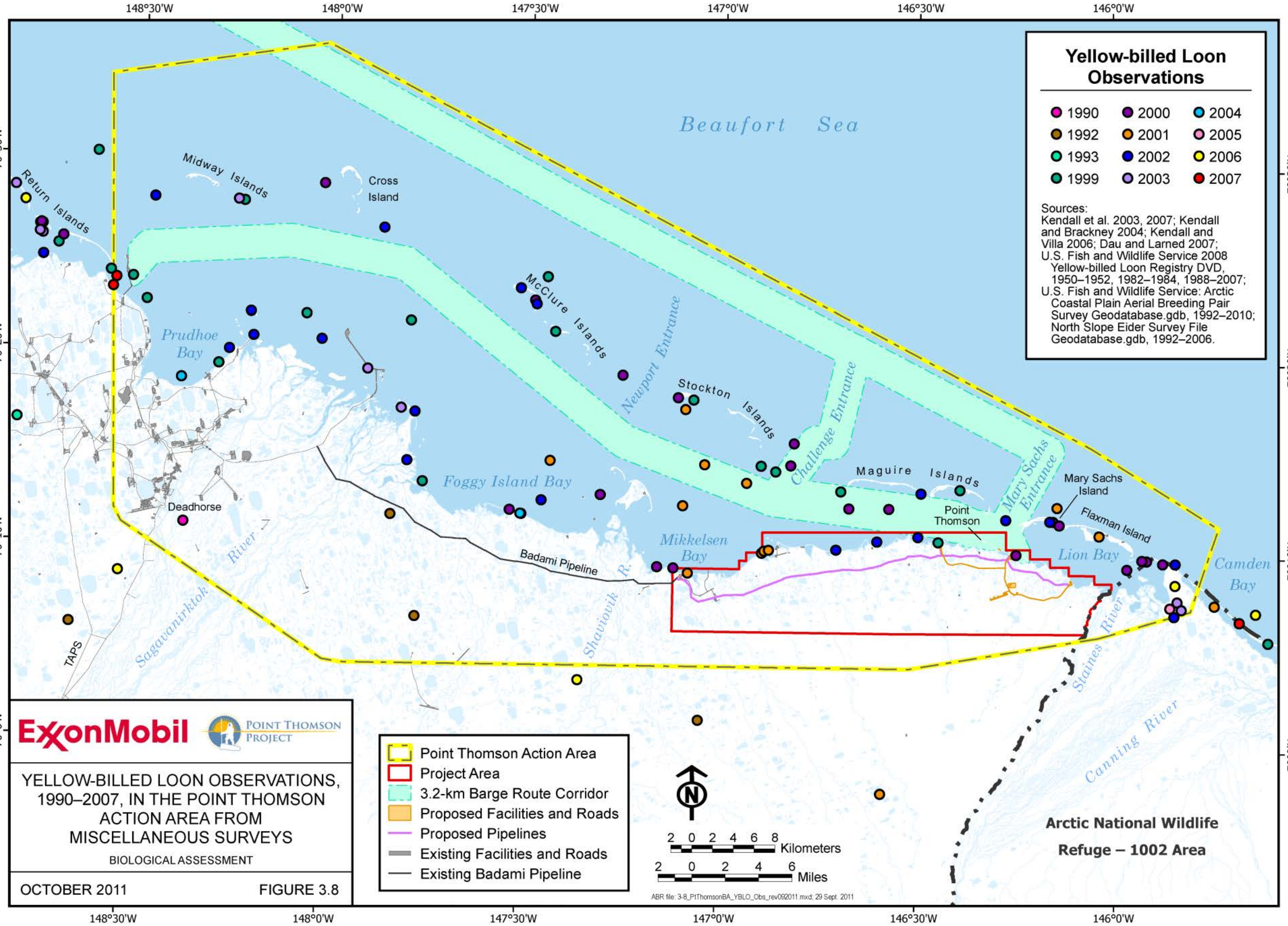
3.4.3 Population Status

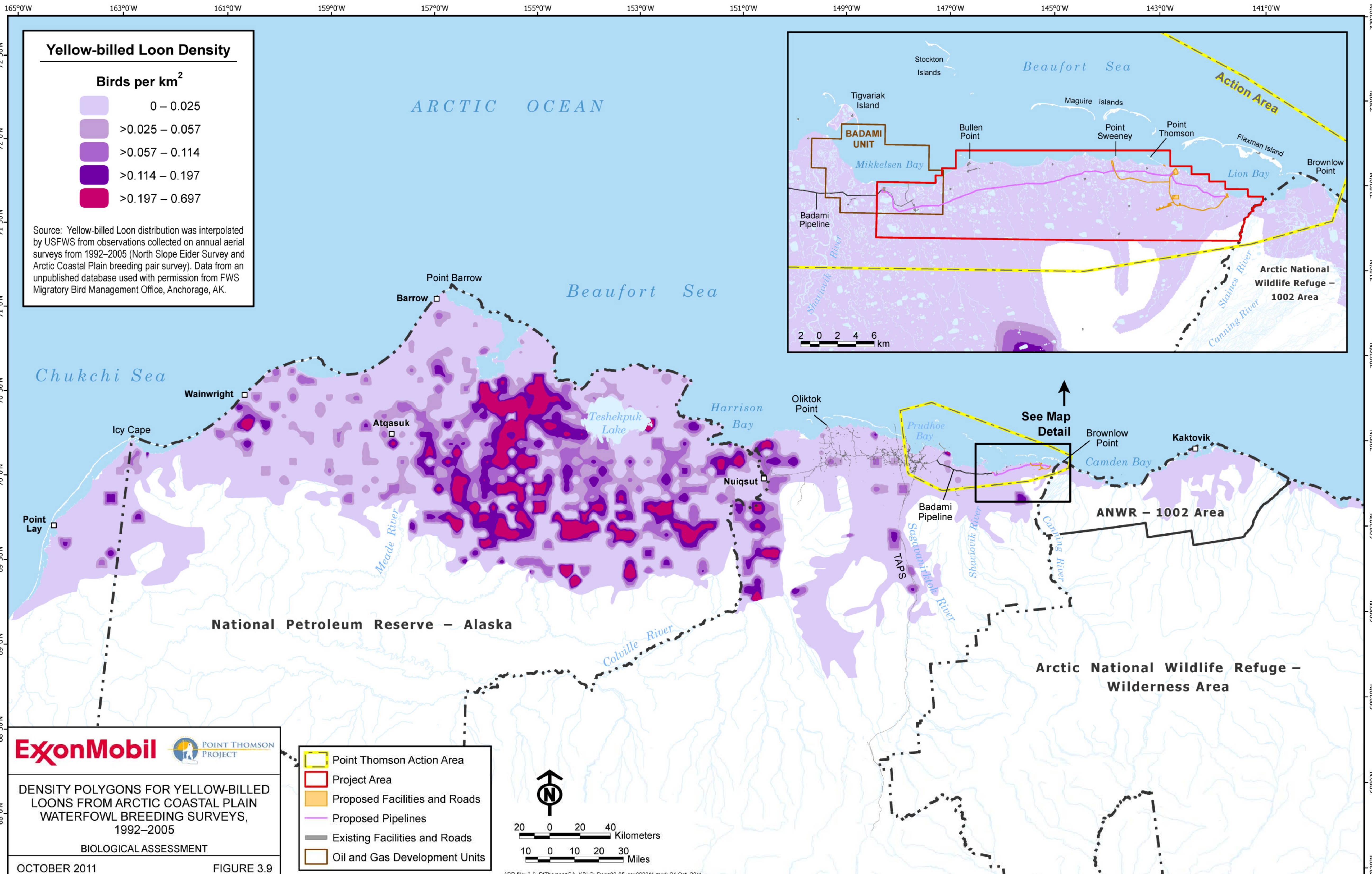
The most current population estimate of Yellow-billed Loons in Northern Alaska is 3,369 birds and <1,000 nesting pairs, with most pairs occurring between the Meade and Colville rivers (Earnst 2004).

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 2 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) in 2001 (Fischer and Larned 2004). Noel et al. (1999, 2000, 2002a, b) conducted replicate surveys for molting waterfowl along 4 contiguous strip transects between Oliktok and Brownlow points 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 3 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 3 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

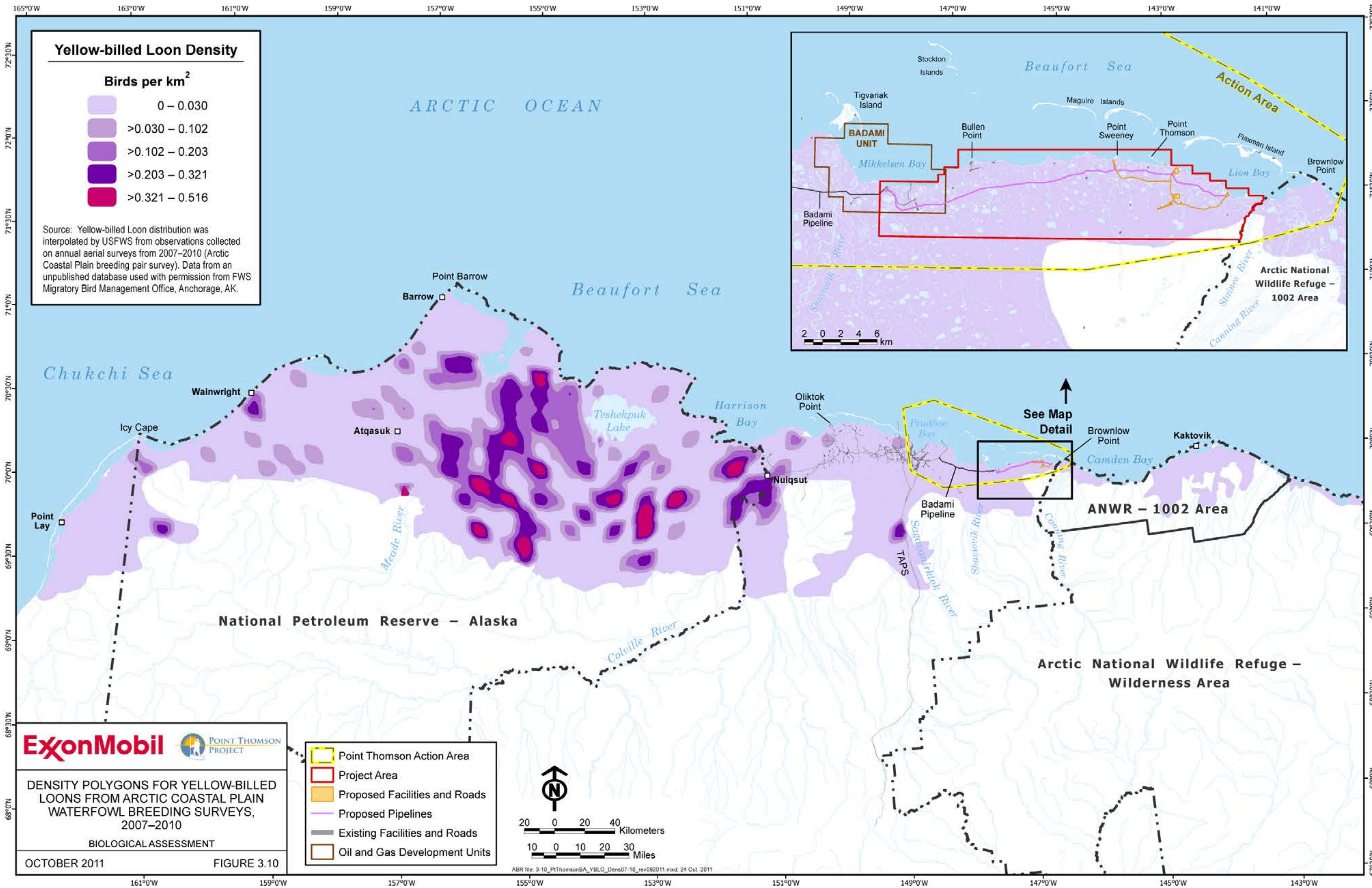

Yellow-billed Loon Observations
1990
1992
1993
1999
2000
2001
2002
2003
2004
2005
2006
2007
Sources:
Kendall et al. 2003, 2007; Kendall and Brackney 2004; Kendall and Villa 2006; Dau and Larned 2007;
U.S. Fish and Wildlife Service 2008 Yellow-billed Loon Registry DVD, 1950–1952, 1982–1984, 1988–2007;
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
Point Thomson
Flaxman Island
Lion Bay
Camden Bay
Prudhoe Bay
Foggy Island Bay
Mikkelsen Bay
Deadhorse
Badami Pipeline
Sagavanirktok River
Shaviovik R.
Staines River
Canning River
TAPS
Arctic National Wildlife Refuge – 1002 Area
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
Kilometers
Miles
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



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
Sagavanirktok River
Shaviovik River
Canning River
Meade River
Colville River
See Map Detail
Brownlow Point
Kaktovik
Camden Bay
ANWR – 1002 Area
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
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 2 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 remainder were located along the coast from the Shaviovik River and Tigvariak Island west to the Sagavanirktok River delta.

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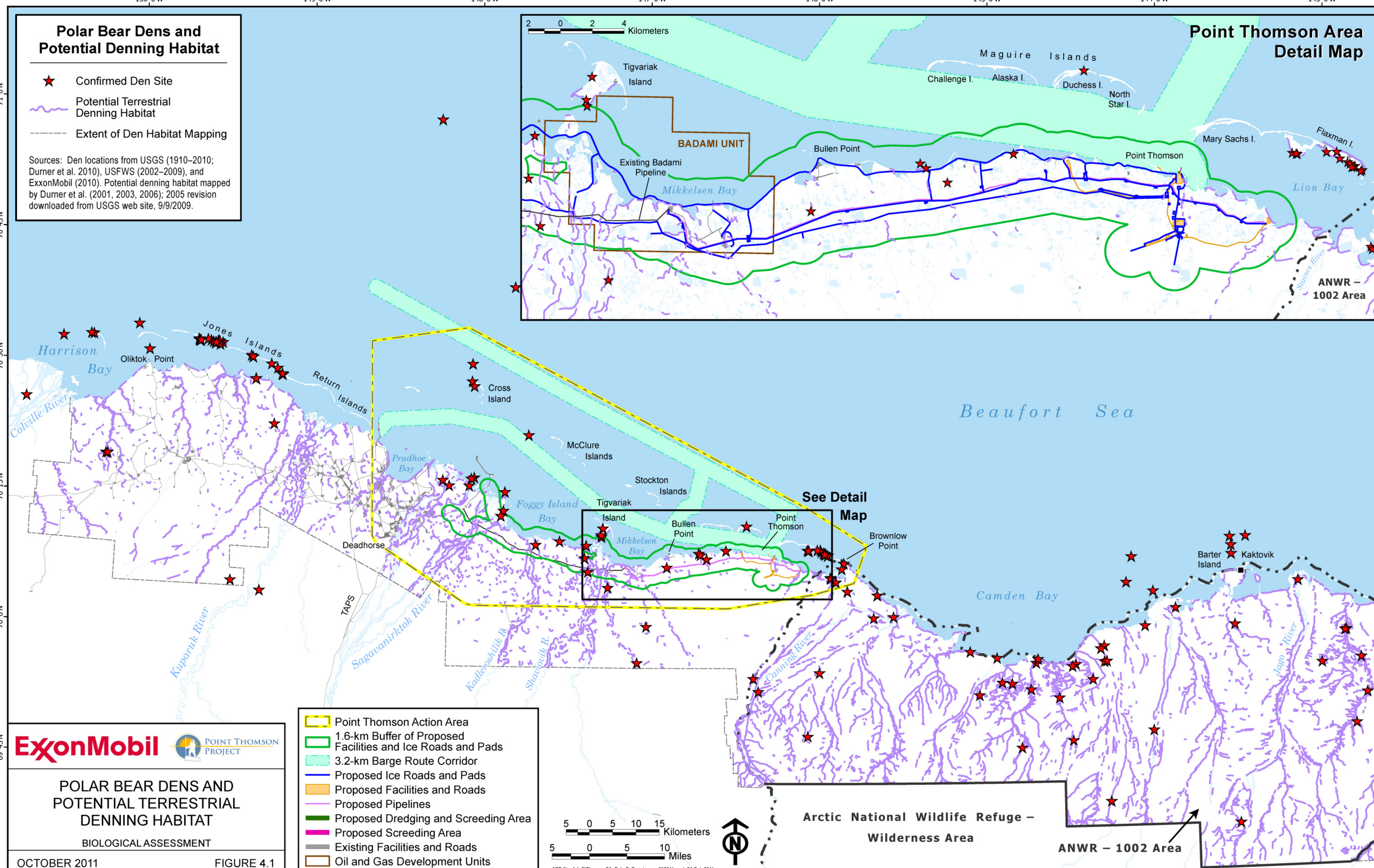
Polar Bear Dens and Potential Denning Habitat
Confirmed Den Site
Potential Terrestrial Denning Habitat
Extent of Den Habitat Mapping
Sources: Den locations from USGS (1910–2010; Durner et al. 2010), USFWS (2002–2009), and ExxonMobil (2010). Potential denning habitat mapped by Durner et al. (2001, 2003, 2006); 2005 revision downloaded from USGS web site, 9/9/2009.
Point Thomson Area Detail Map
Beaufort Sea
See Detail Map
Arctic National Wildlife Refuge – Wilderness Area
ANWR – 1002 Area
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
ExxonMobil
POINT THOMSON PROJECT
POLAR BEAR DENS AND POTENTIAL TERRESTRIAL DENNING HABITAT
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.1

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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

The most prominent concern regarding the effects of human actions on polar bears has focused on the rapid decline of arctic sea-ice cover, especially during the summer, which has been linked to climate warming as a result of human activities (ACIA 2004, 2005; IPCC 2007). Various analyses of 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 in nine reports prepared by USGS, which 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, based on resource selection functions developed from radio-collared bear locations and environmental data, and then compared those habitat models 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 declines in sea-ice cover during summer observed recently have occurred at a rate exceeding that 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. The predicted 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, due to the energetic demands of traveling the long distances required to continue using the traditional areas of the species range that are predicted to experience total loss of summer ice. 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).

The other four factors analyzed by USFWS for the ESA listing decision were regarded as being of much less concern than are the effects of climate change in the Arctic (Schliebe et al. 2006; 73 FR 28212). 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).

Several reviews and analyses have commented on the potential for cumulative effects to increase as a result of expanding oil and gas activity in the Beaufort Sea region (Amstrup 2003a; NRC 2003; USFWS 2008, 2009; 76 FR 47010). The greatest concern focuses on the risk of a major oil spill in the marine environment (Amstrup et al. 2006b; USFWS 2008, 2009; 76 FR 47010), which is considered to be increasing in probability as a result of future increases in exploration and development prospects in the Beaufort Sea. 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 and the risk of marine oil spills, most of the past and present human actions in the region of influence have occurred on shore in terrestrial habitats that generally receive much less use by polar bears than do marine habitats offshore. By far, most of those actions have occurred in the existing Prudhoe Bay and Kuparuk oilfields and associated satellite developments. The nearest existing oil and gas development to the Point Thomson Project is the Badami Project. 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). 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 2006, 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 2006, 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.

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). As was mentioned earlier, 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).

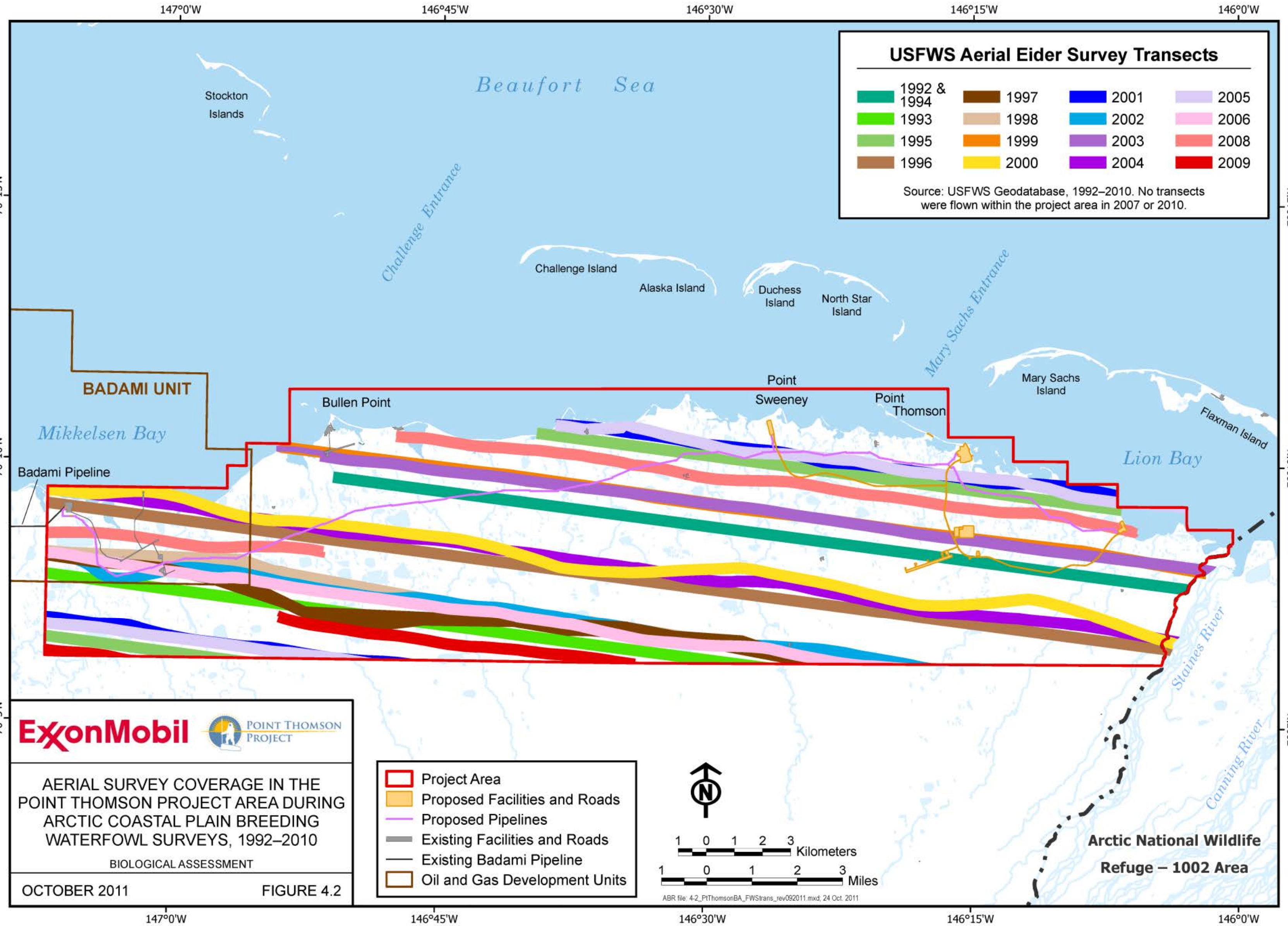
Factors such as attraction of polar bears to areas of human activity, behavioral disturbance by humans, and site-specific contamination generally have not had population-level effects, although concerns have been expressed about the potential effects of contamination from widespread pollutants, especially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

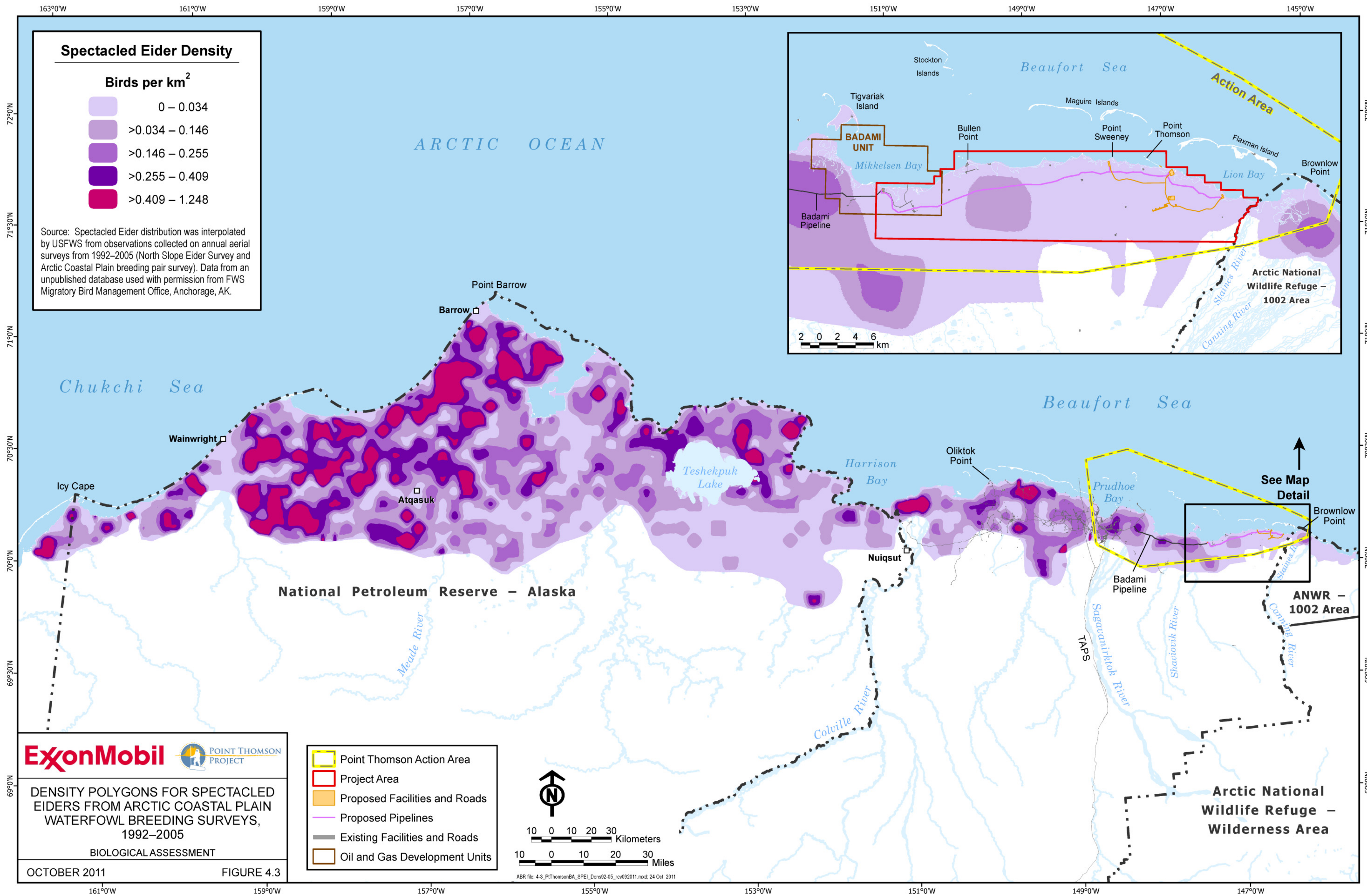
4.2 Spectacled Eider

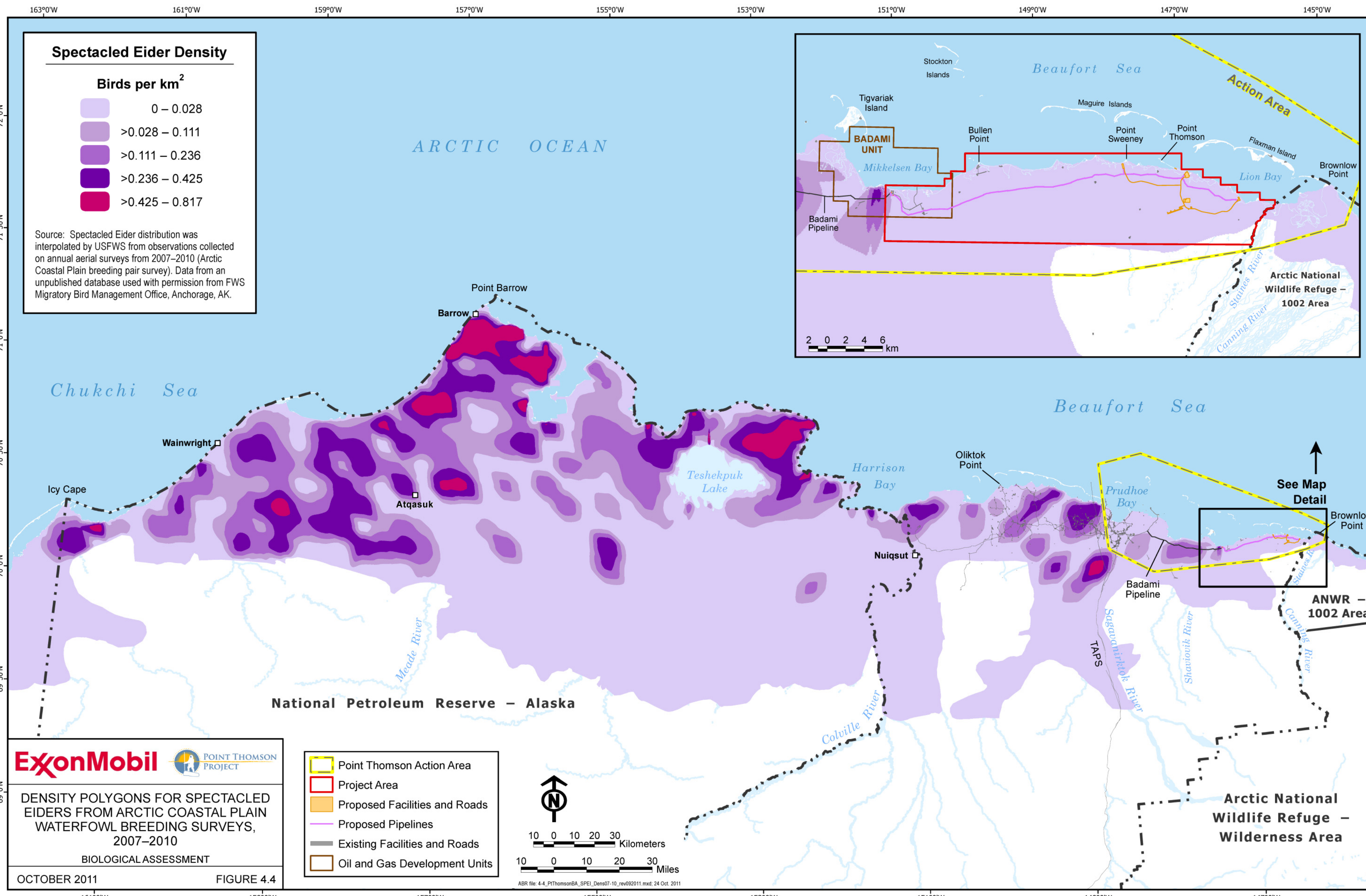
4.2.1 Status in the Action Area

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 2 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 2 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


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
Point Sweeney
Point Thomson
Bullen Point
BADAMI UNIT
Mikkelsen Bay
Badami Pipeline
Lion Bay
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


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
Prudhoe Bay
Nuiqsut
Badami Pipeline
Brownlow Point
See Map Detail
ANWR – 1002 Area
National Petroleum Reserve – Alaska
Meade River
Colville River
Sagavanirktok River
Shaviovik River
Canning River
TAPS
Arctic National Wildlife Refuge – Wilderness Area
Stockton Islands
Tigvariak Island
Maguire Islands
Bullen Point
Point Sweeney
Point Thomson
Flaxman Island
Action Area
BADAMI UNIT
Mikkelsen Bay
Lion Bay
Badami Pipeline
Staines 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
DENSITY POLYGONS FOR SPECTACLED EIDERS FROM ARCTIC COASTAL PLAIN WATERFOWL BREEDING SURVEYS, 1992–2005
BIOLOGICAL ASSESSMENT
OCTOBER 2011
FIGURE 4.3



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

BIOLOGICAL ASSESSMENT

OCTOBER 2011 FIGURE 4.4

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 does 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).

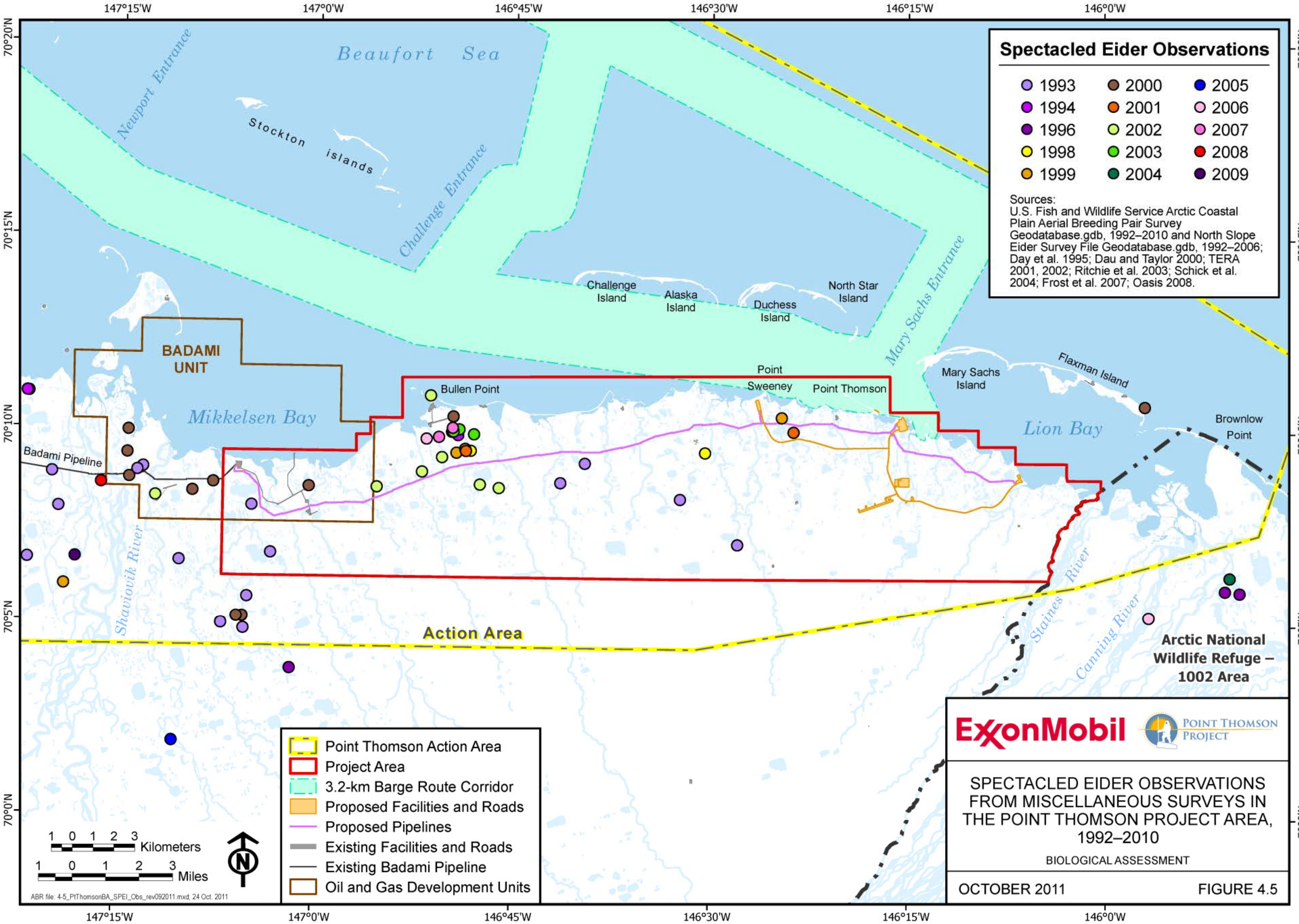
Densities of Spectacled Eiders seen on these local surveys in the Point Thomson area were low (0–0.03 pairs/km² [0–0.09 pairs/mi²], Table 4.1). No Spectacled Eiders were observed in 2 of 6 years and 2–5 pairs were seen annually in the other 4 years. Most recently, no eiders were seen on a survey conducted 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 4 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/km^2) 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 (km^2)	Source [a]
	Number of Pairs	Density (Pairs/km^2)		
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).


Beaufort Sea
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.
Newport Entrance
Stockton islands
Challenge Entrance
Challenge Island
Alaska Island
Duchess Island
North Star Island
Mary Sachs Entrance
BADAMI UNIT
Mikkelsen Bay
Bullen Point
Point Sweeney
Point Thomson
Mary Sachs Island
Flaxman Island
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
147°15'W
147°0'W
146°45'W
146°30'W
146°15'W
146°0'W
70°20'N
70°15'N
70°10'N
70°5'N
70°0'N

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, Inc. 2008). These surveys produced observations of 0–14 Spectacled Eiders each year. During those 6 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, Inc. 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 2 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 2006). 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 2006, 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 2008, 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 2006, 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 6 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 2008, 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 2008, 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 2006, 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 2008), 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 2008, 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 2006)—and none have been killed intentionally since the Chukchi Sea and Beaufort Sea ITRs went into effect in 1991 and 1993, respectively (USFWS 2008, 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 2006, 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 2 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 2008, 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 2008, 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 2006, 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 2 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 km² (162-mi²) 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 2 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/km^2 (0.08 pairs/mi^2), 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 2 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 2 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 2 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 2 years. Seasonal ice roads and pads will be used for 3 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 3 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 2 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

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.

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.

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 2 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 3 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 3 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 3 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 2 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 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 4 years before construction and 3 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 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 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 2 summers following gravel placement to prepare the pads for aircraft, vehicles, and operation, the levels would drop considerably after 2 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 3 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 3 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 2 construction years and declined in the second 2 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/km² [0.16 birds/mi²], 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 4 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 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 7 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 7 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 (≥378,541L [≥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, 2 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 8 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 2 eiders and 8 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 2 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.

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APPENDIX A

Polar Bear and Wildlife Interaction Plan North Slope, Alaska

Appendix A accompanies this document in PDF format called:
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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

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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

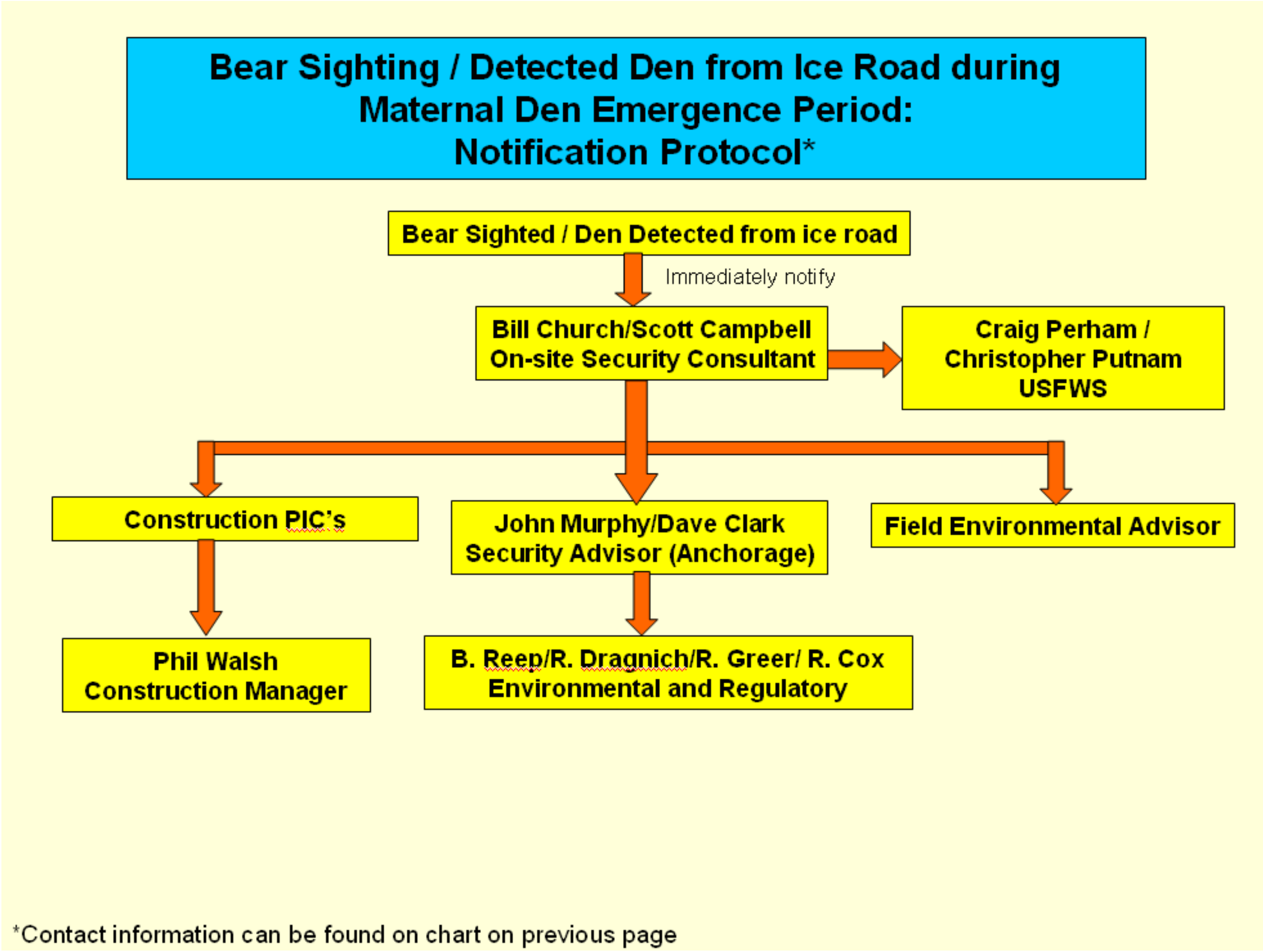
Dick Shideler
Alaska Department of Fish and Game (ADF&G) Habitat Division
1300 College Road
Fairbanks, Alaska 99701
Fax: (907) 459-7332

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.



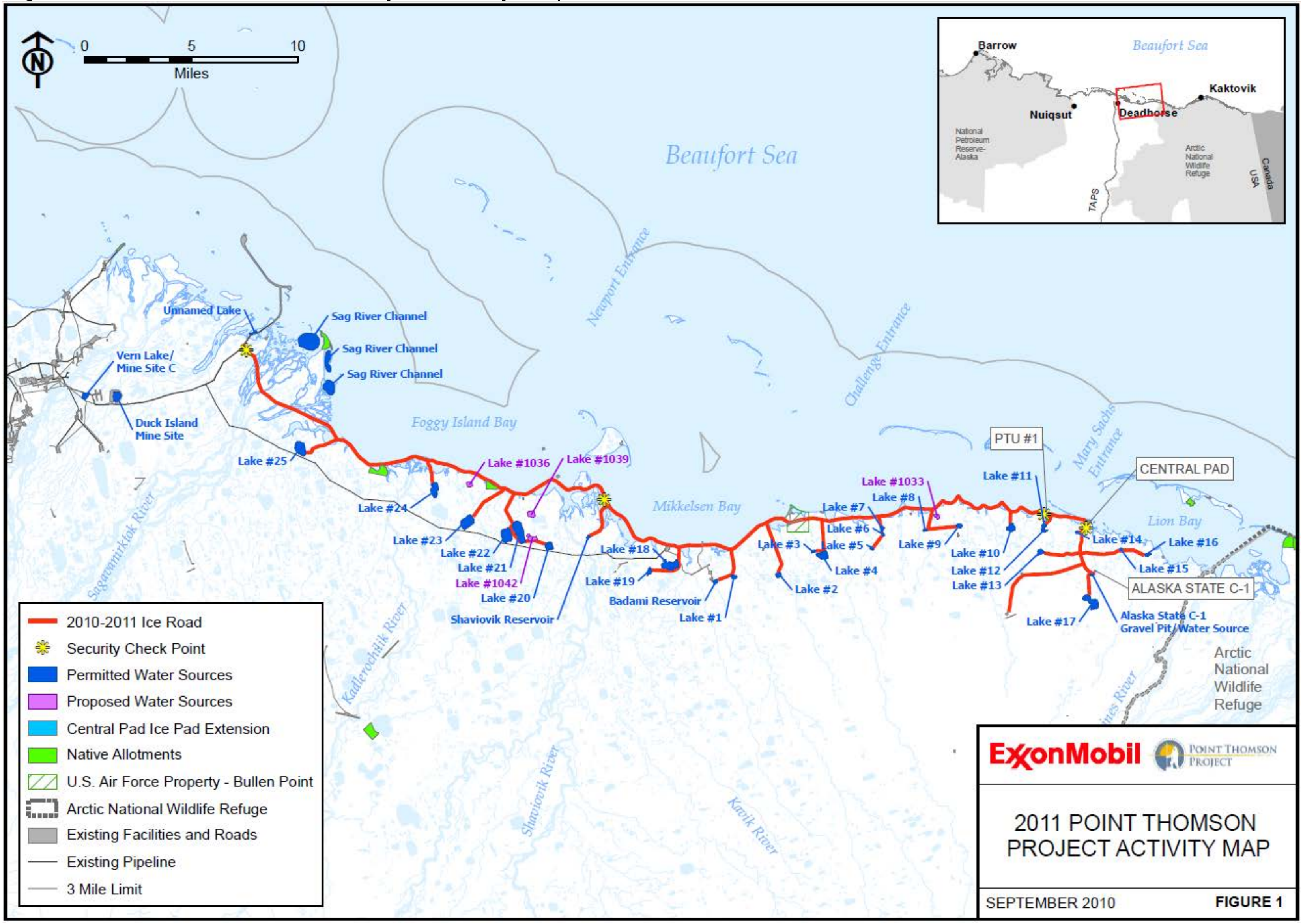
12.0 IMPLEMENTATION/EVALUATION/FEEDBACK

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^{o}F (20^{o}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.

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:____
____
____
____
____

<u>Agency contacts/ Time of Contact:</u>
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

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ACRONYMS AND ABBREVIATIONS

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

INTRODUCTION

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

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

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

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

1. PROJECT WIDE OIL SPILL PREPAREDNESS

DESIGN, CONSTRUCTION, AND OPERATIONS PREVENTION MEASURES

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

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

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

- The well pad locations were chosen to allow development of offshore portions of the reservoir from onshore pads, thereby avoiding placement of drilling structures in marine waters. Small spills that might otherwise escape the pads and enter marine waters will be contained on the onshore pads or adjacent land.
- Formal Hazard and Operability analyses (HAZOPs), risk assessments, facility site reviews, design readiness review, independent project review and constructability reviews will be used to identify potential spill risks and associated prevention or response measures.
- Provisions have been made to ensure that the Point Thomson Project will not adversely impact North Slope subsistence users. ExxonMobil has established a Mitigation Agreement with the North Slope Borough (NSB) to provide rapid and direct financial assistance related to effects on subsistence resulting from a major marine spill.
- Storage tanks for oil and hazardous substances will be located within impermeable secondary containment areas. These storage tanks will not be stored within 100 feet of waterbodies, unless otherwise approved by the appropriate regulatory agencies.
- Spill response equipment and materials will be readily available at designated locations throughout the facility.
- Fuel transfers will follow BMPs, including using secondary containment devices. Refueling and transfer sites will be located away from the shoreline and river crossings and outside active floodplains.

SPILL PREVENTION DURING FUEL TRANSPORT, STORAGE, AND USE

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

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

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

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

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

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

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

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

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

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

TRAINING AND SPECIAL PROGRAMS FOR PREVENTION

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

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

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

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

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

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

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

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

RESPONSE PLANS

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

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

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

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

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

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

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

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

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

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

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

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

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

- Properly staffed and trained teams
  - Onsite Spill Response Team (SRT)
  - Incident Management Team (IMT)
  - ExxonMobil’s internal spill response organization, the North American Regional Response Team (NARRT)
- Contract with ACS as the primary Oil Spill Removal Organization (OSRO) and Response Action Contractor (RAC) for Point Thomson
- Participation in the North Slope Operator’s Mutual Aid Agreement for Oil Spill Response

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

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

RESPONSE CAPABILITIES

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

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

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

- Point Thomson site SRT with approximately 10 personnel.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[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

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
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
Badami	2,135	1,550	1,252	1,493

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

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

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

EAST AND WEST GATHERING LINES

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

- Length of time to detection
- Operator reaction time
- Large leak scenario (100% of flow)
- Contents in gas phase resulting in complete evacuation of the lines and discharge of entire equivalent liquid volume
- Summer and shut-in conditions

- All liquid hydrocarbon is lost before any containment can be mobilized and implemented

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

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

3. DRILLING PREVENTION MEASURES

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

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

The primary drilling related oil spill prevention measures include:

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

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

TRAINING

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

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

WELL PLANNING

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

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

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

DRILLING RIG AND WELL CONTROL/BLOWOUT PREVENTION EQUIPMENT

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

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

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

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

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

WELL CONTROL WHILE DRILLING BELOW THE SURFACE HOLE

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

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

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

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

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

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

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

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

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

4. SPILL RISKS AND POTENTIAL SPILL SCENARIOS

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

POTENTIAL FOR SPILLS ON THE NORTH SLOPE

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

In this analysis potential spills are categorized as follows:

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

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

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

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

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

USFWS SPILL ANALYSIS FOR POLAR BEAR INCIDENTAL TAKE RULE

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

- Assumptions in the model used (Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE)):
  - The constituents of large spills do not weather. However, Point Thomson produces light condensate, much of which would be lost to evaporation. This is not the case for crude oil.
  - Cleanup scenarios are not simulated. In the model, oil spill trajectories move as though no response action was taken. When response actions such as booming, mechanical recovery, and burning are taken, they will limit the residence and potential for further oil movement in the environment.
- Developments targeted by the analysis were offshore while Point Thomson is onshore.
- The analysis states that to date no major offshore oil spills have occurred in the Alaska Beaufort Sea and, although it is reasonable to assume the chances of one or more large spills occurring is low, for the purposes of the analysis a large spill was assumed.

POTENTIAL FOR SPILLS AT POINT THOMSON

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

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

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

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

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

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

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

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

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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).

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Appendix N

Visual Resource Assessment

POINT THOMSON PROJECT EIS

Visual Resource Assessment

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Acronyms and Abbreviations

ADNR	Alaska Department of Natural Resources
ANILCA	Alaska National Interest Lands Conservation Act
Arctic Refuge	Arctic National Wildlife Refuge
BLM	Bureau of Land Management
Corps	U.S. Army Corps of Engineers
DEW Line	Distant Early Warning Line
EIS	environmental impact statement
ExxonMobil	Exxon Mobil Corporation
GIS	Geographic Information System
KOPs	Key observation points
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
USFWS	U.S. Fish and Wildlife Service

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Chapter 1. Summary

The Point Thomson Project proposed for the North Slope of Alaska, halfway between Deadhorse and Kaktovik, and within a few miles of the Arctic National Wildlife Refuge (Arctic Refuge) boundary, is located in an undeveloped and uninhabited area. Arctic Refuge lands, managed for their wilderness qualities, are visually sensitive. Adjacent state lands for which the project is proposed have the same qualities but are moderately sensitive because they are not managed for visual values. The entire area is considered a single scenic quality rating unit. Under methods described in Bureau of Land Management (BLM) Manual 8400, scenic quality ratings were A in summer and B in winter, reflecting less visual variety in winter. Overall visual resource classification under the BLM method was class I for Arctic Refuge lands and class III for state lands, reflecting strong visual values throughout the area. The BLM method weights the land status differently, because state lands are managed for oil and gas production and Arctic Refuge lands are managed for wilderness qualities and values. (See Section 2.3 below for further information on Arctic Refuge management.)

Proposed new industrial facilities, particularly drilling rigs, communications towers, flare stacks, support facilities, air traffic, and facility lights are expected to create strong "visual contrast" when compared to baseline conditions (pre-2009). The vertical lines of towers in an environment of principally horizontal lines; contrasting colors and dark silhouettes against bright water, ice, or sky backgrounds; and bulky boxy forms not reflected in the baseline condition are the principal contrasts that make the industrial developments visually prominent, even at substantial distances. Key observation points (KOPs) associated with travel corridors on the Canning River and along the Beaufort Sea coast at graduated distances from proposed facilities (a few hundred feet, 0.8 mile, 1.8 mile, 5 miles, 8 miles, and 20 miles) indicated strong visual contrasts in the foreground-middle ground distance zone (up to about 5 miles), moderate contrasts in the background distance zone (8 miles) except for strongly contrasting lights, and very weak to no visual contrast in the seldom-seen distance zone (20 miles), except for project lights in dim dark conditions.

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Chapter 2. Introduction and Methods

Exxon Mobil Corporation's (ExxonMobil's) proposed Point Thomson Project is located on the northern edge of Alaska, east of the Prudhoe Bay oil fields and immediately west of the Arctic Refuge (see Figure 1). The area is principally undeveloped (no roads or communities) but sees some use for subsistence hunting and gathering, local transportation, and recreation. Use levels are low, much lower than highly-viewed areas that are the subject of many visual assessments. The sensitivity of viewers mostly is high. The project aims to produce hydrocarbons from a large, high pressure reservoir that lies beneath a portion of the Beaufort Sea and a portion of the mainland and requires construction of multiple wells, processing facilities, housing, an airport, an elevated pipeline, and other structures. The environmental impact statement (EIS) for the project describes the proposed action and alternatives in detail. Construction of new human elements in a mostly natural landscape would change the appearance of the area. This visual assessment characterizes the existing landscape and its visual value, and illustrates the proposed changes in an effort to assess potential visual impacts and to determine if mitigation is necessary.

The lead federal agency for the EIS is the U.S. Army Corps of Engineers (Corps). The following are federal and state cooperating agencies in the EIS effort: U.S. Fish and Wildlife Service (USFWS), as manager of the Arctic Refuge; the Environmental Protection Agency, because of its permit and oversight responsibilities; and the State of Alaska Department of Natural Resources, as land owner of the project site.

Discussion of *de facto* and federally-designated wilderness recurs in this document because the Molly Beattie Wilderness, designated by Congress in the Alaska National Interest Lands Conservation Act (ANILCA), occurs within the boundaries of the Arctic Refuge and because wilderness qualities are an important part of the refuge and its management even outside the designated wilderness area. Congress created the "1002 Area" of the Arctic Refuge (so-called after ANILCA Section 1002), which was to be studied for its oil and gas potential, its wildlife, and potential impacts to wildlife. ANILCA indicated that, until Congress determined otherwise, the 1002 Area was to be administered "to maintain presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System."

Figure 1 illustrates the 1002 Area and Molly Beattie Wilderness.

2.1 METHODS

By agreement of the lead and cooperating agencies, this visual assessment was prepared primarily by using methods described by the BLM in Manual 8400 Visual Resource Assessment (BLM N.D.), a method used by the USFWS in other instances. It also drew on the Visual Resource Assessment Procedure for the Corps (Smardon et al. 1988). The BLM method was designed largely for lands managed by BLM, so the methodology was modified to account for actual land ownership in the study area and the lack of visual management objectives on lands in the study area, especially the state-owned lands.

The method involved the following steps:

1. Visual Resource Inventory (Section 3 in this document)
    a. Regional Landscape Identification (Section 3.1)
    b. Rating of Scenic Quality (alphanumeric ratings based on landform, vegetation, water, color, and other parameters—Section 3.2)
    c. Sensitivity Level Analysis (Section 3.3)

  d. Distance Zones (mapping—Section 3.4)
  e. Visual Resource Classification (assigned a classification based on a combination of management intent and the analysis in previous steps—Section 3.5)

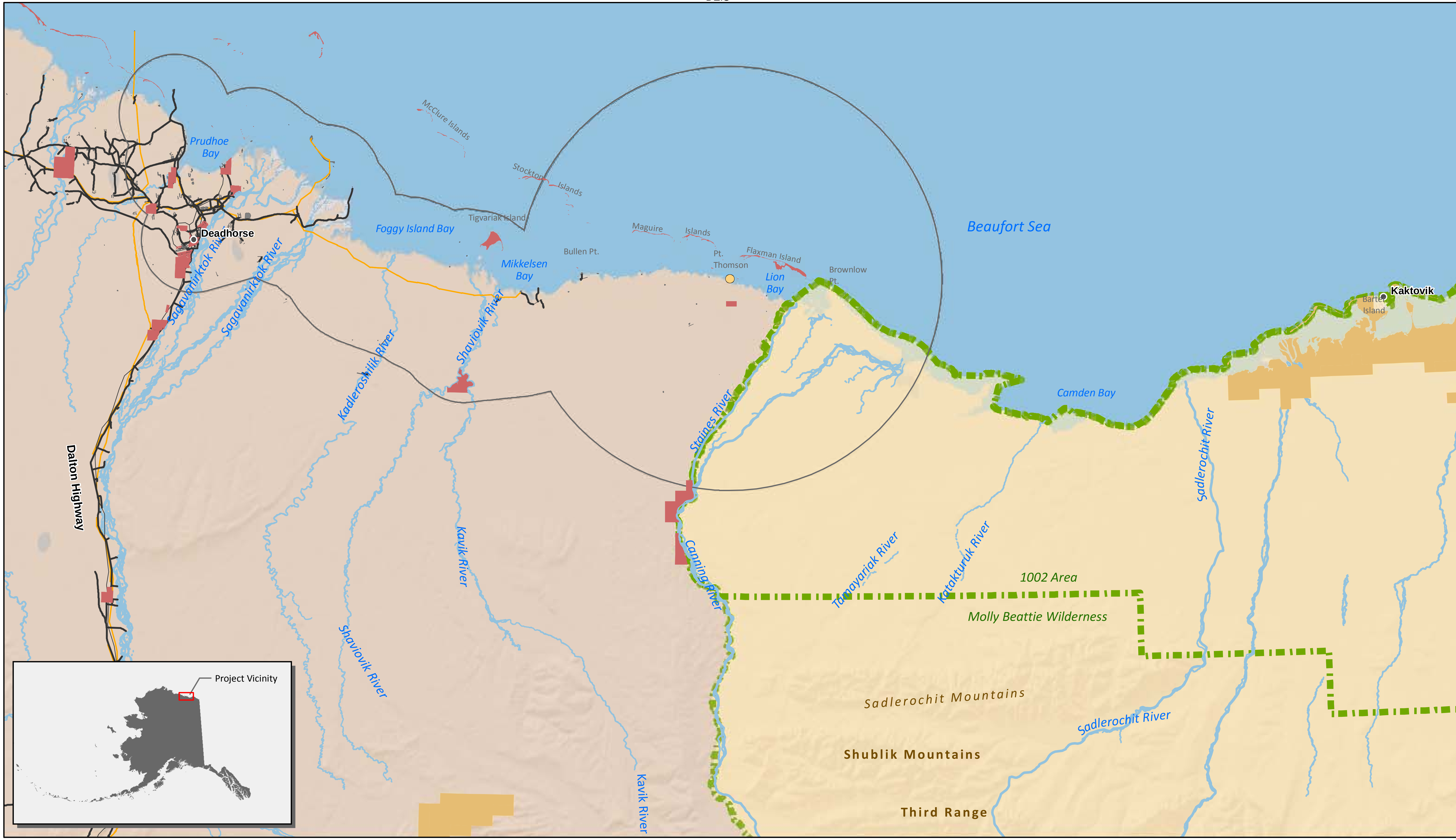
2. Visual Contrast Rating (Section 4 in this document)
  a. Identification of Key Observation Points (KOPs)
  b. Visual Simulation from KOPs
  c. Description of Characteristic (Existing) Landscape from KOPs
  d. Description of Proposed Activity (Project) from KOPs
  e. Contrast Rating (degree of contrast between existing conditions and proposed conditions)

A team of two, including a senior landscape architect with experience managing visual assessments across the nation and an experienced Alaska environmental planner, collaborated on this visual assessment. Site visits were conducted in March 2010 by one person and in July 2010 by both.

2.2 DEFINING THE STUDY AREA

The proposed Point Thompson Project is located in a flat landscape that offers views to distant horizons. Also, the project is located in a principally undeveloped environment adjacent to Arctic Refuge lands valued for wilderness qualities (see the EIS Recreation and Arctic Refuge sections for detail). Because the presence of human development in a backcountry or de facto wilderness environment may be a determinant of a visual impact (see Section 2.3), and because the area's uninterrupted views may allow visibility of the project from inside the refuge and its designated federal wilderness area, the project area for visual assessment purposes is defined based on the concept of "visibility," as further described below.

A common definition of visibility, quoted in a 1999 National Park Service (NPS) paper on the atmospheric effect to visibility, is "the greatest distance at which an observer can just see a black object viewed against the horizon sky" (Malm 1999). This common definition holds that the visibility distance is determined by the "threshold contrast" of an object. An object is usually referred to as at "threshold contrast" when the difference between the brightness of the sky and the brightness of the object is reduced to such a degree that an observer can just barely see the object. However, the NPS paper states that the "threshold contrast for the eye, adapted to daylight, changes very little with background brightness, but it is strongly dependent on the size of the target and the time spent looking for the target." Therefore there are several aspects at work in determining visibility.



POINT THOMSON PROJECT EIS

Arctic National Wildlife Refuge
Existing Facilities
Water Body
Existing Pipeline
Existing Road
Stream
Primary Study Area Boundary
Federal Land Arctic National Wildlife Refuge
State Land
State Lands Selected by the North Slope Borough
Kaktovik Inupiat Native Corporation Land

0 5 10 Miles

N

Figure 1
Project Vicinity

Date: 27 September 2010
Map Author: HDR Alaska Inc.
Sources:

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While conducting field work for the visual assessment, observers noted it was barely possible to make out the existing Point Thomson drilling rig with the naked eye on clear days with light haze at a distance of 20 miles. The decreasing visibility with distance appeared to be attributed to the reduced brightness of the object (due to haze and light scattering) and the relatively small size of the object in the characteristic landscape at that distance. At 20 miles, observers needed to be keenly aware of the target to be able to see it (that is, it would likely be invisible to a casual observer not otherwise aware it was there). Based on this observation, the primary study area for visual assessment purposes is defined as the area within 20 miles of the proposed project site. In addition to the circle around the project site, the study area extends west in a swath parallel to the coast in which an access road and the export pipeline are proposed to connect with existing facilities at the Badami development (22 miles west) or the greater Prudhoe Bay developments (approximately 50 miles to the west). This swath covers pipeline and road alignments both relatively close to the coast and farther inland and the “foreground-middle ground” area from which they might most readily be seen (five miles farther inland and seaward).

Figure 1 illustrates the primary study area. The western end of the primary study area ends where the pipeline and road routes would intersect existing permanent roads and pipelines near Deadhorse/Prudhoe Bay. ExxonMobil’s staging pad in Deadhorse and other facilities there are not included in the visual assessment study area because it was not an area of concern during scoping and is an area already industrialized where visual contrast of new structures would be quite low.

Because there is little to physically obstruct a view besides atmospheric conditions, and because of the sensitivity of the federal lands within the Arctic Refuge, a secondary project area also was considered. It is defined by the theoretical maximum limits of visibility as indicated by a Geographic Information System (GIS) computer modeling exercise that accounted for topography and curvature of the earth.

Figure 2 illustrates all areas from which Point Thomson development might theoretically be visible, and this is the secondary study area.

This maximum distance is assumed to be the area from which unobscured lights from the project might be seen in dim or dark conditions. This secondary area may also be an area from which daytime reflections or exhaust plumes might be seen from beyond the 20 mile primary zone. The form of structures is considered unlikely to be visible with the naked eye under most conditions to most people in the secondary zone. See Section 4.10.1, below, for further detail on this computer modeling exercise.

The focus of this assessment is on closer views and the aesthetic character of the view more than simply the presence or absence of on object within the view. As stated in the NPS report, people typically are more interested in the detail of what they can see and less interested in a tiny black object against the horizon: “visibility is more closely associated with conditions that allow appreciation of the inherent beauty of landscape features. It is important to recognize and appreciate the form, contrast detail, and color of near and distant features…. Visibility includes psychophysical processes and concurrent value judgments of visual impacts, as well as the physical interaction of light with particles in the atmosphere” (Malm 1999). This document explores not only visibility but the quality of a view, with a focus on the primary project area.

2.3 DEFINING THE BASE CONDITION

Although exploratory drilling has been underway since 2009 by the Applicant under state permits, the baseline condition for the visual assessment is the condition prior to 2009—without the exploratory drilling and associated drilling rig tower and other facilities and activities. The current activity has been a preliminary part of the project evaluated in this EIS. The preliminary activity did not require federal approvals, and the applicant was able to proceed before completion of the EIS. The No Action Alternative would return the area to approximately the pre-2009 condition, without structures, and it is thus the appropriate baseline for visual resource assessment.

2.4 TYPES OF VISUAL IMPACT

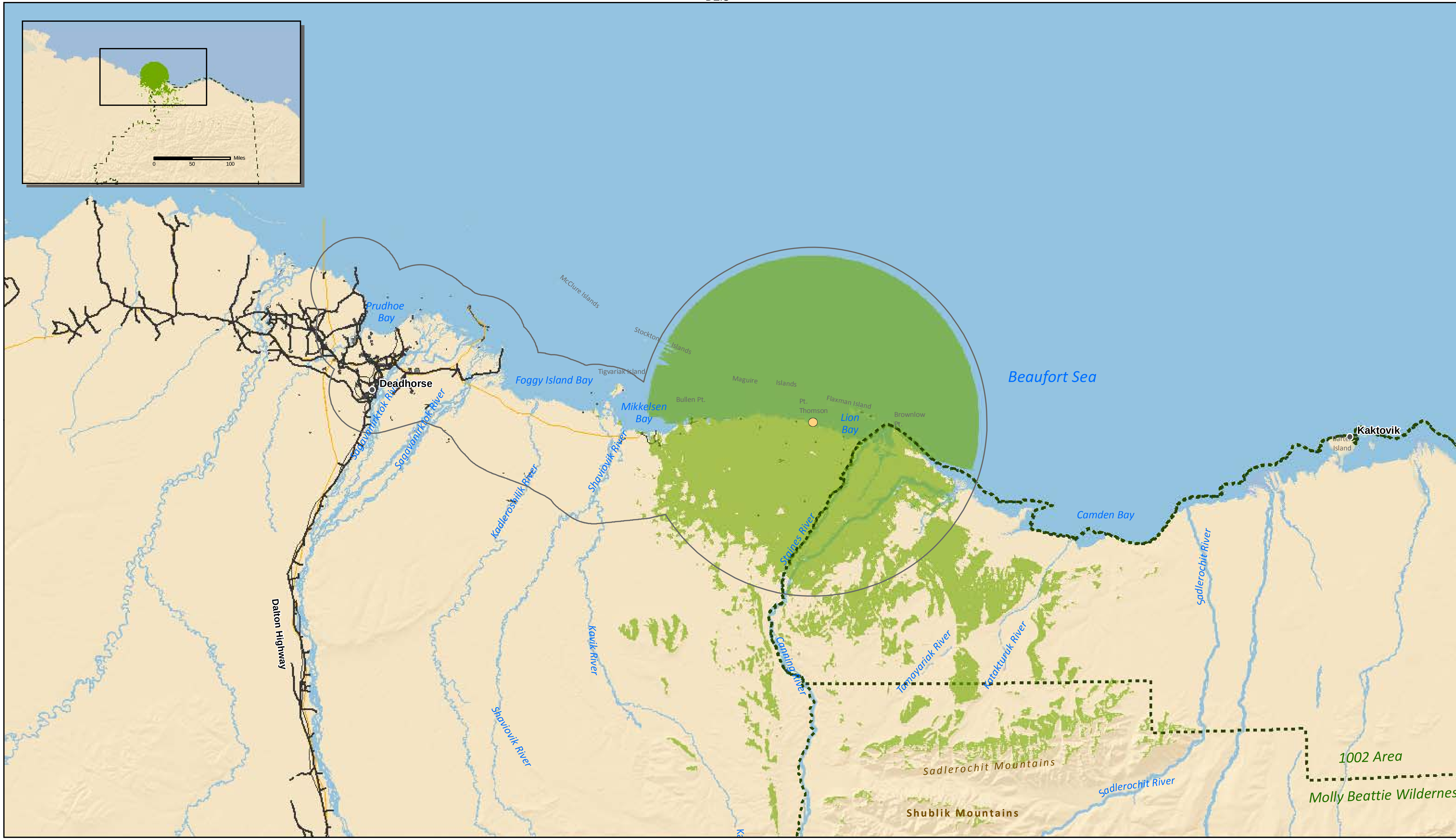
The BLM and Corps methodologies focus on visual assessment measures meant to be as objective as possible—line, form, color, texture—to determine visual contrast or change associated with the implementation of the project. This visual assessment also includes analyses of impacts not typically evaluated as part of BLM or Corps methodologies. At the request of the Lead and Cooperating Agencies this visual assessment examines visibility of the project from the Arctic Refuge and visual impacts as they might affect wildlife. Each of these is briefly described below. Discussion of these topics in this assessment document is separate from the contrast ratings process. For example, any visual influence on wildlife does not influence the contrast ratings, which are based on human perceptions.

Arctic Refuge: The process of determining visual contrast is effectively independent of land protection status (in this case designated and *de facto* wilderness); however, the sensitivity and ultimate visual classification of lands are influenced by management decisions and the status of protected lands. The Arctic Refuge as a whole is touted for its wilderness qualities. A refuge brochure states: "The Arctic Refuge is recognized as one of the finest examples of wilderness left on the planet." A large portion of the refuge was specifically designated as wilderness by Congress in 1980 with passage of ANILCA. The northwest corner of the Arctic Refuge's Molly Beattie Wilderness area lies 30 miles from the proposed Point Thomson project site.

In addition, ANILCA stipulates that the 1002 Area, the western edge of which is adjacent to the Point Thomson project site, be managed for its wilderness characteristics until Congress decides whether the area should be opened for oil and gas leasing or designated as wilderness. Effectively, the 1002 Area is managed the same as the Molly Beattie Wilderness and is considered as such by wilderness advocates in Alaska and nationwide. The nearest portion of the 1002 Area to proposed project facilities is 2 miles.

Because of the sensitivity of the Arctic Refuge this document considers simply where the proposed facilities would and would not be visible—how deeply into the refuge project facilities would be visible and whether or not the project would be visible within the designated Molly Beattie Wilderness.

Wildlife: The Arctic Coastal Plain is known for its wildlife—herds of thousands of caribou and well-known species of large mammals such polar bears and musk ox that are unique to the far north. Birders appreciate the dozens of migratory species that travel long distances to nest in the arctic. All of these are present in the project area. Project wildlife subject matter experts have indicated that the most likely visual effects to wildlife would be based on motion and reflection or glare. Scoping comments from 2009 and 2002 related to proposed Point Thomson development indicated that, according to observations of local elders, caribou notice and tend to steer clear of reflective pipelines. Therefore, this document considers motion and reflection with respect to wildlife.



POINT THOMSON PROJECT EIS

Arctic National Wildlife Refuge
Existing Facilities
Water Body
Existing Pipeline
Existing Road
Stream
Point Thomson Visibility Areas
Primary Study Area Boundary

Note: This image illustrates the theoretical areas from which lights, flares, reflections, or exhaust plumes at 150 feet above the ground surface at Point Thomson would be visible by an observer 5 ft above the ground surface, accounting for topographic obstructions and the curvature of the earth. This does not account for reductions in visibility based on atmospheric conditions. The digital elevation model in this area is considered "coarse," with elevation values assigned based on a cellsize of approximately 65m by 65m (i.e. no actual elevation change that may exist within 65m is noted). This is meant as a tool to help determine maximum visibility potential. See text.

Figure 2
Primary and Secondary Study Areas and Theoretical Maximum Visibility

Date: 20 October 2010
Map Author: HDR Alaska Inc.
Sources:

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Chapter 3. Visual Resource Inventory

A visual resource inventory is the first step in assessing visual impacts. The inventory provides background information on the region as a whole, to provide context for a more specific inventory of an area—in this case, the Point Thomson area. The specific inventory identifies scenic quality rating units and describes them in terms as objective as possible, based on landform, vegetation, color, and other parameters. Ratings are assigned based on the BLM Manual.

3.1 REGIONAL LANDSCAPE IDENTIFICATION

3.1.1 Physiographic Province

Both the BLM and Corps methods refer to the "physiographic province" as the basis for comparing visual qualities of the subject area to its surroundings. The BLM method does not specifically call for description of the regional landscape, although it is implied. It is included here because the Corps procedure is more specific on the issue. The project site is located in the Arctic Coastal Plain physiographic province and adjacent to the Arctic Foothills physiographic province. The following is verbatim from *Physiographic Divisions of Alaska* (Wahrhaftig 1965):

> **ARCTIC COASTAL PLAIN**
>
> **General topography** The Arctic Coastal Plain is a smooth plain rising imperceptibly from the Arctic Ocean to a maximum altitude of 600 feet at its southern margin. The coastline makes little break in the profile of the coastal plain and shelf, and the shore is generally only 1-10 feet above the ocean; the highest coastal cliffs are only 50 feet high. The Arctic Coastal Plain province is divided into the Teshekpuk and White Hills sections. Scattered groups of low hills rise above the plain in the White Hills section; the Teshekpuk section is flat. Locally, an abrupt scarp 50-200 feet high separates the coastal plain from the Arctic Foothills. Locally pingos are sufficiently abundant to give an undulatory skyline. The part of the coastal plain between the Kuk and Colville Rivers has scattered longitudinal sand dunes 10-20 feet high trending N. 55"-75" E.
>
> **Drainage** The Arctic Coastal Plain is very poorly drained and consequently is very marshy in summer. It is crossed by rivers which head in highlands to the south. Rivers west of the Colville River meander sluggishly in valleys incised 50-300 feet; those east of the Colville cross the plain in braided channels and are building deltas into the Arctic Ocean.
>
> **Lakes** The Teshekpuk Lake section of the Arctic Coastal Plain province is covered by elongated thaw lakes oriented N. 15" W.; these range from a few feet to 9 miles long, are from 2 to 20 feet deep, and are oval or rectangular in shape (pl. 4, fig. 3). The lakes expand about 1 meter per year in places, and several generations of drained lake basins may be seen.
>
> **Glaciers and permafrost** There are no glaciers. The entire land area is underlain by permafrost at least 1,000 feet thick. The permafrost table (base of zone of summer thaw) is (immediately) below the surface. A network of ice-wedge polygons covers the coastal plain. These are oriented parallel and perpendicular to receding shorelines because of stress

differences set up by horizontal temperature gradients. Random polygons form in areas of more uniform stress.

Geology The Teshekpuk Lake section is underlain by 10-150 feet of unconsolidated Quaternary marine sediments resting on nearly flat Cretaceous sedimentary rocks containing coal. The White Hills section contains, in addition, lower Tertiary sedimentary deposits.

The primary, unifying visual characteristics of the landscape of the Arctic Coastal Plain are its essentially flat nature, expansive views, and very low vegetation—all evident year round—as well as the many lakes and ponds (poor drainage), and ground and vegetation patterns influenced by permafrost. It differs from other mostly treeless plains primarily in the preponderance of surface water in summer.

In addition to the physical characteristics noted in the quotation above, it is worth noting that the climate is dry, averaging 2.6 inches of precipitation per year in the Barrow area, according to the Web site of the National Oceanic and Atmospheric Administration (NOAA). There is little natural spatial enclosure; the characteristic landscape is wide open and exposed. Typical viewing distances are not limited by landforms or vegetation. Exceptions are in the river valleys and the ocean shoreline, from which low bluffs may obscure distant views.

3.1.2 Cultural Modification of the Landscape

The land has been inhabited for thousands of years by Native people. The entire coastal plain is large (some 650 miles east-west, and varying from 30 to 100 miles or more north-south), and many cultural modifications are swallowed up by the mostly-unmodified natural environment. Seven villages exist in the coastal plain, almost all of them widely scattered along on the coastal edge of the plain. Oil and gas development occurs principally in the center of the coastal plain and effectively encompasses Nuiqsut, one village that is located somewhat inland from the coast. The oil and gas development appears from the air as a large network of narrow roads and pipelines connecting nodes of industrial buildings and structures. On still days, layers of air pollution are visible over these developed areas, and during darkness, the lights are a distinct contrast to the rest of the coastal plain. Modern cultural modifications in villages and industrial complexes are typically functional and mostly do not appear to be designed for visual quality or aesthetics. Because the area is flat and without trees, even low structures are visible over long distances.

From the air, the pattern of roads and pipelines presents an engineered orderliness and attractiveness that creates visual interest and draws the eye. On the ground within developed areas, there is a great deal of industrial storage and buildings (whether homes and offices in communities, or industrial buildings in the oilfields) that appear in aggregate to be mismatched and cluttered. In the less-developed areas across much of the coastal plain there are old gravel pads and airstrips that were created for oil and gas exploration or military or other uses, but most currently are not in use. These may be visible from the air, but without substantial relief or structures built upon them, they usually are not visible when seen from the ground except when immediately upon them. East and west of the greater Prudhoe Bay/ Deadhorse area that is widely developed, the coastal plain is principally undeveloped, with natural elements dominating.

3.2 SCENIC QUALITY EVALUATION: THE ARCTIC LANDSCAPE

3.2.1 Basis for Scenic Quality Evaluation

BLM Manual H-8410-1 states "Scenic quality is a measure of the visual appearance of a tract of land" and provides a method for giving public lands an A, B, or C rating "based on the apparent scenic quality which is determined using seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications." For a given tract of land, or "scenic quality rating unit," each of these factors is ranked on a comparative basis with similar features elsewhere, especially other parts of the same physiographic province. The rankings are compiled into the overall A, B, or C rating (A indicates better overall scenic quality and C worse).

The physiographic province for the Point Thomson Project site is the "Arctic Coastal Plain," as described in the previous section, with the "Arctic Foothills" province adjacent to the south and the ocean adjacent to the north. The "adjacent scenery" factor considers the adjoining provinces.

The BLM manual provides further background on the application of the scenic quality ratings as follows:

> An important premise of the evaluation is that all public lands have scenic value, but areas with the most variety and most harmonious composition have the greatest scenic value. Another important concept is that the evaluation of scenic quality is done in relationship to the natural landscape. This does not mean that man-made features within a landscape necessarily detract from the scenic value. Man-made features that compliment the natural landscape may enhance the scenic value. Evaluations should avoid any bias against man-made modifications to natural landscape. –BLM Manual 8410

3.2.2 The Scenic Quality Rating

3.2.2.1 Introduction to Scenic Quality Rating Unit and Summary of Rating Results

This section applies the BLM's scenic quality rating system to a specific tract of land, or "Scenic Quality Rating Unit," as a way to measure scenic quality.

BLM Manual H-8410-1 states: "Rating areas are delineated on a basis of: like physiographic characteristics; similar visual patterns, texture, color, variety, etc.; and areas which have similar impacts from man-made modifications." For purposes of this assessment, the portion of the primary study area that is within the 20-mile radius shown in figures is considered to be one single scenic quality rating unit—referred to here as the Point Thomson Scenic Quality Rating Unit. The foothills and mountains would be separate rating units but are sufficiently distant from the study area that they are not described in detail but are considered as adjacent views. The coastal corridor portion of the primary study area was not formally examined for scenic quality. However, based on observations from the air flying between Deadhorse and the Point Thomson area, and based on views on the ground in the Deadhorse area, it appears that the landscape is substantially similar, with the exception of cultural modification in the form of industrial developments. From east to west, these facilities begin at Bullen Point, a coastal radar station and airstrip that began during the Cold War era as a part of the Distant Early Warning Line (DEW Line). Near Bullen Point is the Badami development and its pipeline along the coast from Badami toward Endicott. In the Endicott area, in addition to pipelines, there are permanent roads and the edges of relatively dense network of facilities in the greater Prudhoe Bay/Deadhorse area.

The following subsections rate the Point Thomson Scenic Quality Rating Unit for each category, typically on a 1-5 scale, with high scores indicating high distinctiveness. BLM criteria for the ratings appear in the Appendix.

The subsections provide narrative detail as the basis for scoring the elements of the scenic quality rating unit and for determining an overall scenic quality rating (A, B, or C) for the area. Table 1 summarizes the scores from below to arrive at a total Scenic Quality Score: Based on the following evaluations, and on a sum of the scores presented, a preliminary scenic quality rating of “A” has been assigned for the summer and “B” for the winter for the Point Thomson Scenic Quality Rating Unit. Both ratings indicate relatively high scenic quality, with winter lower than summer based primarily on lack of visible vegetation or water (and therefore less visual variety), and reduced variety of color and textural contrast in the landscape.

Table 1: Summary of Scenic Quality Rating for the Point Thomson Unit

Characteristics	Ratings		Basis for Rating
	Summer	Winter	
Landform	3	3	”Striking” in expansiveness of plain; “detail features interesting though not dominant or exceptional.”
Vegetation	4	1	“A variety of vegetative types as expressed in interesting forms, textures, and patterns” but on a scale mostly visible in the close foreground. Vegetation not visible in winter.
Water	5	1	Ocean, large braided river, and extensive ponds create variety and interest in summer. Lack of liquid water in winter.
Color	4	3	Variety of color in combination of vegetation and water in summer. In winter, the changing quality of light as reflected in the snow.
Adjacent scenery	5	4	Adjacent mountain and ocean scenery greatly enhances visual quality. Ocean is less visible in winter when frozen.
Scarcity	3	3	Area is “distinctive, but somewhat similar” to other areas of the coastal plain and quite unusual overall in the U.S.
Cultural modification	0	0	“Modifications add little or no visual variety to the area, and introduce no discordant elements.”
Total score	24 (A)	15 (B)	

BLM Manual 8410 indicates ratings as follows: A = 19+ / B = 12-18 / C = 11 or less See guidance from BLM Manual 8410 in the Appendix regarding these ratings.

Detail on the origin of the scores in each category appear in the following paragraphs. BLM guidance on these ratings appears in the Appendix.

3.2.2.2 Landform

The principal landform is the coastal plain, with coastal landforms such as a very low bluff shoreline, low curvilinear barrier islands and spits of land with similar low bluff shorelines, and a major river delta at the mouths of the Staines/Canning River. No large pingos (ice-core hills) exist around the proposed drilling sites and few to the west along proposed pipeline routes. The BLM scenic quality inventory and evaluation chart in the Appendix highlights striking peaks, canyons, and cliffs as the most highly rated landforms. The coastal plain is not striking in this way but is striking in its vast expansiveness, and “detail features which are interesting though not dominant or exceptional,” such as the shoreline, spits of land that extend into the ocean, and the complex river delta, which are features common in this area that are not as common farther west along the coastal plain. A score of 3 has been assigned and applies to both summer and winter.

3.2.2.3 Vegetation and Ground Cover

Vegetation includes a variety of low wetland vegetation types interspersed with substantial open water. There are no trees. Virtually all vegetation is wetland vegetation, but there are variations between “moist tundra” areas (22 percent), “wet tundra” areas (20 percent), complexes of these two types (17 percent), and the open water ponds visible in summer (35 percent). The tundra environments are dominated by sedges and dwarf shrubs, in different proportions depending on “moist” or “wet” conditions and microclimates. Some areas have tussock-forming cotton-grass. Dwarf shrubs, also in different proportions depending on moisture content, include willows and entire-leaf mountain avens. Frost boils occur in some locations, resulting in barren and partially vegetated areas. The EIS vegetation and wetlands section provides detail.

The pattern of low-growing vegetation is complex in some areas and visually interesting, including “patterned ground” that is a distinctive arctic feature. Permafrost soils, along with ice wedges or lenses close to the surface, affect vegetation patterns. These arctic soil conditions are visible as irregular, interlocking polygons dozens of feet across defined visually by vegetation and micro-topography. River margins may include some taller willow brush, but typical vegetation throughout the study area is barely ankle-high. River deltas consist of coarse sand and gravel bars that are lightly vegetated, and low ocean bluffs and beaches show similar material, so that dark rock of various small sizes and a variety of colors in shades of black, gray, brown, and red are evident.

The visual variety in vegetation is on a small scale, visible principally in the immediate foreground. Over the entirety of the coastal plain, the vegetation pattern is similar—low plants in irregularly alternating patches over a vast plain, interspersed at intervals by river drainages and gravel bars. From any given location, taken on this larger scale, the vegetation pattern can appear similar. In winter, most vegetation and ponds are snow covered, and the sense of uniformity of the ground cover is greater. Wind sculpted snow, and even the sinuous patterns of blowing snow, provide interest in ground cover in winter but appear quite uniform over vast areas. These patterns of summer vegetation and winter snow cover are similar across the Arctic Coastal Plain physiographic province. A score of 4 has been assigned for summer, reflecting “a variety of vegetative types as expressed in interesting forms, textures, and patterns” but on a scale mostly visible in the close foreground. For winter, during times of snow cover, a score of 1 has been assigned, reflecting “little or no variety or contrast in vegetation,” because vegetation is principally not visible.

3.2.2.4 Water

In summer, water is a dominant feature of most of the coastal plain and adjacent ocean (the Beaufort Sea). As indicated in the EIS, in the area that is within about four miles of the coast (not the entire Point Thomson Scenic Quality Rating Unit), one-third of the “land” is the open water of multiple ponds. Other parts of the coastal plain may include greater percentages. On a slightly broader scale, the area proposed for drilling and support facilities is somewhat unique on the Arctic Coastal Plain because it is on the lower edge of an old delta of the Canning River, which appears from aerial photographs to have a different drainage pattern than areas farther west. Parts of the study area that are inland farther than about four miles present more continuous vegetation cover, while the lake pattern in most other parts of the coastal plain extends inland 10 to 50 miles or more.

Running water occurs in small rivulets and lake drainages and in the much larger Canning River. The Canning River runs in a broad gravel bed and braided channels, with enough turbulence and waves to disturb the surface and creates a texture of lighter and darker areas and alternating patterns of rougher and still waters. However, there are no dramatic drops or falls.

The coastline in the study area is buffered by barrier islands about two miles offshore. Ocean water can be ice-free in summer but is subject to a dynamic pack of arctic sea ice that floats in and out, often changing the visual seascape very quickly. This is typical of the arctic coastal margin. Ocean water conditions range from calm to stormy, and the ocean is capable of shoreline erosion. For much of the year all water, including ocean water, is completely frozen over, and the ice is covered by usually dense and wind-sculpted snow of shallow depth. Ocean and land in winter may often be barely distinguishable, and most ponds are entirely indistinguishable from the surrounding land. Larger lakes and the active Canning River delta may be partially blown clear, with multicolored ice visible. In breakup in late May and early June, the ponds thaw in a variety of colors (light blue, yellow, green/olive, dark blue), with water and ice apparently colored by soil and vegetation. Water bodies exist in great variety, including ponds of different size and shape, ocean lagoons and the open sea, freshwater rivulets and the much larger braided river, and the river delta. Because of this variety and the preponderance of water, a score of 5 has been assigned for summer. Because of the relative lack of liquid water in winter, a score of 1 has been assigned for the snow season.

3.2.2.5 Color

Color of the landscape varies intensely with the season and the natural lighting. During snow seasons (mid-September through May, with patches of snow remaining through June) the landscape color reflects daylight in shades of blue and white and otherwise reflects the color of sunlight. The high latitude means low-angle sun year round, but particularly in winter, and a substantial period when the sun never rises above the horizon (approximately November 25 through January 16 each winter) so that the full “day” may be shades of sunrise and sunset for several hours. During mostly-clear days, the gold, rose, and orange colors of sunrise and sunset color the snow. On cloudy days, and on days with severe blowing snow (even if otherwise mostly clear), the light can be “flat.” During days of flat lighting, the land, sea, and the sky may all blend together in one uniform color with no shadow and little or no contrasting features, causing visual disorientation. (The uniform color may vary from bright white to gray-blue). In spring, when the snow cover is still virtually 100 percent but the sun has returned (staying above the horizon for 24 hours approximately May 17 through July 27), the surface most of the day can be brilliantly white, and the most reflective highlights as if fluorescent. During sunny days during the snow season, snow drifts create shadows in shades of blue. Because the coastal plain and ocean are flat, the sky is a dominant feature, varying in color itself depending on cloud cover and sun color.

During summer, for a few months, the Arctic Coastal Plain appears much different. The coastal plain presents a rich variety of color. Lakes, ponds, and the ocean may reflect bright sunlight in white or bright gold tones, or may appear black or deep blue, depending on the angle of view and angle of the sun. Vegetation presents in various shades of green and warm colors from yellows, to oranges, to browns. The greenest period is quite short, from mid-July to mid-August. During autumn, yellow, oranges, and some reds predominate until leaves fall or snow covers the landscape. During the latter half of summer, sea ice may drift in and out rapidly, changing the ocean surface to the mottled bright white of reflected snow and ice interspersed with the sharply contrasting dark water. Summer presents the greatest color combinations and the unusual dynamics of a changing ocean surface. Based on these color qualities, a score of 4 has been assigned for summer. In winter, based principally on the changing quality of light as reflected in the snow, a score of 3 has been assigned.

3.2.2.6 Adjacent Scenery

The scenery adjacent to the Point Thomson Scenic Quality Rating Unit includes two features that add a great deal of variety to the visual environment: the ocean with offshore barrier islands, and the Brooks Range Mountains, which rise to elevations of 3,000-8,000 feet above sea level. From the proposed project site, the mountains are relatively distant, with the nearest about 30 miles inland, and the ocean near—immediately adjacent or within about two miles depending on the project component. At the coast, the ocean influence adds appreciably to the visual environment in summer, providing a striking contrast to the vegetated wetlands on land, and providing interesting low but curvilinear barrier islands about two miles offshore and a variety of similar spits, bars, and points along the mainland itself. The mountains from many parts of the coastal plain are so distant as to be not visible on most days, but in the eastern end of the study area the coastal plain between the mountains and the ocean is narrower than virtually anywhere else (about 30 miles wide), and so it is common to see the mountains from the coast and ocean. The mountains, as adjacent scenery to the south of the study area, are distant but provide important visual contrast to the flat coastal plain. Because adjacent mountain and ocean scenery greatly enhances visual quality, a score of 5 has been assigned for summer. For winter, a score of 4 has been assigned, because the ocean is frozen over much of the snow season and does not provide the same contrast to the inland areas.

3.2.2.7 Scarcity

There is substantial similarity in the natural landscape across the coastal plain, without many visual characteristics that are truly unique or scarce within this physiographic province. However, compared to other parts of the United States, the coastal plain in its entirety is unique. The central and coastal areas of the Arctic Coastal Plain have cultural modifications at villages and in the loosely sprawling oil and gas developments that spread out from Prudhoe Bay. The western and eastern portions of the coastal plain have a high degree of wilderness quality, including large areas without cultural modifications within view. The coastal plain in general provides outstanding opportunities for wildlife viewing, including viewing of large dynamically moving herds of caribou at some times of year, one of the only places in the U.S. where this viewing opportunity exists. The opportunity to view musk ox, polar bears, and other rarely seen species also exists. The eastern portion of the Alaska coastal plain narrows to a band of plain about 30 miles wide—one-fourth the width to the west—resulting in a unique (or scarce) area within the coastal plain where the mountains, the plain itself, and the ocean all are within close proximity and inter-visible, heightening the visual quality of the eastern area. Because this eastern area is “distinctive, but somewhat similar” to other areas of the coastal plain, a score of 3 has been assigned.

3.2.2.8 Cultural Modifications

In the study area there are several preexisting gravel pads, widely scattered, and ExxonMobil has recently made new use of one existing pad for current drilling operations associated with this project. The visual environment baseline for this project is without these existing Point Thomson well drilling operations. There is also evidence of past military and other use of the offshore islands and general human use in isolated pockets (e.g., rusted drums were observed in beach gravel and at Brownlow Point and the USFWS has a research camp within the Canning River Delta). The BLM guidance for cultural modifications presents a numeric rating scale that includes positive and negative numbers (i.e. man-made objects can complement or detract from scenic quality of the landscape unit)—see the scenic quality inventory and evaluation chart in the Appendix. Considering the physiographic province as a whole, the description from the chart that best fits is the neutral one (score 0): “modifications add little or no visual variety to the area, and introduce no discordant elements.”

2.2.3 Other Visual Resource Issues

There are several other visual resource issues specific to the Arctic Coastal Plain and study area that are not directly addressed in BLM methods but that help to define the visual environment. These include:

- Atmospheric effects/mirage
- Darkness/light effects
- Arctic haze, ice fog, and blowing snow

3.2.2.9 Atmospheric Effects/Mirage

A mirage is formed when the atmosphere behaves as a lens. Mirages are normally seen near the horizon and involve image displacements and distortions (American Meteorological Society, no date). An arctic mirage, or hillingar, results from the existence of relatively cold air next to the ground surface. That cold layer exists because a cold snow, ice, or water surface extracts heat from the air just above. In the arctic mirage, a distant object appears normal (i.e. not inverted, as in a desert mirage) but higher than the object’s actual location (Davis 1979). This effect can take the form of making objects (ice floes, mountains, etc.) look larger or taller than normal, and can make objects from beyond the horizon appear visible, reportedly (but not usually) at distances of up to 300 miles away (Davis 1979). These mirage effects add to the sense of a dynamic visual landscape in the study area (moving ice packs on the ocean and the movements and caribou that may make a large portion of the viewed area from a given point appear to be in motion also contribute to this sense of changing views, in addition to movement of clouds and clouds shadows as are common elsewhere). Mirages reportedly are common on the Arctic Coastal Plain, and minor mirage effects were observed both in winter and summer during fieldwork for this study. For example, mirage effects to the Brooks Range made the mountains looks somewhat taller to observers during March 2010 field work, and in July equipment at the C-1 Pad appeared somewhat enlarged when viewed from the coastline.

3.2.2.10 Darkness and Light

The arctic is known for its extremes of darkness and light, when the sun does not rise above the horizon in mid-winter and does not set below the horizon in mid-summer. This does not mean there is darkness around the clock in winter, but the days are short—approximately five hours of civil twilight on the shortest day of the year, the December 21 Winter Solstice. At night, with little or no artificial light outside of the seven small villages and the oil and gas developments, hundreds of square miles of land are subject to natural darkness. The project site is within these areas of natural darkness. Observers in these areas subject to natural darkness may be particularly sensitive to light in the night sky—the moon, stars, and Aurora Borealis. The artificial light that does exist on the Arctic Coastal Plain may be visible over long distances, because the terrain is flat and without screening vegetation, and because artificial light reflects off of snow on the ground, ice fog crystals in the air, and low cloud layers. Thus, reflected artificial light may be visible in the air even when the curvature of the earth precludes line-of-sight observation of the light source. Vertical projection of individual lamps in ice fog crystals is common in the arctic as well, giving the appearance of a tube of light projected skyward from each lamp. During travel for this project, unofficial comments from residents of Kaktovik reported a glow in the sky from the current Point Thomson development as seen from their community 60 miles away.

Natural darkness is a feature of wilderness areas that outdoor recreation and wilderness advocates value highly. For example, researchers on the night sky topic state, "the present-day effort to save night skies is not merely analogous to, but an integral part of the wilderness ethic" (Duriscone 2001). The NPS maintains a Night Sky Team and a Natural Lightscapes program to address this issue, and its Web site states, "dark night skies are not only a resource unto themselves, but are an integral component of countless park experiences." In the Point Thomson area, Arctic Refuge lands on the coastal plain in the study area (the 1002 Area) are managed to maintain wilderness values or, farther away, are actually designated federal wilderness. Artificial light visible from these areas could be a management issue for the Arctic Refuge, although the refuge does not currently have any management objectives specifically associated with the night sky.

3.2.2.11 Haze, Fog, and Blowing Snow

Haze: According the U.S. Environmental Protection Agency's "Visibility" web site (www.epa.-gov/visibility/what.html), haze occurs when sunlight encounters tiny particles in the air. These particles absorb some of the light, and the rest is scattered. More pollutants mean more absorption and scattering of light, which reduce the clarity and color of what the human eye sees. "Arctic Haze" is a term for haze visible at high latitudes. It is a haze of air pollution that has been tracked to industrial uses, usually hundreds or thousands of miles away.

Fog/Ice fog: Fog and ice fog are common on the Arctic Coastal Plain and can both obscure a view and can be lit from within and cause artificial light to be projected in the sky, making the light visible over long distances. These effects were observed in the field and have been reported by local residents.

"According to international definition, fog reduces visibility below 1 km (0.62 mile) and differs from cloud only in that the base of fog is at the earth's surface while clouds are above the surface. Visibility reduction in fog depends on concentration of cloud condensation nuclei and the resulting distribution of droplet sizes" (American Meteorological Society, n.d.).

Ice fog is composed of suspended particles of ice. It occurs at very low temperatures, and usually in clear, calm weather in the arctic. In daytime, the sun usually is visible through the ice fog and may cause halo phenomena. Ice fog is rare at temperatures warmer than -22 F and increases in frequency with decreasing temperature until it is almost always present at air temperatures of -49 F in the vicinity of a source of water vapor, such as open water, herds of animals, volcanoes, and products of combustion for heating or propulsion (American Meteorological Society, n.d.). As an element of a viewed landscape, ice fog, like normal fog, can obscure views. But it also can make artificial lights more visible by projecting the light vertically and can add interest in halo and rainbow type effects.

Blowing snow: With flat terrain, frequent wind, and cold, dry conditions much of the year, the Arctic Coastal Plain is subject to blowing snow and ground blizzards that can dramatically reduce visibility, even on otherwise clear days. Snow particles blow across the surface, and finer particles lift into the air to heights of 100 feet or more above the ground. From the ground on a clear day, the sun may be visible in the sky but horizontal visibility through blowing snow may be very low—measured in tens of feet. On overcast winter days, or at times when blowing snow may be mixed with falling snow or fog, the entire view in all directions may appear as a uniform white or blue-gray-white color with no shadows and no depth perception—sometimes called a whiteout. Less extreme conditions may simply result in a pattern of sinuous threads of blowing snow visible on the surface, and visible on a broad scale from the air.

3.3 SENSITIVITY LEVEL ANALYSIS

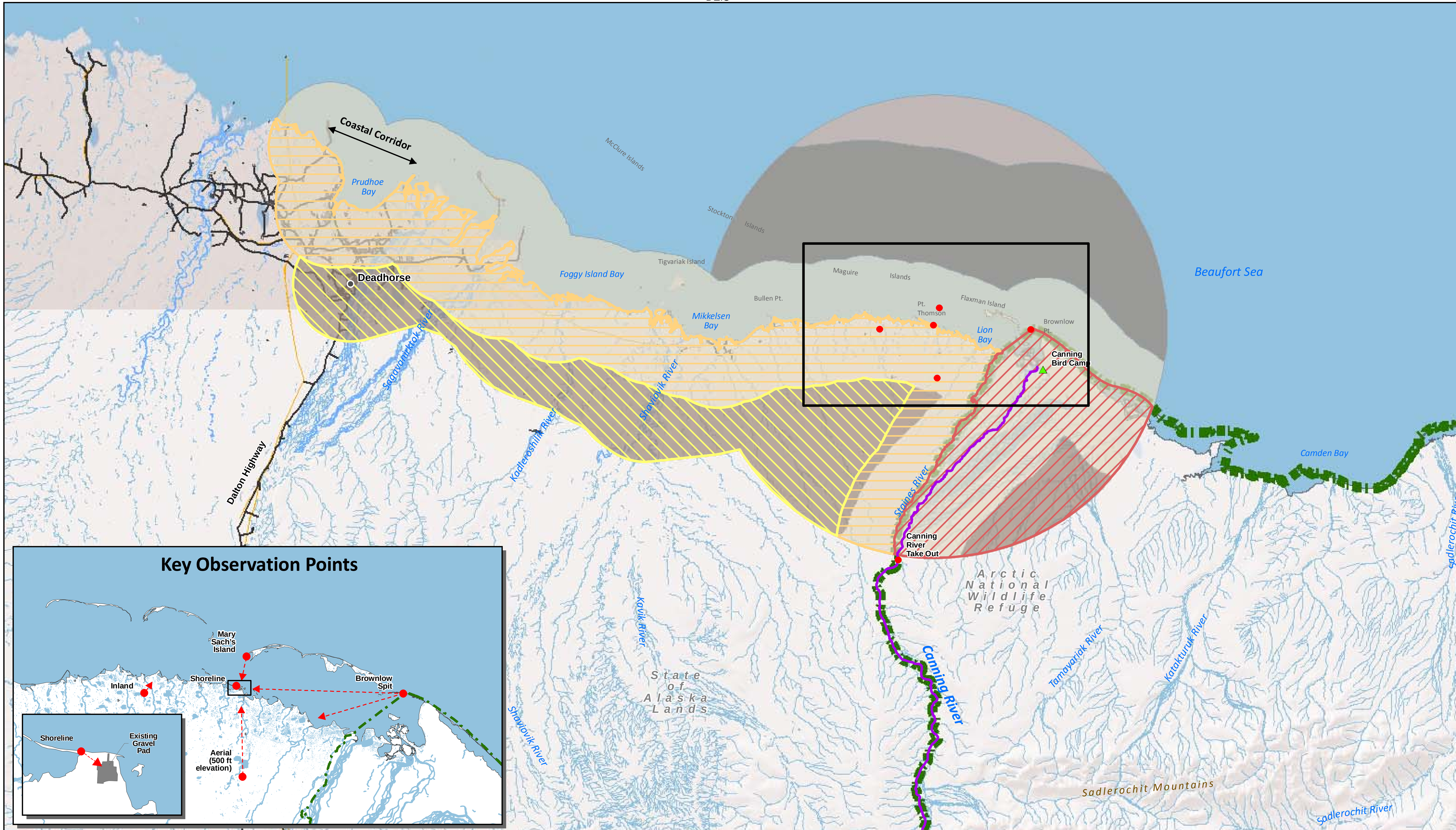
The BLM Visual Resource Inventory Manual states "sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analyzing the various indicators of public concern." BLM specifies five "factors to consider": type of users; amount of use; public interest; adjacent land uses; and special areas. The paragraphs below explain each of these. The conclusion of the following discussion is that "special area" status of the Arctic Refuge automatically places it in the "high" sensitivity category. It is an "adjacent use" for the state land on which the project is proposed. The state land adjacent to this "special area" is rated "medium" sensitivity. Figure 3 shows the study area with several overlays, including sensitivity levels. The same "medium" sensitivity is applied to areas along the coast, because the coast is a travel corridor and use area for subsistence hunting and camping by residents of the North Slope Borough, for recreation, and for general transportation by boat and snowmachine. Other state lands farther inland are rated "low" sensitivity because of low human use and because it is not managed for visual values. Detail on these sensitivity levels is described in the remainder of Section 3.3.

3.3.1 Type of Users

There are three basic categories of user in the study area: local residents of the North Slope Borough camping in, hunting and fishing in, or transiting the area on the ground or transiting the area in the air; recreational or tourism visitors on the surface or in the air; and industrial workers on the surface or in the air. Figure 3 shows the surface travel corridors commonly used in the study area:

- A coastal corridor paralleling the shoreline but encompassing an area from a mile or two offshore to a mile or two inland. This corridor would be used by boat, by snowmachine on sea ice or inland, and on foot.
- A Canning River corridor following the main stem of the river but encompassing land areas on both sides in which river travelers would be most likely to camp, hunt, and hike.

Air travel routes (not shown on the figure) are generally north-south and east-west. North-south traffic typically is aircraft flying over the Brooks Range on standard routes between Fairbanks and Kaktovik and charter flights to pick up people from the Canning River. East-west traffic includes overflights on standard routes between Deadhorse and Kaktovik.



POINT THOMSON PROJECT EIS

Existing Facilities
Arctic National Wildlife Refuge
Water Body
Stream
Existing Road
Existing Pipeline

Primary Study Area Boundary
Canning River Corridor
Key Observation Point

Visual Sensitivity Level
High
Medium
Low

Distance Zones
Foreground-Middleground - 5 miles from Travel Corridors
Background Seen- 5-15 miles from Travel Corridors
Seldom Seen Zone - Remainder of Lands and Waters in Primary Study Area

Scenic Quality Rating Unit: The Point Thomson Scenic Quality Rating Unit is the all the land areas within the primary study area circle

Visual Resource Classification: Arctic Refuge lands in the primary project area are Class I, and all other lands in the primary study area are class III (see text)

N

0 5 10 Miles

Figure 3
Scenic Quality Inventory Mapping and Key Observation Points

Date: October 15 2010
Map Author: HDR Alaska Inc.
Sources:

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3.3.1.1 Local Residents

Based on project scoping and a general level of concern expressed about changes in their area, local residents of the North Slope Borough are thought to have moderate to high sensitivity to changes in the visual environment. Typically, they visit the study area for subsistence hunting, fishing, or gathering. Some areas, particularly along the coast, have a long cultural history among some local residents, and local people are emotionally attached to the land, including its visual environment. Although the Iñupiat people do not typically think of their subsistence lifestyle as recreation, and specifically have addressed recreation as something visitors do, there is, in western cultural terms, a recreational element to subsistence activity—camping, getting away from one's usual daily routine, reconnecting with family, and enjoying the natural quiet and scenery. The Recreation section of the EIS provides further documentation on this topic. Access to and from Kaktovik may be by boat along the coast in summer, by snowmachine parallel to the coast in winter, and by scheduled flights over the study area. The coastline, in general terms, may be considered a broad travel corridor, although no specific route is defined. Low numbers of local residents transit the industrial western edge of the primary study area near Prudhoe Bay and Deadhorse. Some Nuiqsut residents travel the roads by private car with permits. Others transit the coastal corridor via snowmobile and boat. Because of the industrial development, relatively little hunting and camping is likely to occur in this portion of the study area.

3.3.1.2 Recreation and Tourism Users

Recreation and tourism users include river floaters on the Canning River, private pilots flying over or landing, backpackers, ocean kayakers, and hunters on the coastal plain, in the coastal corridor, and adjacent to the primary study area in the Sadlerochit Mountains. Offshore, there are occasional arctic cruise ships that transit the area. Most people recreating on the ground (rather than flying over, paddling, or touring on a cruise ship) come to visit the Arctic Refuge, but some venture onto neighboring state land. None of these user types occurs in large numbers, but their sensitivity generally is thought to be high (see also the recreation section of the EIS). The Arctic Refuge logs just over 100 recreationists on the Canning River in the average summer.

The Canning River, a common float trip in the Arctic Refuge, can be considered a recreational travel corridor, along with an area alongside it used for camping and short walks. The coast may also be considered a recreational travel corridor by a few; the coastal corridor likely gets more use by local residents than visitors from outside the area.

The Arctic Refuge Comprehensive Conservation Plan (1988), coupled with other documents regarding wilderness users, indicate that people come for wilderness values for which the refuge originally was founded and is managed. Congress stipulated that the coastal plain portion of the refuge shall, "until Congress determines otherwise, be administered … so as to maintain presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System." Many of those who visit are likely to be highly sensitive to seeing other parties, litter, or footprints in the immediate foreground or human development or artificial light at any distance during their visit for the following reasons (among others):

- Most users specifically come for a wilderness experience (Christensen 2009).
- The area is remote and requires considerable investment of money and time to visit. The average stay is nine days according to the Arctic Refuge (Reed 2010 pers. comm.).

- The rhetoric and polarized views expressed in the national media and in public opinion campaigns about wilderness vs. hydrocarbon development on the Arctic Coastal Plain portion of the Arctic Refuge heightens sensitivity.

Because most visitors on the ground access the area via small aircraft, they will see the area from the air as well as from the surface.

At the western edge of the primary study area near Prudhoe Bay and Deadhorse are larger numbers of tourists and recreationists who drive the Dalton Highway for pleasure and adventure. Others arrive by air. Some of them take organized bus tours through the industrial facilities to see the facilities and the Arctic Ocean (private cars are not allowed; there is no public access to the ocean except by bus). This group of recreationists is likely to be less sensitive overall to the visual environment because they are coming to see or expect to see industrial facilities.

3.3.1.3 Industrial Workers

Industrial workers are likely to be the least sensitive category of the area's users. Occasional oil and gas exploration activity has occurred in the study area, outside of the current drilling operation at Point Thomson. Cleanup of old contaminated sites has been on-going in 2009-2010 at Bullen Point radar station (a federal facility west of Point Thomson) and at old oil and gas drilling locations, and activities like these could continue in the future with or without the Point Thomson Project. The largest influx of workers, however, is likely to occur if the project is approved and operates for many years. Workers typically are not allowed to go off the developed areas except for specific work purposes, and such work is relatively rare. Most work is indoors. Presumably workers might enjoy the view when outdoors or when flying in and out, but because they expect to be staying at an industrial facility, their overall sensitivity level is considered low. Large numbers of industrial workers occur at the western edge of the primary study area near Prudhoe Bay and Deadhorse.

3.3.2 Amount of Use

The level of use in the study area is low compared to designated public recreation land areas across much of the United States. Because the area of the Arctic Refuge adjacent to the Point Thomson Project is managed for its wilderness qualities, including low encounters with other groups, low use levels meet the expectations of users, including visual expectations. Management for preservation of wilderness qualities implies use is not likely ever to be high on Refuge lands as it is at highly accessible and much more developed areas in national parks like Denali National Park and Preserve (in excess of 335,000 visitors annually, according to the Denali National Park Web site). As an example of the main use in the area, the Arctic Refuge reports an average of 147 people per year using the Canning River corridor (range 99-204), and a little more than 1,000 visits the entire Arctic Refuge annually. Because the Arctic Refuge does not have a way to count all visitors, these numbers are considered the minimum. There are no counts of users of the coastal corridor. Kaktovik residents are reportedly the most common users of the coastal corridor in the study area, and Kaktovik's entire population in 2009 was 286, according to the Alaska Division of Community & Regional Affairs Web site. One or two cruise ships per summer appear to transit the area offshore, and each ship likely contains more people than see the study area from the Canning River or coastal plain each year. Overflights include Canning River users, virtually all of whom fly in and out in small aircraft, near daily flights to and from Kaktovik that traverse the study area at relatively high altitudes (likely at or above 1,000 feet), and current and projected future project-oriented flights that would land and take off at the project site daily. The western end of the study area is the Prudhoe

Bay/Deadhorse area, which has high use by industrial workers and some tourists terminating their highway trips or wishing to see the industrial facilities.

3.3.3 Public Interest

Concern on the part of the public for visual quality of the area, particularly the Arctic Refuge lands, is evident in the years of public controversy about opening the 1002 Area to oil and gas development, or designating it as a federal wilderness area. The Arctic Refuge is also the subject of many books published over several decades celebrating its wilderness qualities, responding to the perceived threat of oil and gas development to wilderness qualities and wildlife, or examining the interplay of these issues.[1] These books, and similar articles and films, are indicative of and contribute to public interest in the area.

3.3.4 Adjacent Land Uses

See Special Areas, below. The Arctic Refuge's overlap with the study area heightens the visual sensitivity rating of the area, based on public concern for such areas.

3.3.5 Special Areas

BLM Manual 8410 describes "special areas" by example, including "Natural Areas, Wilderness or Wilderness Study Areas, Wild and Scenic Rivers,[2]" and several others. The "1002 Area" of the Arctic Refuge is a "minimal management" wilderness study area. It is managed in part to preserve the natural landscape setting and for maintenance of its visual values, which include seeing little or no human development. State land on which the project is proposed is not included in any special area of this kind. Rather, the proposed project site is managed as an oil and gas lease sale area by the Alaska Division of Oil and Gas.

3.3.6 Delineation of Sensitivity Level Rating Units

Sensitivity Level Rating Units are relatively straightforward in this case. All refuge lands within the primary study area are rated "high" sensitivity, because they are a "special area," as described in the preceding subsection. State lands adjacent to the refuge boundary and the coastal corridor are rated "medium." Although the appearance of the land itself is virtually identical on each side of the state-federal boundary, and although the study area has high wilderness and natural qualities, the sensitivity of the refuge is higher because of its management as a "special area," the types of users attracted to it, and the public interest in the area. The adjacent state land is rated "medium" rather than "low" because it is adjacent to and within view of the Arctic Refuge and because it physically has the same qualities as the Arctic Refuge land. Public interest is lower, and the state manages the area for oil and gas development, although until this project there has been no long-term industrial development. Similarly, lands along the coastal corridor are rated "medium" because of the use of the corridor by local residents and by recreationists likely to be seeking a mostly natural experience. Other state lands farther inland and at the developed areas of Prudhoe Bay (far western end of the project area) are rated "low" sensitivity. The

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1 An Internet search of Amazon.com books on Arctic National Wildlife Refuge returned 2,401 results, compared to other random but known examples, as follows: Everglades National Park (480), Denali National Park (353), and Kenai National Wildlife Refuge (185).

2 At this printing, an Arctic Refuge planning process may evaluate the Canning River for recommended designation under the Wild and Scenic River Act. At this time, it is not designated.

bands of sensitivity zones along the Arctic Refuge boundary and the coastal corridor are five miles wide, corresponding with the “foreground-middle ground” distance zone explained in the next section. See Figure 3.

3.4 DISTANCE ZONES

BLM Manual 8410 states:

> Landscapes are subdivided into three distance zones based on relative visibility from travel routes or observation points. The three zones are: foreground-middle ground, background, and seldom seen. The foreground-middle ground zone includes areas seen from highways, rivers, or other viewing locations which are less than 3 to 5 miles away. Seen areas beyond the foreground-middle ground zone but usually less than 15 miles away are in the background zone. Areas not seen in the foreground-middle ground or background (i.e., hidden from view) are in the seldom seen zone.
>
> The distance zones provide valuable information that can be very useful in the sensitivity analysis. For example, the foreground-middle ground zones are more visible to the public and changes are more noticeable and are more likely to trigger public concern.

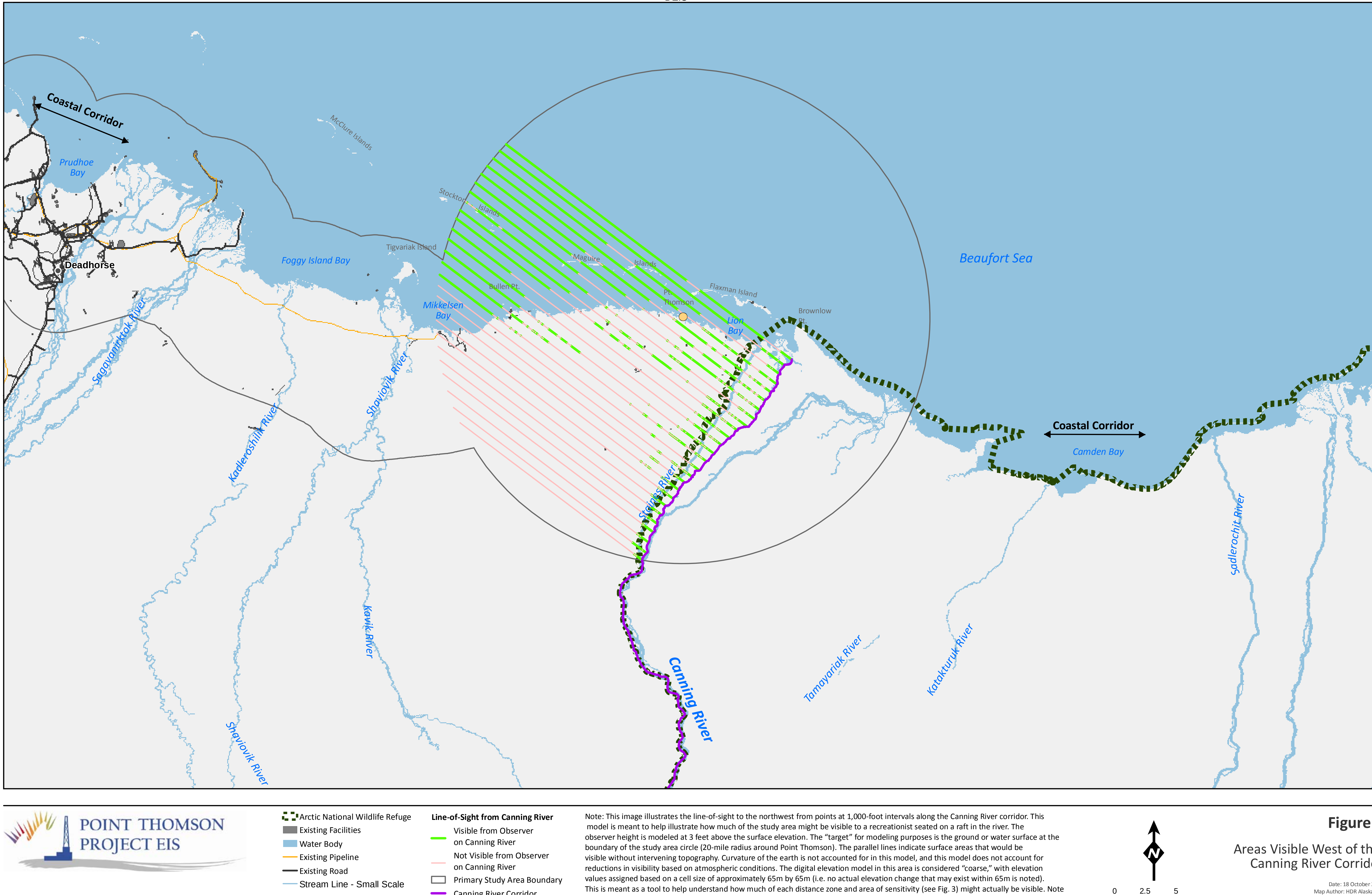
For this project, two general travel corridors were defined—a Canning River corridor, based on recreational floating of the river and associated camping and hiking in the river area, and a coastal corridor, based on summer boat travel along the coast and winter snowmachine travel in this same general alignment on snow-covered sea ice or land.

Because there is little in the natural environment to restrict visibility, this document uses the outer limit of BLM’s guidance for the foreground-middle ground zone (five miles rather than three miles). The background zone is the area between five miles and fifteen miles from the corridor. The seldom seen zone is that area beyond 15 miles from the corridor. For purposes of impact assessment, several KOPs were selected at various distances from the project site and generally in association with the two surface travel corridors, but these are not necessarily exact locations known to attract viewers.

Figure 3 illustrates the distance zones. A north-south line reflects the Canning River corridor, and the coastline itself reflects an east-west coastal corridor. For each line, a five-mile offset illustrates the foreground-middle ground zone. Similarly, a zone offset from 5 to 15 miles illustrates the background distance zone. Areas beyond 15 miles comprise the seldom-seen zone. All of the primary study area except for a small portion of the ocean falls within the background or foreground-middle ground zones from these corridors.

In landscapes with greater topographic relief and forests to frame views, it would be possible to more clearly define areas within the foreground-middle ground zone or background zone that would actually be visible from a corridor.

Figure 4 illustrates a GIS modeling exercise for the Canning River corridor that helps define areas that might or might not be visible from the corridor. For this exercise, the Canning River corridor viewing area was defined by a line set on the main channel of the river (based on information from the USFWS about the most common float route).



Note: This image illustrates the line-of-sight to the northwest from points at 1,000-foot intervals along the Canning River corridor. This model is meant to help illustrate how much of the study area might be visible to a recreationist seated on a raft in the river. The observer height is modeled at 3 feet above the surface elevation. The "target" for modeling purposes is the ground or water surface at the boundary of the study area circle (20-mile radius around Point Thomson). The parallel lines indicate surface areas that would be visible without intervening topography. Curvature of the earth is not accounted for in this model, and this model does not account for reductions in visibility based on atmospheric conditions. The digital elevation model in this area is considered "coarse," with elevation values assigned based on a cell size of approximately 65m by 65m (i.e. no actual elevation change that may exist within 65m is noted). This is meant as a tool to help understand how much of each distance zone and area of sensitivity (see Fig. 3) might actually be visible. Note that increases in target height or observer height would be expected to rapidly increase the surface area that would be visible (compare Fig. 2).

Figure 4

Areas Visible West of the Canning River Corridor

Date: 18 October 2010
Map Author: HDR Alaska Inc.
Sources:

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Using points at 1,000-foot intervals along the line and at three feet above the surface elevation (to approximate eye-level of someone sitting in a raft), the model examined surface-to-surface visibility (areas that should be visible without intervening topography). The model is limited by the coarse digital elevation model available in this remote area (grid size 65 meters, or 213 feet), but it helps to illustrate that large parts of the foreground-middle ground zone would likely not be blocked by bluffs and would be visible, especially at the lower end of the river. It also shows that some parts of the standard five-mile off-set foreground-middle ground zone likely would not be visible. Field work by helicopter near the Canning River Take-Out, where some rafters end their trips, indicated that low river bluffs in that area were enough to limit the view principally to the river area between the bluffs.

For mapping the coastal corridor, cartographers used the mapped shoreline itself to approximate the travel corridor. The corridor is not specific and is meant to capture travel sometimes on the water and sometimes on land, a corridor that might be used for near-shore boat traffic and onshore snowmachine or foot traffic, and for potential shoreline camps. The shoreline was given five-mile and 15-mile buffers to illustrate the distance zones, as shown on Figure 3. No GIS modeling of the potential view was completed for this corridor, because it is a less specific travel corridor than the Canning River corridor. Most of the inland portion of the study area is assumed to be visible from the coastal area, because the land is gently rising at a fairly uniform rate.

Beyond the background distance zone, the BLM method describes a seldom seen zone. Taking into account the two corridors and the flat, open terrain, virtually all of the study area falls within the background or foreground-middle ground zones. Therefore, project features are likely to be readily visible from many points in the primary study area. It is worth noting that use of these two corridors is low; by most standards, even the foreground is not often viewed, not because of low visibility but because of limited use. Nonetheless, mapping distance zones is a tool to use in conjunction with sensitivity, public use, and type of users to better understand project effects for those who do use the study area.

3.5 VISUAL RESOURCE CLASSES AND OBJECTIVES

3.5.1 Visual Resource Classification

BLM Manual 8410 states:

> Visual resource classes are categories assigned to public lands which serve two purposes: (1) an inventory tool that portrays the relative value of the visual resources, and (2) a management tool that portrays the visual management objectives (of the land managing agency).

The guidance is aimed in part at creating land-management objectives within the context of a BLM management plan for BLM lands. Such use for visual resource classification does not apply here. Instead, this visual assessment seeks to illustrate any existing visual resource management objectives of the USFWS (Arctic Refuge) and the State of Alaska for their lands and to be an inventory tool.

Neither the BLM nor the Corps methods is perfectly suited to state-owned and refuge land in the study area. However, both methods include similar classification systems. The classification system for this assessment draws on both but was developed for this specific document. The classification levels are defined as follows:

- **Class I**: Areas where visual values are strong and where management decisions have been made to preserve visual values.
- **Class II**: Areas where visual values are strong, distinctive for the region, but not protected by management action.
- **Class III**: Areas where visual values are strong, but not necessarily distinctive for the region.
- **Class IV**: Areas where visual values are neither distinctive nor poor. Average visual environment for the region.
- **Class V**: Area where visual values are poor, usually as a result of human activity or physical damage to a landscape, highly contrasting structures or forms, and the visual environment is not harmonious, could be improved, or is in need of rehabilitation.

The Arctic Refuge is assigned as Visual Resource Inventory Class I, because Congress made a management decision in ANILCA to maintain the natural landscape. State lands are assigned Class III, based on a scenic quality rating of “A” in summer when virtually all of the highest sensitivity visitation occurs. Because the rating is relatively high and breaks solely on land management/land ownership boundaries, it is not necessary to map the area in detail as might normally be done for a BLM visual resource assessment. Figure 3 shows the Staines River boundary between Arctic Refuge lands (Class I) and state lands (Class III); this corresponds to the area noted as “high” sensitivity.

3.5.2 Objectives for Visual Resource Classes

The BLM method specifies management objectives for different classifications (I, II, etc. as indicated above) for management of BLM lands. In this case, the Arctic Refuge does not have specific visual management objectives spelled out in its management plan or in any resource specific plan (Voss 2010, Reed 2010). Refuge managers have indicated that their visual management guidelines are those generally laid out in the Arctic Refuge’s founding purposes and ANILCA purposes, in the Wilderness Act, in ANILCA, and in other legislation and policy. These documents indicate the Arctic Refuge places high value on scenic resources and manages its lands for preservation of visual resources generally, but the Arctic Refuge does not enumerate specific management objectives for visual resources. The state and borough do not substantially address management for visual resources at all. The following sections provide additional detail regarding visual resource management for these agencies.

3.5.3 Arctic Refuge Visual Management

The Arctic Refuge plan indicates the USFWS:

> …will identify and maintain the scenic values of the refuge and minimize the visual impact of developments consistent with the constraints imposed by (the management plan as a whole). Refuge facilities and commercial use support facilities will be designed to blend into the landscape. The (U.S. Fish and Wildlife) Service will cooperate with state agencies to prevent any significant deterioration of visual resources.-Arctic National Wildlife Refuge Comprehensive Conservation Plan, USFWS 1988

Arctic Refuge personnel were unaware of any specific or formal cooperation effort with the State of Alaska regarding visual resources (Reed 2010 pers. comm.).

The Wilderness Act (16 USC 23.1131) indicates that a federally designated wilderness is a place "in contrast with those areas where man and his own works dominate the landscape." Further, a wilderness area "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable." ANILCA made several modifications for federal wilderness areas in Alaska, including allowing the use of aircraft and snowmachines "for traditional activities…and for travel to and from villages and home sites." These motorized uses are allowed in the Arctic Refuge's Molly Beattie Wilderness and the 1002 Area.

Congress in ANILCA required the Arctic Refuge to identify "special values of the Arctic Refuge;" this was accomplished through the Arctic Refuge's Comprehensive Conservation Plan (CCP; USFWS 1988) which includes "wilderness values" and "scenic and recreational values" as special values. The closest specific area called out as an area of "special value" (both "scenic" and "wilderness") is the subset of the Brooks Range called the Sadlerochit Mountains, the closest mountains to the Beaufort Sea and to the Point Thomson study area. Under "wilderness values," the CCP quotes from Congressional reports associated with the debate over ANILCA before the legislation passed:

> The Arctic National Wildlife Range is spectacularly scenic. Unlike elsewhere in the Alaska Arctic, the transition zone from mountains to coast is compressed into a relatively compact area. Within 150 miles there is a complete wilderness transect from the forested Brooks Range South Slope to the Beaufort Sea. (96th Congress, 1st Session, House Report No. 96-97, Part I, quoted in the CCP, USFWS 1988)

Besides this indication, most of the specific areas associated with "scenic values" in the CCP are in the mountains and visually remote from the study area. Nonetheless, scenic values in general are highlighted as among the Arctic Refuge's most important values.

3.5.4 State and Borough Visual Management

The State of Alaska Administrative Code addresses scenic values principally in the context of state park management. No state parks exist in the area. State regulations for the Department of Natural Resources (ADNR) include stipulations for designation of special use areas, and include a North Slope Special Use Area, which applies to state lands in the study area. The Administrative Code introduces special uses as follows: "The department has determined that these sites and areas of land have special scenic, historic, archeological, scientific, biological, recreational, or other special resource values warranting additional protections or other special requirements" (11 AAC 96.014). Although scenery is listed, the code does not state whether scenery or any of these other factors were the primary reasons for designation of the North Slope Special Use Area. The code merely requires a permit for overland motorized transportation, unless such use is for subsistence uses.

The North Slope Borough's Municipal Code at Title 19 defines a Conservation District for all undeveloped parts of the borough, including much of the general project area. While Title 19 indicates the Conservation District is "intended to conserve the natural ecosystem for all the various plants and animals upon which Borough residents depend for subsistence," there is no mention of scenic values.

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Chapter 4. Visual Resource Contrast Rating

4.1 INTRODUCTION TO VISUAL RESOURCE CONTRAST RATING

The BLM methods in Manual 8431 define the visual contrast rating system:

> The contrast rating system is a systematic process used by the BLM to analyze potential visual impact of proposed projects and activities…. The basic philosophy underlying the system is: The degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape."

The manual specifies the following steps to develop a contrast rating for a project that might alter the visual environment:

- **Obtain Project Description.** A detailed project description was provided by ExxonMobil (ExxonMobil 2009) and is contained in Chapter 2 of the EIS; it is not repeated here. ExxonMobil provided a detailed three-dimensional model of the proposed action components that visually describes the project in photo simulations presented in this section.
- **Identify Visual Resource Management Objectives.** As stated in subsection 3.5.2, above, the state and borough have no visual resource management objectives. The Arctic Refuge, on adjacent land, manages generally for preservation of the natural visual environment.
- **Select Key Observation Points.** Observation points were selected for summer and winter field work and visual simulations, as shown on Figure 3. Subsection 4.1.1, below, further describes the selection of observation points.
- **Prepare Visual Simulations**. Based on project field work at the KOPS, visual simulations have been prepared illustrating preexisting conditions and conditions for the applicant's proposed action, and they appear below (Figure 8 through 23) in subsections 4.2 through 4.7. Note that in illustrations of "preexisting conditions" at the Central Pad, the existing exploratory drilling equipment and camp were removed from site photographs to simulate the baseline condition.
- **Complete Contrast Rating.** Based on the visual simulations and field visits, contrast ratings have been prepared and are described below in subsections 4.2 through 4.7.

4.1.1 Selection of Key Observation Points

The study area—remote, principally undeveloped, treeless, and mostly flat—presents an environment in which views are not framed by terrain or vegetation. Typically, KOPs would be associated with places frequented by viewers (designated scenic overlooks along highways, camp sites, etc.), and this assessment attempts to follow this protocol even though the corridors are lightly used and have vaguely defined edges. The KOPs have been selected based in part on the Canning and coastal corridors shown in Figure 3, but also based on a selection of sites at graduated distances from the proposed project features. Table 2 describes and provides rationale for selection of the KOPs. Figure 3 illustrates their locations.

Table 2: Key Observation Points for Visual Assessment of the Point Thomson Project

Key Observation Point	Key Element Viewed (distance to KOP)	Rationale for Selection	Notes
West end Mary Sachs Island (State land)	Central Pad (1.8 mi.) Others: East Pad 4.25 mi West Pad 5.25 mi	Local communities use coastal corridor for transportation by snowmachine and small boat and may use barrier islands and mainland coast at the foreground distance for camps. There is also some recreation use.	Site represents a distance that boaters or snowmachiners would see if passing between the mainland and barrier islands, and possible view from any camp at this distance. Also generally represents views from an inland transportation route south of the project at a distance of about 2 mi. The distance is also similar to the closest point between the Arctic Refuge boundary and the project.
Brownlow Spit (State land near Arctic Refuge boundary)	East Pad (5 mi.) Central Pad (8.2 mi)	Brownlow Point is a destination for Kaktovik residents by boat and snowmachine; site of Native allotments; near Arctic Refuge boundary, used by Arctic Refuge visitors.	Similar distance as other points on the Canning River delta used by river rafters and inhabitants of the Arctic Refuge's bird research camp. Also represents views at the limits of the foreground-middle ground and background distance zones.
Shoreline West of Central Pad (State land)	Central Pad (0.16 mi) Others: West Pad (4 mi) Pipeline (1 mi)	Local communities use coastal corridor for transportation by snowmachine and small boat and use coastal locations in the study area for camps.	A close view of the Central Pad also generally represents close views of all the pads at an immediate foreground distance
Canning River Bluff (Arctic Refuge land)	Project Site (20 mi.)	Common destination for recreational floaters on Canning River in summer only.	Representative of other sites at the outer limits of the study area inside and outside the Arctic Refuge. Camp site from which the project site is at "seldom-seen" distance.
Aerial, at 500 ft above ground level at a point due south of Central Pad.	Central Pad (4.7 mi.) Others: East Pad 5 mi West Pad 7 mi	Commercial and private aircraft traverse the area carrying Kaktovik travelers and Arctic Refuge travelers. Elevation is minimum cruising altitude.	Meant to represent general flights to and from Kaktovik or points in the Arctic Refuge. Elevation and location is compromise between higher elevation overflights and those landing and taking off at Canning River or Point Thomson itself. Also, location is meant to help represent middle ground and background views from the south looking north.
Pipeline/Inland SW of W. Pad	Pipeline (225 ft.) West Pad (0.8 mi)	Proposed pipeline would run west from the drilling area for 22-50 mi. and would be visible to subsistence hunters and others.	Represents foreground view from the south with an ocean backdrop. Represents the stand-alone pipeline and the pipeline with facilities behind it.

4.1.2 The Nature of the Project

The project is a substantial industrial development. It includes the necessary facilities to drill for, produce, process, and export (via pipeline) hydrocarbons from beneath the Arctic Coastal Plain and beneath the Beaufort Sea (via directional drilling). The project proposes development along the coast on three gravel pads separated by about three to four miles. There are also airport and water supply facilities proposed farther inland, along with gravel roads and aboveground pipelines connecting the three pads, and an aboveground export pipeline extending to the Badami development area. The views of the project differ based on the KOP and which pad is closest to that observation point. On Central Pad, the project would construct substantial industrial facilities where previously there was only a gravel pad. The gravel pad would be expanded and built upon for drilling and hydrocarbon production and reinjection of non-exportable hydrocarbons back into the natural underground reservoir. Associated worker housing, maintenance facilities, fuel and water storage, a helicopter pad, and vehicles all would be part of the development. East Pad and West Pad would have more limited facilities focused on drilling for and production of hydrocarbons but would not have the processing, maintenance, and housing functions of Central Pad, so they would be smaller and more compact.

Figure 5 illustrates developments proposed for the three pads side by side at the same scale. West Pad development is anticipated to be similar in scale to that shown for East Pad. The visual simulations that appear later in this section focus on developments on the pads and less on connecting pipelines, roads, and the airport. Specifically, Figures 8-10 (Mary Sachs Island) include data for Central Pad and the connecting pipelines only; Figures 14-16 (Brownlow Spit) include data for the Central Pad and East Pad only; Figures 19-20 (Shoreline) include data for Central Pad only; Figure 24 (Aerial) includes data for the Central Pad, connecting pipelines, roads, and the airport gravel pad but not airport buildings or towers, an excavated lake, or other facilities or features; Figure 25 (West Pad and Pipeline) includes data for the West Pad and export pipeline only; and Figure 26 (Pipeline) includes data for the export pipeline only.

4.1.3 Guide to Contrast Rating Tables

The following subsections generally each present two tables. One of the tables is a “Landscape Characteristics and Project Characteristics” table, which lays out as simply as possible the basic elements of the visual landscape prior to 2009 Point. Thomson drilling activity using headings for landform/water, vegetation/snow cover, and structures and row headings for form, line, color, and texture. The same headings repeat in the lower half of each table but are specific to the project itself. The table format comes from the BLM Manual 8400 and is designed for a wide range of projects or activity types in a wide range of environments. Projects or activities can include timber harvests or open pit mines, where the project itself alters the line and form of vegetation or earth. It is important in reviewing the tables to understand that the lower half is focused on the proposed activity (the project) and not on the broader visual environment. This two-part first table summarizes narrative information presented for each KOP.

The second table in the subsections below is a “Contrast Rating” table. This second table summarizes the first table in the form of a strong-moderate-weak rating of visual contrast. It rates the contrast between the project’s visual characteristics and the broader landscape’s visual characteristics.

When actually completing the contrast rating, the BLM guidance indicates the following definitions:

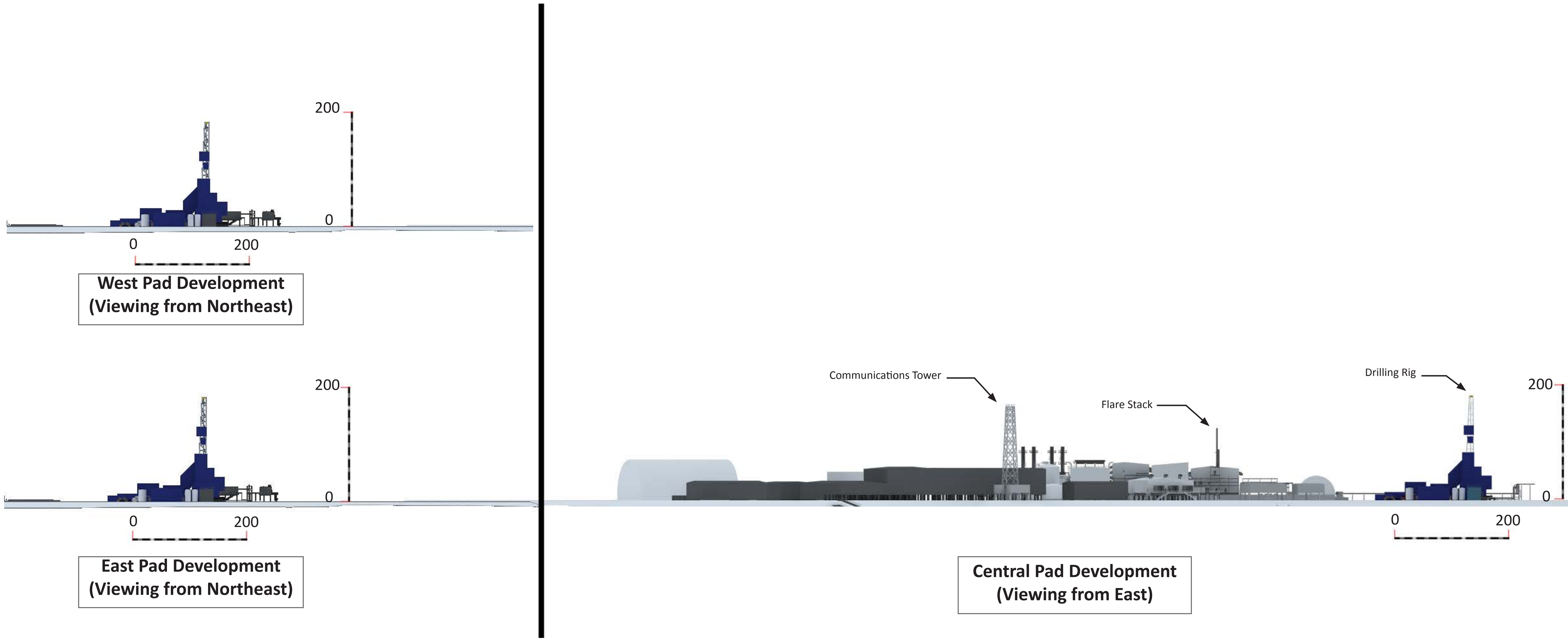
None: The element contrast is not visible or perceived.

Weak: The element contrast can be seen but does not attract attention.

Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.

Strong: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

The rating is done without regard to the number of people who would see the view. The numbers of viewers is acknowledged to be low.



Note: Drilling rig is shown at each site but is unlikely to be located on two sites at once.

POINT THOMSON PROJECT EIS

Figure 5

Proposed Point Thomson Facilities

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.2 WEST END MARY SACHS ISLAND (VIEWING CENTRAL PAD)

4.2.1 Basic Information

Visual Resource Inventory Class: III-A (summer), III-B (winter).

Location: T10N R23 E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from Central Pad: 1.8 mi

4.2.2 Characteristic Landscape Description—Mary Sachs Observation Point

4.2.2.1 Characteristic Landscape, Summer—Daylight

Figure 6 illustrates a characteristic view in summer, showing the gravel island and surrounding ocean.

Figure 6: View to the West from Mary Sachs Island (Summer, Daylight)

Land/Water

The immediate foreground is occupied by gravel of the island, unvegetated at the observation point, and by the nearby water of the Beaufort Sea and the enclosed marine waters between the island and the mainland. Multiple small pans of ice are collected against the shoreline, mostly white, some of them speckled with gray-brown mud or sand. The various shapes and sizes of the ice blocks add interest to the foreground view. The larger arctic ice pack is visible offshore as a bright white line. The mainland is visible as a thin yellow-ochre line. The color of the shoreline is tan to grey. The texture of the sand cobble is fine. Some woody debris along the shoreline adds a little more texture and color to the foreground view. The Brooks Range mountains are visible as a blue backdrop in the background distance zone.

Vegetation/Snow

No vegetation is visible in the immediate foreground. The yellow-ochre color of the mainland is the color of vegetation that has principally not yet greened up for the season. The vegetation edge is a horizontal line.

Structures

The baseline condition for this site is without structures and development. However, at HDR’s site visit, the Central Pad is in use for authorized exploratory drilling and is covered with a compact cluster of structures. The PTU-1 Pad also is occupied by buildings which are visible in Figure 6 as low boxy silhouettes distorted by heat waves.

4.2.2.2 Characteristic Landscape, Winter—Daylight

Land/Water

Figure 7: View to the South from Mary Sachs Island (Winter, Daylight)

The foreground-middle ground primarily is the snow-covered coastal plain. Mountains are visible in the far background. Land and water are virtually indistinguishable. During the March 2010 field visit, a sharp horizontal line is evident between the plain, which is darker (blue) and fog (bright white, somewhat backlit by sunlight). The mountains are a bluish uniform color, without texture. There are some areas of shiny reflective snow on lower mountain slopes—a gold color through a thin mist of fog. In the very immediate foreground is partially exposed gray dirt of the island, with very small tufts of grass about one inch tall. The relief of this low island above the ocean is not evident at this time of year, but snow is thin in some spots on the island, with sand visible (this would be called coarse sand but is not coarse visual texture). Figure 7 illustrates a representative view to the south (inland).

Vegetation/Snow

At this time of year, no vegetation is visible except for the wind-exposed tufts of grass in the immediate foreground. In the foreground is coarsely textured wind-sculpted snow drifts (sustrugi), fading to fine texture with distance. Snow depth is variable. Relief of drifts is variable at around one to two feet. The texture is evident as an irregular pattern of dark blue shadows and light blue sun-exposed snow with a bit of a pink-gold warm tone.

Structures

The baseline condition for this site is without structures and development. However, at HDR's site visit, the Central Pad is in use for authorized exploratory drilling and is covered with a compact cluster of structures. The PTU-1 Pad also is occupied by buildings which are visible as low, boxy, dark silhouettes on the horizon.

4.2.2.3 Characteristic Landscape, Winter—Darkness

HDR's winter field visit fell at the end of civil twilight, with the sky relatively bright in the west and dark in the south. The baseline condition, without human influences, includes vaguely distinguishable differences in shadow on the snow surface. A waxing moon high in the sky to the south casts a shadow, but with some light still coming from the sunset, the shadow is not strong. Strong, dark, deep orange sunset colors are visible in the west-northwest sky even at 9:45 p.m. Overall, the environment is all a very dark blue-gray (Payne's gray) with some variation in shades based on remaining light in the sky. Overhead, besides the moon, the brightest stars are visible but not a full array of stars. Under project baseline conditions, no point source of artificial light is visible, with the possible exception of a light visible at what was likely the Bullen Point radar station. Distant lights visible on the horizon to the west, both fixed and in motion, may have been located at Bullen Point, but it was not possible to verify the location or whether these were temporary lights associated with a soil clean-up effort (which had been seen from the air) or permanent lights associated with the radar equipment. In any case, the Bullen Point facility is slated to be demolished, and there will be no permanent lights there in the future.

4.2.3 Proposed Activity Description—Mary Sachs Observation Point

Figure 8 through Figure 10 simulate the view from Mary Sachs Island with the project in place. East Pad and West Pad would be visible also to the right and left of this view, but at much greater distance (similar distance to the views of East Pad from Brownlow Spit, see below).

4.2.3.1 Proposed Activity, Summer—Daylight

Land/Water

Figure 8 simulates the summer view. In summer, the flat line that is the edge of the mainland is altered and the low hills and distant, hazy mountains behind are partially blocked from view with insertion of project facilities.

Vegetation

The yellow-ochre line of tundra vegetation that is visible as the edge of the mainland is removed at the location of facilities and is not visible.

Structures

Facilities include vertical elements of the drill rig, a communications tower, and a narrow flare stack spaced at about equal distances across the view. Buildings and tanks form a blocky, undulating line lower than the towers. All facilities appear mostly silhouetted, but it is possible to make out some depth between facilities, and light and dark colored facilities appear different. A pipe system emerges strongly on the right-hand side of the facilities. Pipelines at greater distances behind the Central Pad facilities are visible running east and west, and disappearing in the distance to the west.

4.2.3.2 Proposed Activity, Winter—Daylight

Land/Water

Figure 9 simulates the winter daylight view. In winter, the crisp line of the horizon or demarcation between a layer of fog and the ground is broken by the dark silhouette of the industrial complex. The complex sprawls across a limited portion of the horizon and is cleanly separated from the rest of the natural backdrop.

Vegetation/Snow

Except for the silhouetted structures, the expanse of snow and its texture is as described above. Only on the pad is there elimination of snow, as further described below.

Structures

With snow cover, the environment is bright with reflected daylight, and the color of the structures is mostly not perceptible—the silhouette mostly appears to be a uniform dark blue or blue gray against the bright snow, and the silhouetted structures stand out boldly. A few colors, such as the blue of the drill rig, are barely visible. Three towers are slender vertical lines in the principally horizontal view. The structures otherwise appear as boxy and cylindrical forms that run together into a mostly horizontal arrangement.

Texture within the silhouette is vague, but the collection of structures taken together gives a sort of coarse texture.

4.2.3.3 Proposed Activity, Winter—Darkness

Figure 10 simulates the Central Pad at night. The base photo was taken at about 9:30 p.m. March 24, 2010, after sunset (8:25 p.m.) but before full darkness.

Land/Water

The daytime crisp horizon that define the coastal plain generally is not visible in these dark conditions; land and sky nearly blend together in a dark blue wash. The facilities define a horizon that otherwise nearly has disappeared.

Vegetation/Snow

The dim blue snow cover is subtly lighted with silver-blue and pink highlights from the sky in the west-northwest and from a quarter moon high in the sky to the south. The proposed facilities are brightly lit in contrast with the surrounding dimly-lit snow cover.

Structures

The lights mounted on and around the structures, taken together, create a mostly horizontal line across the surface; the three towers are not as prominent as they are in the daytime, although they are visible. The pipelines are barely visible as shadowy lines east and west of the Central Pad.

Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 8

View of Central Pad from Mary Sachs Island (Summer, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 9

View of Central Pad from Mary Sachs Island (Winter, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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Pre Existing Conditions—Simulated Condition Prior to 2009

Conditions, March 2010

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 10

View of Central Pad from Mary Sachs Island (Winter, Dark)

Date: 10/07/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.2.4 Contrast Rating—Mary Sachs Observation Point

Figure 8 through Figure 10 are photo simulations of the Central Pad area as seen from Mary Sachs Island in winter and summer. The contrast rating was completed from the daylight simulations, as shown in Table 3 and Table 4. Refer back to subsection 4.1.3 for explanation of these tables. Nighttime conditions provide the strong contrast of relatively bright lights in a dark (but not totally black) environment but are not addressed in the contrast ratings tables because mostly light and dark are visible, not form, line, other color not associated with lights, or texture.

Table 3: Landscape Characteristics and Project Characteristics—Mary Sachs Island

	Land / Water	Vegetation / Snow	Structures
Characteristic Landscape Description (Preexisting Condition)			
Form	Very flat overall. Mountains in background	Summer: Poorly visible thin line of mainland vegetation. Winter: No vegetation visible. Snow surface flat with small wind-carved drift pattern	None
Line	Horizontal. Mountains form a jagged line against sky in background	Summer: Vegetation visible as a line above the water. Winter: No vegetation line visible	None
Color	Summer: Light tan/gray island beaches. Blue sky, water, mountains. Winter: Whites and blues of snow and mountains. No water.	Summer: Yellowish/straw color Winter: White/blue snow	None
Texture	Fine (some coarser wind-carved snow in immediate foreground)	Summer: Fine vegetative texture. Winter: Fine snowdrift texture	None
Proposed Activity Description (Landscape with Proposed Project)			
Form	Flat, elevated gravel pad (barely distinguishable). Appears as snow in winter.	Summer: Vegetation partly displaced by development Winter: Project does not affect form associated with snow.	Combination of boxy, cylindrical, open-web tower structures. 'Fence' appearance of pipes on vertical supports.
Line	Horizontal	Summer: Line of visible vegetation broken by development. Winter: Project does not affect lines associated with snow.	Horizontal overall, with three tall vertical lines in towers.
Color	Summer: Gray/tan Winter: White/blue	Partly displaced by development of different colors.	Whites, dark blue, tan, gray. Many structures mostly silhouetted (dark).
Texture	Fine	Summer: Fine veg. texture partly displaced by development Winter: Fine snowdrift texture partly displaced by development	Some coarse texture in blockiness of forms. Individual surfaces appear smooth.

Table 4: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Mary Sachs Island

DEGREE OF CONTRAST		FEATURES											
		Land/Water Body				Vegetation/Snow				Structures			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form			W/S		W		S		W/S			
	Line			W/S			W/S			W/S			
	Color			W/S		W	S			W/S			
	Texture			W/S			W/S			W/S			

Legend: winter (W), summer (S), winter and summer (W/S)

4.2.5 Conclusion

Although close to two miles in the distance, when seen from Mary Sachs Island, the Central Pad development is large enough and different enough (particularly in form and color) that it effectively “fills the view.” Without similar forms and colors in the same proximity, the facilities dominate and draw the eye, so that the focus is on the facilities more than on the surrounding landscape. The contrast overall is strong.

This view is one that may be seen by users of the coastal corridor, such as local residents in small boats using the protected waters inside the barrier islands, or perhaps camping on the islands. This is a closer view of Central Pad development than any view from within the Arctic Refuge boundaries but is a similar distance and scale as the views of East Pad developments from the refuge boundary, although the Central Pad development includes more facilities and takes up more land than the proposed East Pad development.

4.3 BROWNLOW SPIT (VIEWING EAST PAD AND CENTRAL PAD)

4.3.1 Basic Information

Visual Resource Inventory Class: III-A (summer), III-B (winter).

Location: T9N R25E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from East Pad: 5 mi.

Distance from Central Pad: 8.2 mi.

4.3.2 Characteristic Landscape Description—Brownlow Spit Observation Point

4.3.2.1 Characteristic Landscape, Summer—Daylight

Figure 11: View West along Brownlow Spit, with caribou and Flaxman Island Bluff Visible in Distance (Summer, Daylight)

Figure 11 shows a characteristic view in summer.

Land/Water

The basic landform at this location is Brownlow Spit, which is a narrow gravel bar extending westward into the sea paralleling the mainland coastline. The topography is very flat. A dark bluff that forms the eastern end of Flaxman Island is visible to the west. Mountains associated with the Brooks Range are visible in the distant background and form a jagged line against the sky. The coastline and the spit form a distinct line between land and water in the foreground view. The texture is very fine with the smoothness of the water and the fine cobble beach making up Brownlow Spit views in the foreground. Logs and woody debris scattered along the shore of the spit add some interest and textural contrast to the immediate foreground. The water is deep blue; the cloudless sky may contribute to the blueness of the water on this particular day. The floating / melting ice pieces north of the spit add some color and texture contrast to the blue water in the foreground view.

Vegetation and Structures

There is no vegetation on the spit. No structures are visible. Mainland vegetation is not visible on the day of the summer visit, apparently lost in a minor mirage effect that makes the protected marine water south of the spit appear continuous to the sky or background mountains. Views during the winter visit indicated the mainland coastline might normally be visible, and like the summer view from Mary Sachs Island, the vegetation color of the mainland often may be visible.

4.3.2.2 Characteristic Landscape, Autumn—Darkness

The project field team visited during summer and during winter darkness (July and March) but not in autumn. However, the Lead and Cooperating Agencies were interested in addressing autumn conditions, especially related to refuge visitors. The summer snow-free experience and winter darkness experience are combined for this KOP with general knowledge of daylight at high latitudes, because this KOP best represents Arctic Refuge views.

The summer "midnight sun" sets for the first time (briefly) about July 27 each year. There is still 24 hours of twilight for the rest of the summer. Approaching the September 21 equinox, daylight disappears quickly, but until the equinox there is more daylight in each 24-hour period in the arctic than there is at any point farther south. By mid-August, nighttimes are twilight, and growing periods of actual darkness soon follow. This timing coincides with reported reduction in visitation by recreationists. Marine waters remain unfrozen well into October, which means remaining opportunities for travel by boat, especially for local residents. The landscape from this KOP in autumn would appear much the same as the summer description, except that at night land and water features would be dim, or invisible at a distance. At night, natural light likely would be the only light visible—the glow of the sun below the northern horizon, moonlight, stars, aurora borealis, and reflections of these natural lights in the water. Reflections of natural light may distinguish water from land. In rare circumstances of patchy fog or low clouds, it may be possible to make out a reflected glow from Kaktovik to the east or oil developments to the west. No structures would be visible, and no artificial lights would be visible in any direction.

Figure 12: View West along Brownlow Spit from the Air (Winter, Daylight)

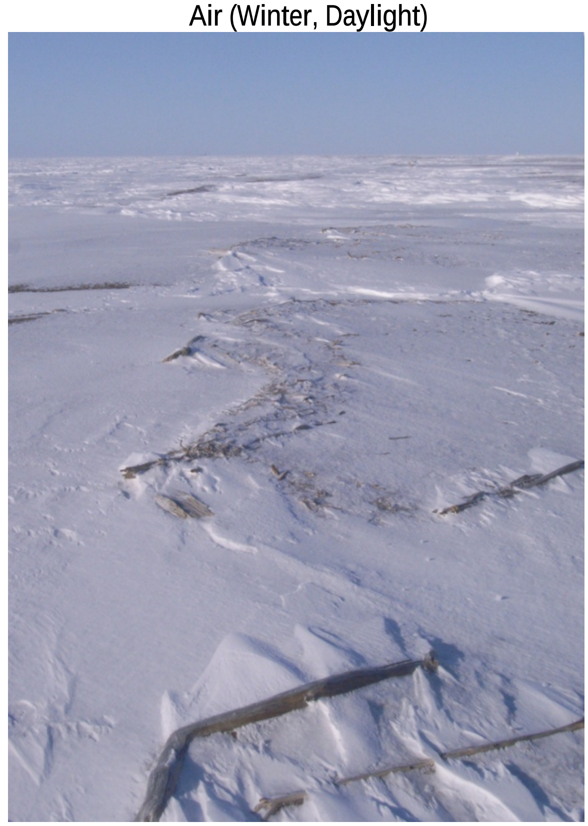

Figure 13: View West along Brownlow Spit from the Ground (Winter, Daylight)

4.3.2.3 Characteristic Landscape, Winter—Daylight

Figure 12 and Figure 13 show characteristic views in winter.

Land/Water Body

This site is located on a long, narrow, low, gravel strip in the ocean (a spit), running generally east-west. The low bluff along the spit creates a visual line separating the spit from the lower ocean surface. Except for the spit, the foreground-middle ground is dominated by the snow-covered coastal plain and frozen ocean surface, which largely run together. There is a hint of the coastal bluff to the left of the Figure 13 view, across the frozen "bay." A higher bluff is visible out the spit to the right (appears to be the eastern end of Flaxman Island). Mountains are visible in the distance to the south (to the left). The mountain color is mostly a uniform light blue-gray with a couple of areas of shiny reflective gold highlights off snow crust.

The horizon to the west is a sharp horizontal line, as shown in Figure 12 and Figure 13. The land at the horizon is very bright white. The sky is dusky blue-gray above. The color of the land at the horizon to the left fades to bluish and is darker than the sky. A distance out the spit to the west, and standing vertically, is a form that may be an ice chunk, but is too far away to identify.

Relief above the “bay” surface on the south side of spit is estimated at four to six feet. The beach is slightly stair-stepped from different water levels. The relief is greater on the ocean side—perhaps 10 feet or more.

The line of the spit and line of the horizon (roughly perpendicular) lead the eye somewhat to their intersection.

Vegetation/Snow

No vegetation is visible. In the immediate foreground, there is gravel visible where the wind has swept the snow off portions of the land surface. Where gravel is visible, it has a semi-coarse texture. These are black-red-brown stones generally less than 3 inches in diameter, some angular, some rounded, interspersed with firm snow. The foreground also includes driftwood and one large stump (these reportedly drift from the MacKenzie River Delta in Canada), which add considerable foreground interest.

The site is located on the south (inside) edge of the spit. The snow texture to left of spit on the “bay” surface is very coarse, with etched “canyons” about two feet deep. A hump probably caused by ice pressure is visible to the northeast, apparently on the frozen ocean surface.

The snow color is gray-brown where it is very thin over gravel and very bright white-gold on highlighted south-facing edges. Shadows are gray-blue, at different intensities.

Structures

There are no structures visible.

4.3.2.4 Characteristic Landscape, Winter—Darkness

The field visit is on a partly cloudy evening at about 11:00 p.m. with some layers of low cloud or fog to the west of Brownlow Spit. The sky directly overhead is mostly clear, with a very light haze that appears to be shifting during the observation. A near-three-quarter moon and a few of the brightest stars are visible, but the moonlight appears somewhat diffused by mist and some snow particles in the air (whether this is precipitation or windblown snow is not clear) and does not appear to cast a lot of light or sharp shadow. The baseline condition (without visible human influence) includes thin layers of low cloud vaguely visible to the south and west and lit somewhat by the moon. Dim light from the sun, long since set, remains in the sky to distant west-northwest, but is mostly faded and/or obscured by clouds.

Land/Water Body

The flat landform and frozen ocean surface generally is apparent but depth perception is difficult.

Vegetation/Snow

Vague dark shadows and slightly lighter areas are visible in the drifted snow around the site. The general aura is quite dark, with filtered moonlight making snow and cloud features partially visible, but the snow and sky visually run together as one.

Structures

In the baseline (pre-2009) condition, no structures or lights on structures are visible in any direction.

4.3.3 Proposed Activity Description—Brownlow Spit Observation Point

4.3.3.1 Proposed Activity, Summer-Daylight

Figure 14 simulates the view from Brownlow Spit in summer daylight.

4.3.3.2 Proposed Activity, Winter Daylight

Figure 15 simulates the view from Brownlow Spit in winter.

Land/Water Body and Vegetation/Snow

Land and (frozen) water appear much the same as under preexisting conditions, except where structures break the flat coastal plain horizon.

Structures

Project development is visible but small to the west/west-southwest. East Pad development is closer and therefore more sharply contrasted with the bright snow and sky (less obscured by mist and scattering of light by moisture or ice crystals in the atmosphere). Central Pad development is farther away and somewhat less distinct but is a larger development, spread somewhat farther along the horizon. It too is a dark feature on a bright horizon. Both developments appear almost entirely as silhouette. No particular color or texture is visible. The vertical towers and cranes on both sites create dark vertical lines, perpendicular to the strong horizontal line of the horizon. Although small in context of the vast plain and frozen ocean, the sites present unusual low blocky forms and spires. The distance is such that the developments appear small in a vast environment, but they are not lost because they are the only dark, blocky, and vertical visual elements on the horizon.

Pre Existing Conditions

Proposed Conditions

Note: Figures 13-15 show different apparent size and distance between facilities based on different camera location and different lens settings.

Note: Only one drilling rig is expected to be in use for the Point Thomson Project. It would move from pad to pad. In this figure, the drilling rig is shown on East Pad to illustrate the greatest visual contrast likely from this observation point.

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Figure 14

View of East and Central Pads from Brownlow Spit (Summer, Daylight)

Date: 10/07/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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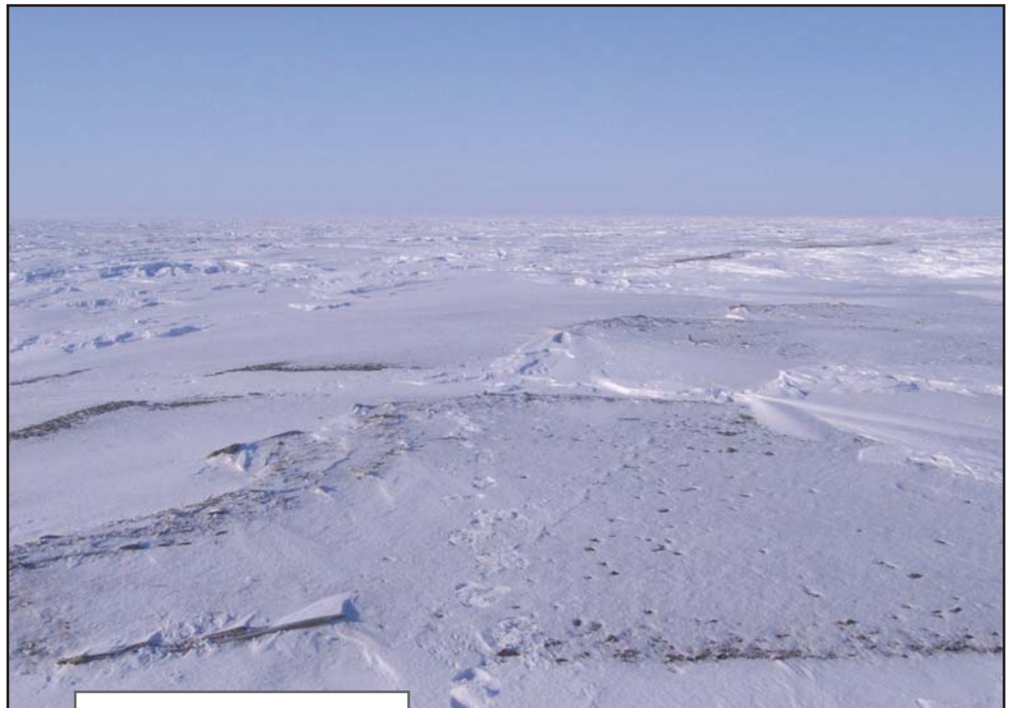

Note: Figures 13-15 show different apparent size and distance between facilities based on different camera location and different lens settings.

Note: Only one drilling rig is expected to be in use for the Point Thomson Project. It would move from pad to pad. In this figure, the drilling rig is shown on East Pad to illustrate the greatest visual contrast likely from this observation point.

POINT THOMSON PROJECT EIS

Figure 15

View of East and Central Pads from Brownlow Spit (Winter, Daylight)

Date: 10/07/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.3.3.3 Proposed Activity, Winter Darkness

Figure 16 simulates the view from Brownlow Spit during winter darkness.

Land/Water Body and Vegetation/Snow

Structures

The lights of the project, principally East Pad and Central Pad lights, are the only lights visible in any direction and therefore are quite prominent in the darkness, although they are located several miles away and appear small. The simulation captures the apparent size of the lighted facilities but does not capture the sense of dominance experienced by field personnel. Central Pad, at 8.2 miles away, is perhaps more prominent at night than East Pad (5 miles away), because the development is much larger and contains more lights. The East Pad drill rig lights at the midpoint and the top of the tower indicate the vertical structure is present. There are diffuse lights at the base of the tower creating a horizontal glow. With low-hanging layers of fog and Figure 14 simulates the view from Brownlow Spit in summer. East Pad development is closest (about 5 miles across Lion Bay). Central Pad development, which is more extensive, also is visible but is more distant (about 8 miles). For purposes of the simulation, the drilling rig is located on East Pad and not on Central Pad. In reality the drilling rig could be placed on either pad but would not appear on both simultaneously.

Land/Water Body

Both development areas break the horizon with a silhouetted new form, dark against the sky. East Pad appears much like an island across the water, and Central Pad looks as if it could be at the far end of the spit.

Vegetation

The edge of the coastal plain landform that creates the coast is barely visible. Vegetation is not visible at this distance, so is effectively unaltered in this view.

Structures

Although the structures are distant, they are clearly nonnatural, industrial developments. Vertical elements and the dark shading contrast sharply with the bright and horizontal water-sky horizon and draw the eye. Some vague internal texture and depth may be visible within each development, but except for towers, individual components are not distinct.

4.3.3.4 Proposed Activity, Winter Daylight

Figure 15 simulates the view from Brownlow Spit in winter.

Land/Water Body and Vegetation/Snow

Land and (frozen) water appear much the same as under preexisting conditions, except where structures break the flat coastal plain horizon.

Structures

Project development is visible but small to the west/west-southwest. East Pad development is closer and therefore more sharply contrasted with the bright snow and sky (less obscured by mist and scattering of light by moisture or ice crystals in the atmosphere). Central Pad development is farther away and somewhat less distinct but is a larger development, spread somewhat farther along the horizon. It too is a dark feature on a bright horizon. Both developments appear almost entirely as silhouette. No particular color or texture is visible. The vertical towers and cranes on both sites create dark vertical lines, perpendicular to the strong horizontal line of the horizon. Although small in context of the vast plain and frozen ocean, the sites present unusual low blocky forms and spires. The distance is such that the developments appear small in a vast environment, but they are not lost because they are the only dark, blocky, and vertical visual elements on the horizon.

4.3.3.5 Proposed Activity, Winter Darkness

Figure 16 simulates the view from Brownlow Spit during winter darkness.

Land/Water Body and Vegetation/Snow

Structures

The lights of the project, principally East Pad and Central Pad lights, are the only lights visible in any direction and therefore are quite prominent in the darkness, although they are located several miles away and appear small. The simulation captures the apparent size of the lighted facilities but does not capture the sense of dominance experienced by field personnel. Central Pad, at 8.2 miles away, is perhaps more prominent at night than East Pad (5 miles away), because the development is much larger and contains more lights. The East Pad drill rig lights at the midpoint and the top of the tower indicate the vertical structure is present. There are diffuse lights at the base of the tower creating a horizontal glow. With low-hanging layers of fog and wispy cloud, lights from the facilities reflect off the clouds over each site dimly as a sort of green-white glow.

4.3.4 Contrast Rating—Brownlow Spit Observation Point

4.3.4.1 Proposed Activity, Winter Daylight

Figure 15 simulates the view from Brownlow Spit in winter.

Land/Water Body and Vegetation/Snow

Land and (frozen) water appear much the same as under preexisting conditions, except where structures break the flat coastal plain horizon.

Structures

Project development is visible but small to the west/west-southwest. East Pad development is closer and therefore more sharply contrasted with the bright snow and sky (less obscured by mist and scattering of light by moisture or ice crystals in the atmosphere). Central Pad development is farther away and somewhat less distinct but is a larger development, spread somewhat farther along the horizon. It too is a dark feature on a bright horizon. Both developments appear almost entirely as silhouette. No particular color or texture is visible. The vertical towers and cranes on both sites create dark vertical lines, perpendicular to the strong horizontal line of the horizon. Although small in context of the vast plain and frozen ocean, the sites present unusual low blocky forms and spires. The distance is such that the developments appear small in a vast environment, but they are not lost because they are the only dark, blocky, and vertical visual elements on the horizon.

Pre Exisiting Conditions

Note: Prior to 2009, no light would have been visible under typical nighttime conditions. No simulation of this condition is necessary.

Conditions, March 2010

Note: Figures 13-15 show different apparent size and distance between facilities based on different camera location and different lens settings.

Note: Only one drilling rig is expected to be in use for the Point Thomson Project. It would move from pad to pad. In this figure, the drilling rig is shown on East Pad to illustrate the greatest visual contrast likely from this observation point.

Note: The Proposed Condition simulates lights from the East and Central Pads only. Airport lighting and other minor scattered project lighting data is not available

Proposed Conditions

Figure 16

View of East and Central Pads from Brownlow Spit (Winter, Dark)

POINT THOMSON PROJECT EIS

Date: 10/07/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.3.4.2 Proposed Activity, Winter Darkness

Figure 16 simulates the view from Brownlow Spit during winter darkness.

Land/Water Body and Vegetation/Snow

Structures

The lights of the project, principally East Pad and Central Pad lights, are the only lights visible in any direction and therefore are quite prominent in the darkness, although they are located several miles away and appear small. The simulation captures the apparent size of the lighted facilities but does not capture the sense of dominance experienced by field personnel. Central Pad, at 8.2 miles away, is perhaps more prominent at night than East Pad (5 miles away), because the development is much larger and contains more lights. The East Pad drill rig lights at the midpoint and the top of the tower indicate the vertical structure is present. There are diffuse lights at the base of the tower creating a horizontal glow. With low-hanging layers of fog and Figure 14 through Figure 16 are photo simulations of the East Pad and Central Pad areas as seen from Brownlow Spit in summer and winter daylight, and in winter darkness. From the daylight simulations, the contrast rating was completed, as shown in Table 5 and Table 6. Refer back to subsection 4.1.3 for explanation of these tables. The contrast rating in Table 6 is for daylight conditions only. The facilities during winter darkness, as the only lights in a completely dark environment, create strong contrast despite the distance. The contrast created by form and line is essentially the same in both seasons, as indicated in Table 5. The difference is primarily in the "color" contrast--in this case the strength of the silhouette against the background.

Table 5: Landscape Characteristics and Project Characteristics—Brownlow Spit			
Characteristic Landscape Description (Preexisting Condition)			
	Land / Water	Vegetation / Snow	Structures
Form	Very flat overall. Mountains in background	Summer: No vegetation visible. Winter: Snow as a flat plain across ocean and land.	None
Line	Horizontal. Mountains in background form a jagged line against sky.	Summer: No vegetation visible. Winter: Snow horizon flat, horizontal.	None
Color	Summer: Light tan/gray island beaches. Blue sky, water, mountains. Winter: Whites and blues of snow & mountains. No water.	Summer: No vegetation visible. Winter: White/blue snow.	None
Texture	Fine	Summer: No vegetation visible. Winter: Fine (some coarser wind-carved snow in immediate foreground)	None
Proposed Activity Description (Landscape with Proposed Project)			
Form	Gravel pads not distinguishable from other structures.	Summer: No vegetation visible. Winter: Snow is locally displaced by development	East Pad appears as a sort of triangular form with apex forming a tower. Central Pad appears as low boxy forms with two vertical towers.
Line	NA-project does not affect lines associated with land/water	NA-project does not affect lines associated with vegetation/snow	East Pad appears as horizontal base, vertical center line (inverted T). Central Pad generally horizontal line along horizon with two vertical towers.
Color	NA- project does not affect color associated with land/water	NA- project does not affect color associated with vegetation/snow	Mostly silhouetted (dark blue, black, gray). Structures hazy with distance, especially Central Pad and especially in winter.
Texture	NA-project does not affect texture associated with land/water	NA-project does not affect texture associated with vegetation/snow	Texture not discernable.

Legend: Not applicable (NA)

Table 6: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Brownlow Spit

DEGREE OF CONTRAST		FEATURES											
		Land/Water Body				Vegetation/Snow				Structures*			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form				W/S				W/S		W/S		
	Line				W/S				W/S		W/S		
	Color				W/S				W/S		S	W	
	Texture				W/S				W/S				W/S

Legend: winter (W), summer (S), winter and summer (W/S).

*Structures appear small and are not necessarily prominent at these distances; however they are the only structures visible on the horizon and the only dark and vertical elements in the view.

4.3.5 Conclusion

This view is one that may be seen by local residents staying at hunting camps or visiting Native allotment lands nearby, by those travelling along the sea ice or coast by snowmachine, and by occasional recreational boaters or kayakers in coastal waters. It also approximates views at similar distances (5.5. mi.) from within the Arctic Refuge at the bird research camp/informal airstrip area and on the lower part of the Canning River corridor. Although the facilities appear small and distant and contrast is not as strong as the view from Mary Sachs Island, the contrast remains, and structures attract attention. At this distance, the facilities do not dominate the view as they do from closer observation points, but without similar forms and colors in the same proximity, the facilities draw the eye. It is possible that some viewers who did not know the facilities were present would not notice them, but once noticed, the facilities tend to be the focus of the viewer because they are the unusual element in the view. Nighttime lights and reflection of those lights off of fog and low cloud layers clearly would dominate the night view.

4.4 SHORELINE WEST OF CENTRAL PAD (VIEWING CENTRAL PAD)

4.4.1 Basic Information

Visual Resource Inventory Class: III-A (summer), III-B (winter).

Location: T10N R23E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from Central Pad: 0.16 mi. or 845 ft.

4.4.2 Characteristic Landscape Description—Shoreline Observation Point

4.4.2.1 Characteristic Landscape, Summer—Daylight

Figure 17: View South Inland from the “Shoreline” Site Toward the Coastal Plain and Brooks Range (Summer, Daylight)

Figure 17 illustrates a characteristic view from the “Shoreline” observation point in summer, showing a small impoundment of marine water, the coastal plain, and the distant Brooks Range.

Land/Water

The basic landforms at this location are the coastal plain and the Beaufort Sea shoreline. The viewpoint is adjacent to the Beaufort Sea. Inland ponds are visible as well. The water appears mostly blue, reflecting the sky (likely more silvery on an overcast day). The topography is very flat. There is a very slight undulation in the tundra vegetation visible only in the foreground view. No rock outcrops or geologic formations are visible. Bare gravel is visible in the immediate foreground beach gravel.

Vegetation

Vegetation consists of arctic tundra. The vegetative texture is fine as there are no coarse plants and no trees or shrubs. The color ranges from a tan associated with the previous years’ dead plant material to green where new plant growth is emerging.

Structures

An old gravel pad exists and is the baseline condition for this study. Because ExxonMobil had already begun authorized exploratory drilling activity on this existing pad, it was not possible to see exactly what the pad would look like without development. Based on other old pads in the area seen principally from the air, it likely would appear from this viewpoint as a distinctly man-made feature. It would be only perhaps two feet above the surrounding tundra. Its northern edge, visible from this location, would appear continuous with the adjacent beach gravel. Its top surface and edges would be weathered and might show signs of variable subsidence (no longer a perfectly engineered structure). Cylindrical fuel tanks likely would be located on a portion of the pad and would be readily visible.

4.4.2.2 Characteristic Landscape, Winter—Daylight

Land/Water

The foreground-middle ground primarily is the snow-covered coastal plain and the frozen and snow-covered ocean surface to the north, which mostly run together visually as a single plain. The site is located on a narrow spit, which is a linear feature (a hump of sand/gravel) raised about three feet above the wind-sculpted snow of the surrounding "ocean." (Figure 18).

Mountains are visible to the south in the distant background and form a backdrop line against the sky. The mountains have a layer of haze along their lower flanks. Some variety in color and texture of the mountain faces is apparent. There is dark blue contrast that may be rock or simply deep shadows. In general, the powder blue shadow of the mountains is darker than the closer snow of the plain.

Vegetation/Snow

No vegetation is visible. Patchy dark gravel is visible on the spit, intermixed with wind-thinned snow. With as little as about 10 feet of distance, pebbles in this gravel appear as black contrast to the relatively bright snow. Up close, various shades of gray, brown, and black pebbles are visible.

Figure 18: View West from Shoreline Site, Ocean to the right; small bay and land to the left (Winter, Daylight)

The snow surface is sculpted by the wind into a chaotically regular series of drifts with a relief of perhaps 6-12 inches. The light on the snow, at the time of the field visit (just before sunset), on the inland plain and on the ocean, is a rosy gold color on highlights with multishade blue shadows, creating a complex texture that fades to fine texture with distance. In the immediate foreground, a weather-bleached log sticking out of snow contrasts with snow in color and linear form.

To the east, haze in the lower portion of the sky has a blue-gray cast at this visit and does not contrast sharply with the snow surface as does the view to the west. The horizon is very flat and crisp to the west, toward the evening light. The snow has a blue-purple cast when looking toward the sun (the observer sees mostly shadow on the snow), with a few shiny highlights on crusted snowdrift surfaces that reflect "warm" red-orange and dark pink evening sunlight colors.

To the west, the gravel spit is an irregular line of higher (but still low) topography leading toward the horizon. Nothing breaks the crisp horizon in a 180 degree view in this direction.

Structures

The preexisting landscape includes a low gravel pad. In winter it is not visible as a distinctly engineered structure.

4.4.3 Proposed Activity Description—Shoreline Observation Point

4.4.3.1 Proposed Activity, Summer

Figure 19 simulates the view from the Shoreline observation point in summer.

Landform/Water The expansion of the gravel pad and installation of drilling equipment, production facilities, and associated housing and maintenance facilities are located on the coastal plain immediately adjacent to but not in the ocean. The new pad is in the same location as the existing gravel pad but is larger and higher, a more prominent form in itself.. A bulkhead built up with gravel behind driven sheet pile walls is located in the edge of the ocean to provide barge access and is outside the left edge of the Figure 19 image. Gravel road embankments would be visible on the tundra as a raised landform principally to the right of the image.

Vegetation

The expanded pad and structures cover some tundra vegetation and replace the visibly “soft” organic surface with an engineered gravel structure and other facilities.

Structures

Structures are new elements in the view and their bulk completely dominates the view at this proximity. The Central Pad elements include several colors: blue and white are the most dominant colors with lesser amounts of yellow, red, turquoise, and black (detail colors based on current development). The texture of the feature surfaces is mostly smooth. The colors of the main elements on the pad blend fairly well with the blueness of the water but less well with summer vegetation colors (yellow/brown/green). Roads, pipelines elevated on pilings, and various markers and stakes would be visible across the tundra slightly to the right of this view. West Pad development also would be visible at the ocean edge of the coastal plain about 4 miles away. East Pad development would not be visible from this viewpoint; it would be screened by Central Pad development in the immediate foreground.

4.4.3.2 Proposed Activity, Winter

Figure 20 simulates the view from the Shoreline observation point during the day in winter.

Landform/Water

The forms of boxy buildings and tall towers visually break the flat form of the Arctic Coastal Plain and adjacent ocean. Structural forms partially replace the natural form. Where the Brooks Range offers a distant counterpoint to the plain, the structures partially block the mountains in this view.

Vegetation/Snow

The medium textures of winter snow are replaced in part by the smooth textures of individual building panels. Light and shadow on the combination of pipelines, building surfaces, open tower ironwork, railings, cranes, vehicles, and storage containers, and--in winter--piles of plowed snow) give an overall coarse texture with angular break points.

Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 19

View of Shoreline West of Central Pad (Summer, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 20

View of Shoreline West of Central Pad (Winter, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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Structures

A substantial, compact industrial facility dominates the view to the southeast at close range with large boxy blue structural forms and with two principal towers adding a distinct vertical element in an otherwise horizontal landscape. An elevated system of pipelines on regularly-spaced pilings surrounds the sides of the structure that are visible from this observation point. The pipeline system appears from this angle somewhat like a large fence. Low boxy structures are visible behind the pipe system.

The blue and white colors of many of the structural components are similar to blue shadows on snow in winter. Project lights stand out in dim and dark conditions.

To the west, in the nearly the opposite direction, West Pad development also is visible. East Pad development is mostly screened by the foreground development. The pipeline system is visible stretching across the plain toward West Pad as a continuous elevated line on regularly spaced pilings.

4.4.4 Contrast Rating—Shoreline Observation Point

Figure 19 and Figure 20 are photo simulations of the Central Pad area as seen from the Shoreline observation point in summer and winter. From these simulations, the contrast rating was completed, as shown in Table 7 and Table 8. Refer back to subsection 4.1.3 for explanation of these tables.

Table 7: Landscape Characteristics and Project Characteristics—Shoreline			
Characteristic Landscape Description (Preexisting Condition)			
	Land / Water	Vegetation / Snow	Structures
Form	Very flat overall/beach/spit/coastal plain with mountains in background to SE. Ponds visible inland. Summer: Ocean water to north. Winter: Continuous snow cover to north	Summer: Very low arctic tundra, patchy in foreground, continuous in background. Winter: No vegetation visible	Summer: Low, flat, weathered gravel pad (not highly engineered in appearance). Winter: Pad not expected to be distinguishable as a structure; snow obscures it.
Line	Horizontal. Mountains form a jagged line against sky in background.	Summer: Vegetation visible as a line above the water. Winter: No veg. visible	Horizontal pad. Vertical lines in boxy equipment on pad.
Color	Summer: Light tan/gray beaches. Blue sky, water, mountains. Winter: Blue snow & mountains. Pink & white highlights.	Summer: Yellowish / straw color Winter: Bluish snow	Summer: Gray/tan gravel pad.
Texture	Fine (some coarser wind-carved snow in immediate foreground in winter)	Summer: Fine veg. texture. Winter: Fine snowdrift texture	Fine texture gravel pad.
Proposed Activity Description (Landscape with Proposed Project)			
Form	Summer: Flat, elevated gravel pad. Winter: Same; appears as snow.	Summer: Patches of vegetation partly displaced by development. Winter: Vegetation not visible	Large boxy, cylindrical, and open-web-tower structures. Linear 'fence' appearance of pipes on vertical supports.
Line	Horizontal gravel pad, but elevated above natural ground surface and above old pad elevation.	Irregular lines of patchy foreground veg. displaced by expansion of pad.	Strong vertical in towers and pipeline supports, and building walls. Horizontal roofs and pipelines. Some horizontal lines in embankment sides and shadows.
Color	Summer: Gray/tan gravel Winter: Blue with white (snow covered)	Summer: Partly displaced by development	Blue, white with blue-gray shadow, silver. Some tan, gray, red, green. Gray-tan gravel embankment. Strong shadows.
Texture	Fine texture of gravel.	Summer: Partly displaced by development Winter: Fine snowdrift texture	Some coarse texture in blockiness of forms. Individual surfaces appear smooth. Side of gravel embankment is fine texture.

Table 8: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Shoreline Observation Point

DEGREE OF CONTRAST		FEATURES											
		Land/Water Body*				Vegetation/Snow				Structures			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form		W/S					W/S		W/S			
	Line			W/S				W/S		W/S			
	Color			W/S				W/S		W/S			
	Texture			W/S				W/S		W/S			

Legend: winter (W), summer (S), winter and summer (W/S).
*These columns compare existing structure (pad) with new.

4.4.5 Conclusion

From this observation point, the visual contrast is especially strong. The project creates a dominating new element in the view. This view represents only the closest views—those of a passing boat or snowmachine proceeding very close to the shoreline, or the view from a camp or person walking or hunting along the near-shore area.

4.5 BLUFF ABOVE CANNING RIVER TAKEOUT (VIEWING PROJECT AREA IN GENERAL)

4.5.1 Basic Information

Visual Resource Inventory Class: I-A (summer), I-B (winter).

Location: T6N R23 E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from project site: approximately 20 mi.

4.5.2 Characteristic Landscape Description—Canning River Observation Point

Landform/Water

Figure 21: View from Canning River Takeout area bluff downstream and northward toward proposed project site and Beaufort Sea (white sea ice visible on horizon) (Summer, Daylight)

The Canning River takeout, where some rafters floating down from the Brooks Range and upper Canning River pull their boats out of the water and await pickup by aircraft on “tundra tires,” was located during a summer field visit. This observation point is adjacent to the east side of the Canning River within the Arctic Refuge. The basic landforms at this location are a Canning River floodplain terrace, and bluffs that run approximately north-south forming the eastern and western edges of the Canning River floodplain. Figure 21 through Figure 23 presents characteristic views from the bluff top and river terrace. In the foreground distance zone, the eastern bluff rises gently at a consistent slope above the floodplain terrace. The soils of the terrace at the base of the bluff slope are saturated, and form small hummocky mounds. The color of the bluff ranges from brown, where snow has recently melted, to green, where more plants have emerged since snowmelt. The Canning River is a dominant feature in the foreground view at this location. The river (water) ranges in width from approximately 100 feet to 200 feet, with flows carrying substantial silt and looking visually muddy. The channel is braided with varying sizes of gravel bars interspersed throughout the river profile. The water color is a light tan, like light-colored chocolate milk. The rocky bars add to the textural contrasts with the flowing water. The sandy gravels are brownish-gray color that blends well at this time of year with the muddy river flows. After the high runoff period presumably the water clears up some and likely appears green to blue in color. No rock outcrops or geologic formations are visible other than the bluff. The Brooks Range Mountains are visible in the background distance zone to the south. Away from the river and on the bluff top is a vista or rolling terrain leading gently south uphill toward the mountains and north toward the ocean; partially visible in the distance, mostly as a bright white line of sea ice between the darker land and sky.

Figure 22: View from Canning River Takeout area, south from bluff top (Summer, Daylight)

Vegetation

Vegetation on the floodplain consists of arctic dwarf willows, short grass, and wildflowers. The vegetative texture is fine as there are no coarse plants and no trees or shrubs. Some color is added by many blooming wildflowers which included purple, white, and yellow flowers. These flowers are small and only distinguishable at close range. Bluff top vegetation forms a continuous carpet of tundra with tiny flowers.

Structures

A metal USGS monitoring station is present on the edge of the river. It is a piece of technical equipment, approximately human-sized, with metal legs and an antenna. No other structures are visible.

Figure 23: View from Canning River Takeout area, terrace looking upstream to the southwest (Summer, Daylight)

4.5.3 Proposed Activity Description—Canning River Observation Point

No simulation of the proposed facilities was undertaken. The field visit determined that the construction and operation activity at the coast near Point Thomson would be invisible from the river, because of the opposite river bluff, and it would be effectively invisible from higher ground nearby, because of the distance (about 20 miles). The following explains the field effort undertaken to arrive at this conclusion.

A summer field visit in July followed a winter field visit in March. In winter, a field observer went to the coordinates indicated by the Arctic Refuge as the common raft take-out, camp site, and aircraft landing area and determined that low river bluffs across a bend in the Canning River obscured long-distance views toward the coast. A winter attempt to find a location nearby with a long-distance view resulted in an observation on higher ground west of the river, where it was determined that the existing Point Thomson development was all but invisible at that distance (about 20 miles). That is, with effort, the development was visible with the naked eye, but it was not visible in photographs. Later research and consultation with the Arctic Refuge determined the original location for the take-out had not been accurate; the actual location was downstream less than a half mile and around a bend where visibility could be different.

During summer, observers were able to locate the Canning River takeout location on the east side of the river with confidence. The existing Point Thomson development was not visible from this location along the river, because a low bluff on the west side of the stream obscured views of the coast. A short walk up the low bluff on the east side of the river, similar to where people likely would go from a camp near the river, indicated that the existing development was nearly invisible even to those looking for it. The drilling rig showed up as a thin dark vertical line against distant white pack ice. The visibility was similar to that experienced during the winter from a similar distance. The development would not be noticed by the casual observer, and if pointed out, would not be identifiable as an industrial development. The development was not clearer when observed through binoculars. As in winter, the point was so distant that it did not appear in photographs taken.

Although the proposed activity would include a larger Central Pad development and separate developments at West Pad and East Pad, the scale of each would be similar to that observed. For example, the vertical line of the tower was the visible feature, and it is the same height and form as is proposed for future development. It was concluded by field observation that future development would not be visible from the river and would be effectively invisible from the eastern bluff or other points at similar distance. They would not show up in visual simulations. For these reasons, no simulation was attempted for this KOP.

4.5.4 Contrast Rating—Canning River Bluff Observation Point

Although no simulation was created for the Canning River Bluff KOP, contrast rating information was prepared from the bluff top, based on the site visit and field notes, and is provided in Table 9 and Table 10. Refer back to subsection 4.1.3 for explanation of these tables.

Table 9: Landscape Characteristics and Project Characteristics—Bluff Above Canning River Takeout

Characteristic Landscape Description (Preexisting Condition)			
	Land / Water	Vegetation	Structures
Form	Coastal plain with mild rounded hills and low river bluffs. River floodplain. Mountains to south. Ocean to north.	Very low arctic tundra.	None.
Line	Horizontal ocean/icepack. Low-angle diagonal bluff. Curving river edges and bluff lines.	Vegetation cover follows contour of land.	None
Color	River bars light gray/tan. River water light milky color and white reflections. Icepack bright white.	Yellowish / straw colored older vegetation.; green new vegetation Scattered white, yellow, purple tiny flowers	Minor point of metallic reflection from distant USGS station.
Texture	Fine.	Fine	None
Proposed Activity Description (Landscape with Proposed Project)			
Form	No project earth forms visible at all.	No project-related vegetation changes visible at all.	No form distinguishable.
Line	NA-project does not affect lines associated with land/water.	NA-project does not affect lines associated with vegetation.	Very small, faint, vertical line—virtually indistinguishable from background.
Color	NA- project does not affect land/water color.	NA- project does not affect color associated with vegetation.	Dark silhouette, but virtually indistinguishable from background.
Texture	NA-project does not affect land/water texture.	NA- project does not affect texture associated with vegetation.	None distinguishable.

This table represents summer only. Site not visited in winter. NA=not applicable

Table 10: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Bluff Above Canning River Takeout

DEGREE OF CONTRAST		FEATURES											
		Land/Water Body				Vegetation				Structures			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form				S				S				S
	Line				S				S			S	
	Color				S				S			S	
	Texture				S				S				S

Legend: winter (W), summer (S), winter and summer (W/S).
Note: contrast shown as 'weak' is very weak.

4.5.4.1 Conclusion

For the Bluff Above Canning River Takeout, visual contrast is very weak to nonexistent in daylight. The contrast may be strong in dim and dark conditions, and the project likely would appear as a single point of light for each developed pad area, but actual nighttime conditions were not directly observed. It is anticipated that most people would visit the area in summer when there were no dim and dark periods. The relatively few who might visit late in the season would most likely be in tents near the river and not on the bluff during the darkest conditions in the middle of the night. Local residents hunting in the area during winter and spring could camp in areas with a similar view and, based on observations made from this site and on GIS modeling of visibility (Figure 2), would be able to see lights at night.

4.6 AERIAL OBSERVATION POINT

4.6.1 Basic Information

Visual Resource Inventory Class: III A (summer), III B (winter).

Location: T9N R22 E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from Central Pad: 4.7 mi. and 500 vertical ft.

4.6.2 Characteristic Landscape Description—Aerial Observation Point

Landform/Water

This viewpoint represents an aerial view for air travelers crossing over the arctic coastline. The main elements in the view are ponds of water, the coastal plain and patterned ground, and the Beaufort Sea coastline with marine waters and offshore ice pack. At the time of field work in early July, large herds of caribou were visible from the air moving across the view. The basic landforms at this location are the coastal plain and the Beaufort Sea shoreline. Pond colors range from shiny light blue to deep dark blue. The distant ocean water appears almost black and contrasts sharply with white sea ice. The topography is very flat. There is a very slight undulation in the tundra vegetation visible only in the foreground view and not particularly discernable from the air. The patterned ground provides visual interest.

Vegetation

At the time of the field visit, the tundra is the color of straw, yellowish tan, with very fine texture. Wetter areas and drainage channels are greener. Vegetation is interspersed with many ponds and small winding drainages. The wet and relatively dry conditions and the patterned ground provide visually interesting vegetation patterns not readily apparent from the ground.

Structures

Under baseline conditions, there are essentially unaltered views from the air in all directions traveling over this location. Small old gravel pads are visible from the air in the general area.

4.6.3 Proposed Activity Description—Aerial Observation Point

Figure 21 is a photo simulation of the project area as seen from the aerial observation point in summer.

Landform/Water

The proposed airstrip, connection roads, and gravel staging area/water supply are visible in the foreground zone (approximately 1.75 miles away). These are mostly low, flat, linear structures placed on the coastal plain and do not stand out. The Central Pad development is at the far edge of the foreground-middle ground zone (4.7 miles away) and includes taller and bulkier facilities that interrupt the shoreline in color and somewhat in form. No rock outcrops or dominating geologic formations beyond the plain itself are visible. The dark ocean and bright white summer ice pack are visible beyond the shoreline.

Vegetation

Bare gravel of the constructed facilities replaces the yellow-browns and greens of the vegetation with lighter grays and tans of the surface, but from this distance the texture is not different, and color is only mildly different, depending on lighting.

Structures

The structures are mostly new in this view. The gravel mine pit is used as a water supply, so it appears as another pond (the mine pit/lake was not modeled in Figure 21). Although it is a pond with an engineered rectangular shape, it is not readily evident from this vantage point. Roads, the airstrip, and the pipelines have tidy engineered shapes that are symmetrical and visually pleasing but dissimilar from the surrounding natural conditions. Because of distance, the relative size of facilities appears small. The airstrip is the most visible, because it is relatively close and also relatively wide. The background structures and towers of Central Pad are visible as vertical lines and bulky forms against the brighter ocean waters. At this distance, the coastal vegetation also is somewhat dark. The structures from this distance appear as a compact cluster of blocky forms and towers that is readily evident. The simulation suggests the network of roads and pipelines, while visible, would be less visible than the larger pads and the development on Central Pad. Any view of new structures from an aerial vantage point would be relatively brief as the aircraft passed by.

4.6.4 Contrast Rating—Aerial Observation Point

Figure 24 is a photo simulation of the Central Pad and other facilities as viewed from the Aerial observation point. From this simulation, the contrast rating was completed, as shown in Table 11 and Table 12. Refer back to subsection 4.1.3 for explanation of these tables.

Table 11: Landscape Characteristics and Project Characteristics—Aerial

Characteristic Landscape Description (Preexisting Condition)			
	Land / Water	Vegetation / Snow	Structures
Form	Very flat overall, both coastal plain and ocean/icepack.	Low, flat, with patterns following drainage.	None
Line	Horizontal coastline and horizon. Oval/curving pond edges. Angular patterned ground in some places.	Curvilinear vegetation edge along waterways and pond edges.	None
Color	Blue water with white reflections and bright white ice. No bare earth visible.	Summer: Yellowish/straw color with some darker brown and some greener areas.	None
Texture	Fine.	Fine vegetation texture.	None

Table 11: Landscape Characteristics and Project Characteristics—Aerial			
Proposed Activity Description (Landscape with Proposed Project)			
Form	NA-project does not visibly alter land/water except for addition of a pond (not readily evident).	Flat vegetation surface partly overlain by development with minor vertical relief (pads) or strong relief (buildings/towers) at a distance.	Combination of boxy, cylindrical, open-web tower structures. 'Fence' appearance of pipes on vertical supports.
Line	NA-project does not visibly alter land/water	Vegetation partly replaced by arcs or roads, straight pipeline in distance, strong horizontal edges of airport	Faint arcs of road alignments. Strong vertical of towers.
Color	NA-project does not visibly alter land/water	Vegetation partly replaced by development of gray-tan color of gravel.	Some structures/towers silhouetted. Others appear with distance as light neutral tan colors.
Texture	NA-project does not visibly alter land/water	Vegetation partly replaced by development with fine texture.	Some coarse texture in blockiness of forms. Most texture of Central Pad not visible. Road and airport texture is fine.

Legend: Not applicable (NA)

Table 12: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Aerial Observation Point													
DEGREE OF CONTRAST		FEATURES											
		Land/Water Body				Vegetation				Structures			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form				S			S		S			
	Line				S		S			S			
	Color				S			S			S		
	Texture				S			S				S	

Legend: This table addresses summer (S) conditions only. Not visited in winter.

4.6.5 Conclusion

The Central Pad developments would contrast fairly strongly despite the distance because of unusual massing and form for the area, combined with vertical lines and contrast against the bright ocean water. Roads and pipelines at this distance contrast weakly. Any view from the air would take in a broad area, of which the project site would be a limited part. Different angles of view based on different aircraft route, elevation, or distance would alter the view simulated here. Different lighting could cause greater reflectivity off the pipelines and lighter colored gravel road and runway surfaces. Any view from aircraft would be of relatively short duration as the aircraft passed by but at distances similar to those simulated would attract attention because of contrast compared to the surrounding environment.

POINT THOMSON PROJECT EIS

Figure 24

View of Central Pad from Aerial Viewpoint (Summer, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.7 INLAND SOUTHWEST OF WEST PAD (WEST PAD AND PIPELINE)

4.7.1 Basic Information

Visual Resource Inventory Class: III A (summer), III B (winter).

Location: T6N R23 E Umiat Meridian. Figure 3 illustrates the locations of all KOPs.

Distance from West Pad: 0.8 mi. or

Distance from Export Pipeline (closest point): 225 ft.

4.7.2 Characteristic Landscape Description—Inland Observation Point

Landforms/Water

The basic landform at this location is the coastal plain. The topography is very flat. There is a slight undulation in the ground visible only in the foreground view. In places where there is patterned ground, it provides micro topographic relief. No rock outcrops or dominating geologic formations are visible. Ponds are visible and, in the distance, the white offshore icepack is visible.

Vegetation

Vegetation consists of arctic tundra. The tundra vegetative texture is fine as there are no coarse plants and no trees or shrubs. The color ranges from light tan to green where new growth is emerging, generally in wetter areas in and around standing water.

Structures

In the baseline condition, no structures are readily apparent from this location. A dark vertical line on the western horizon, apparent mostly with binoculars, is thought to be the top of a tower at the Badami development.

Other

At the time of the field visit, large numbers of caribou crossed from the western horizon to the northern horizon and eastward.

4.7.3 Proposed Activity Description—Inland Observation Point

Figure 25 and Figure 26 are visual simulations of West Pad facilities and the export pipeline from the Inland observation point.

Landform/Water

The proposed addition of the West Pad drilling rig, other facilities, and export pipeline are new elements in the northeastward view. The pipe itself is slightly above eye level and nearly blocks the horizon, but it is possible to see under it to the horizon. The project does not visibly alter landforms or water.

Vegetation

The vegetation itself is visually unaltered, except for pilings emerging from the tundra to support the pipeline and shadows cast on the vegetation.

Structures

The West Pad development is a new development and is partly obscured by the foreground pipeline, but the drilling rig presents a strong vertical line and tower form about 0.8 mile away. The export pipeline and its vertical support members are new structures and pass 225 feet from this observation point. The pipe is somewhat shiny silver and reflects colors from the sky and the ground. Against the bright horizon sky, the pipeline appears dark, and the shadowed portions of the vertical supports are darker than the backdrop vegetation. The pipeline is a long, linear element in the view and parallels the line of the horizon, the coast, and the distant ice pack. The pipeline supports add a vertical element to the view, but because they are capped by the long-running horizontal pipe, the visual contrast is reduced and the horizontal line dominates. The overall impression of the pipeline is that of a long horizontal element disappearing into the distance to the west. In the view to the northeast, with West Pad development visible behind the pipeline, the vertical tower dominates. The pipeline can be seen running eastward into the distance.

Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 25

View of West Pad and Pipeline from Inland Viewpoint (Summer, Daylight)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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Pre Existing Conditions

Proposed Conditions

POINT THOMSON PROJECT EIS

Figure 26

View of Export Pipeline (Summer)

Date: 09/29/2010
Photosimulation Author: HDR Boise Inc.
Sources: ExxonMobil, USGS, AK DNR, URS

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4.7.4 Contrast Rating—Inland Observation Point

Figure 25 is a visual simulation of the proposed West Pad development, with the export pipeline in the foreground; Figure 26 is a visual simulation of the pipeline alone. While the photos in Figure 26 were taken from the same inland location as those in Figure 25, those in Figure 26 were taken looking directly north instead of northeast. Figure 26 illustrates what the export pipeline might look like at most locations between Point Thomson and Badami. Table 13 presents the preexisting landscape characteristics and the projected project characteristics for comparison. Table 14 presents the contrast rating. Refer back to subsection 4.1.3 for explanation of these tables.

Table 13: Landscape Characteristics and Project Characteristics—Inland Observation Point

	Land / Water	Vegetation / Snow	Structures
Characteristic Landscape Description (Preexisting Condition)			
Form	Very flat overall, both coastal plain and ocean/ice pack.	Very low arctic tundra.	None
Line	Horizontal.	Horizontal edge of vegetation against ocean waters at coastline or of ponds.	None
Color	No bare earth visible. Pond reflections blue and white. Ocean ice pack white.	Yellowish / straw colored older vegetation with patches of new green vegetation.	None
Texture	Fine	Fine texture of tundra cover.	None
Proposed Activity Description (Landscape with Proposed Project)			
Form	No visible earth or water changes.	Vegetation partly replaced by development	Long, thin, cylindrical pipeline and supports visible from foreground to distant background. Combination of boxy, large, and open-web tower structures behind foreground pipeline.
Line	NA-project does not affect lines associated with land/water.	Line of tundra horizon broken by development.	Strong vertical line of tower. Strong horizontal line of pipeline.
Color	NA- project does not affect color associated with land/water.	Minor shadow locally darkens tundra.	Dark blue, tan, gray. Pipeline reflects bright sky and darker ground-cover colors.
Texture	NA-project does not affect texture associated with land/water.	No change to vegetation.	Individual surfaces appear smooth.

This site visited in summer only.
NA=not applicable

Table 14: Rating of Visual Contrast Between the Existing Characteristic Landscape and the Proposed Activity—Inland Observation Point

DEGREE OF CONTRAST		FEATURES											
		Land/Water Body				Vegetation				Structures			
		Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Elements	Form				S			S		S			
	Line				S			S		S	*		
	Color				S				S		S		
	Texture				S				S		S		

Site visited in summer only. *The horizontal line of the pipeline along would have only moderate contrast, while the “line” rating for the pipeline with West Pad would be “strong.”

4.7.5 Conclusion

This view point is representative of all of the pads as they might be seen from about a mile inland, with a tundra foreground. The stand-alone pipeline view is representative of the pipeline at close range at most points over its 22 mile length, as it would be seen from inland locations (but very similar to what it would look like from the opposite side as well). This vantage point would be most likely to be seen by hunters ranging inland from the coast and by those traveling the coastal corridor by snowmobile in winter. Although visually “light” because the pipe and supports are narrow, the structure runs from horizon to horizon, contrasting moderately or greater with the natural landscape, and therefore dominating the view at close range and likely continuously visible at distances two to three miles away. With West Pad and the export pipeline combined, the strong right-angle meeting of the vertical tower and horizontal pipeline create strong contrast of line and form.

4.8 SKY GLOW VISIBILITY FROM KAKTOVIK

Informal reports at the time of project scoping indicated that Kaktovik residents sometimes were able to see a glow in the sky from the lights of the Point Thomson exploratory drilling rig. Visualization experts for the project modeled the potential for the project to cast a reflection in the sky that might be seen from Kaktovik, 60 miles from the project site. Curvature of the earth would hide any direct view of project lighting from Kaktovik. Night sky reflections would be entirely dependent on atmospheric conditions. Clear night conditions would reveal no effect as seen from Katovik. The visualization team modeled atmospheric conditions with cloud cover at altitudes of approximately 3,000-6,000 feet above ground level at the project site, and with limited low-elevation haze or fog. Conditions between Kaktovik and the project site were assumed to have no significant low cloud cover or fog that would obscure the view of clouds at the project site. Project lighting was modeled, including lighting intensity for all three proposed pad developments (but not the airstrip, for which data were not available). Based on observed reflection off low cloud layers during the March 2010 field visit at Brownlow Point, the visualization team prepared a simulation of the reflection as it might be seen from 60 miles away.

In the simulated image, a very low intensity glow was visible in a dark black image, but the light contrast was such that the glow was not visible on a computer screen at typical image sizes and was not visible at all when the image was printed. Therefore, the simulation was not published as part of this document. Nonetheless, the model agreed with informal reports from Kaktovik residents that Point Thomson reflected light may sometimes be visible from the Kaktovik area and other locations approximately 60 miles away. Such reflected light would occur only under certain atmospheric conditions. When it did appear, the reflected light would likely appear quite dim but in very dark conditions would be visible. The glow might not be visible within the community of Kaktovik because of community lights and reflections surrounding the viewer. The glow might be visible only on the outskirts of the community where the surroundings would be darker. It is likely that, at certain times, reflected light from the Prudhoe Bay area similarly may be visible from Pt. Thomson or from the western edge of the Arctic Refuge, which are about 60 miles from the Prudhoe Bay development. No reports of seeing reflected light from Prudhoe Bay at Kaktovik (120 miles) are known.

4.9 VIEW FROM WILDERNESS BOUNDARY

The Molly Beattie Wilderness boundary within the Arctic Refuge lies 30 miles inland from the coast, measured from Point Thomson. The visual assessment team had anticipated completing a simulation based entirely on GIS analysis and not on photography. However, based on the relative invisibility of current drilling operations at Point Thomson from a distance of 20 miles, it was determined to be unwarranted to complete a simulation at 30 miles. It is likely that areas within the wilderness boundary that have unobstructed views to the coast at Point Thomson would be affected by a direct view of lights from the project in dim and dark conditions. Compare Figure 1 and Figure 2; the areas affected are principally the north face of the Sadlerochit Mountains, some low-angle north-facing slopes at the base of these mountains, and the ridge tops of the Shublik Mountains. With minor “spot” exceptions, those parts of the coastal plain designated as wilderness within 5-10 miles of the Canning River, where most use would be expected, would not be within sight of the facilities, according to the model. No visibility during daylight is expected anywhere within the wilderness boundary, unless there were perfect sun angles to cause a bright reflection or unless there was a large plume of dark smoke from an unusual flare event that called attention to the site. See also discussion below in Section 4.10.1.

4.10 OTHER ELEMENTS OF VISUAL IMPACT

4.10.1 Visibility Distances

As indicated in Sections 2.2 and 2.3, limits on visibility on the Arctic Coastal Plain are principally atmospheric, not topographic. Most vistas are not framed by vegetation or topography but are wide open and can include very long views. Because mere presence of human activity or structures in a *de facto* or designated wilderness environment can indicate adverse impact to wilderness recreationists (see Section 2.3), and at the request of resource agencies, this analysis examined the concepts of maximum visibility—how far one might see in good conditions—especially as pertains to the Arctic Refuge and its management for wilderness qualities.

A GIS exercise modeled an observer at five feet above the surface elevation and an observed point at Point Thomson 150 feet above the surface elevation (based on ExxonMobil statement of the expected height of a flare on a tower at the proposed production facility; ExxonMobil 2009). The digital elevation model for the Arctic Coastal Plain is coarse, but the mapped conclusions (Figure 2) are meant as a tool to help define roughly how far a person might be able to see a light or reflection or possibly the structures themselves if inhibited only by topography and curvature of the earth. Including ridge tops and peaks in the Brooks Range, the model indicates that the theoretical maximum is well in excess of 100 miles.

Detailed visibility studies are not available for the North Slope in Alaska. In the Lower 48 states, in the western U.S. under natural conditions (i.e., without air pollution), visibility is 110 to 115 miles. In the eastern U.S., where the climate is more humid, visibility typically is 60 to 80 miles (Malm, 1999). It is therefore likely that the theoretical maximums shown in the model for the project site could be achieved (60-120 miles). This is consistent with actual experience, which showed that far mountain ridges of the Brooks Range were readily visible from the coast. The primary question regarding views *from* those distances *to* project facilities is the relative size of the project facilities. As noted in Sections 2 and 4.5, field experience in March and July 2010 indicated that the forms of existing Point Thomson structures and the drilling rig tower were barely visible with the naked eye during daylight at 20 miles to observers who knew where the facilities were located and were specifically looking for them. However, as soon as a helicopter left the ground at night near the Arctic Refuge boundary at the coast, lights of the greater Prudhoe Bay area were visible about 60 miles away. Therefore, it is assumed that the more distant views would pertain mostly for light at night or reflection during the day, or possibly for larger plumes of exhaust or flare smoke.

The most distant areas in Figure 2where people might be expected to camp are bluffs west of the Canning River or around the base of the Sadlerochit Mountains, some 35-40 miles from the proposed project site. These locations could apply to recreational visitors and to North Slope Borough residents at hunting camps. It seems likely that under good conditions lights at night or reflection or exhaust plumes in daylight at the project site could be visible from these distances and that people would become aware of man-made structures and development.

The more distant areas indicated in Figure 2 are unlikely to be viewpoints for seeing nighttime lights from the project for a combination of the following reasons:

- Summer in the arctic includes 24-hour daylight, and most project lights would not be on or would not be visible under the influence of the “midnight sun.”

- Summer is the time when the vast majority of the most sensitive users are likely to visit the Arctic Refuge; few visitors would be expected in the snow season when longer periods of darkness occur, although local residents are likely in hunting camps during these periods

Overall visitation to the Arctic Refuge and the eastern portion of the Arctic Coastal Plain is low (for example, the Arctic Refuge reports about 1,000 recorded visitors per year in the entire refuge—see EIS Recreation section), and only a small fraction of the visitors ever would be in the area shown in Figure 2 as visible to Point Thomson.

- Even autumn visitors experience only a moderate period of darkness at night.
- During nighttime hours when dim and dark conditions might occur, most Arctic Refuge visitors or local residents in hunting camps are unlikely to be on the high ridges and mountaintops and are more likely to be in a camp at lower elevations, where views to the coast would more likely be obscured by topography.

This analysis indicates that people on the Arctic Coastal Plain, in the Molly Beattie Wilderness, and on mountain slopes outside the 20 mile primary study area radius may be able to see lights, reflections, or plumes and become aware that the visual environment includes man-made features. However, 24 hour daylight, atmospheric moisture, and fog or clouds all are likely on most occasions to keep the project from being visible. Also, when conditions did allow views of project lights from mountain slopes, the observer likely would be at sufficient elevation that he or she also would be seeing lights of the Prudhoe Bay complex on the horizon or would see lights of Kaktovik. That is, project lights likely would not be the only lights visible but would be part of a cumulative reduction in natural dark conditions when combined with lights that already exist.

4.10.2 Motion and Visual Effects to Wildlife

Resource agencies requested that this visual assessment provide information that might be useful to wildlife biologists. A brief treatment of motion associated with the project is presented below. See Wildlife sections of the EIS for further information on effects to wildlife.

Because of predator-prey relationships between species, detection of and response to visual motion may be keys to wildlife survival. Motion in the study area under baseline conditions typically is related to wind or wildlife movements. Motion based on wind includes clouds moving on the wind, low shrubs and grasses waving or vibrating in the wind, or substantial snaking streams of loose snow blowing in the wind. Summer pack ice also moves in and out under the influence of wind and tide, and ocean or river waters sometimes carry sticks, logs, boats, and rafts. Wildlife movement includes large numbers of birds and herds of caribou that migrate to and through the area, as well as individual animals. Occasional snowmachines, motorized boats, people walking, and overflying or landing aircraft are the other typical, if relatively rare, movements of humans.

During construction and operation of the project, human-caused motion would increase, with greater aircraft operations; frequent vehicle traffic on infield roads between drilling pads and access ice roads in winter; exhaust plumes from structures, large snowplow plumes from higher-speed plowing on roads as observed during winter fieldwork, and dust plumes behind vehicles; flares and lights that would vary in intensity or turn on and off; and large barges in motion on near-shore waters. The project would include bright and reflective surfaces, including intentional reflectors marking roads or equipment; and buildings, pipelines, and other structures that may have shiny stainless steel, aluminum, or light-colored exteriors. These may catch the attention of an animal or person that crosses the path of reflected sunlight and bring attention to facilities that might otherwise not readily be visible. Small reflective road markers waving in the wind, for example, were observed causing blinking reflections over long distances (likely a mile or more) during winter field work conducted for this visual assessment.

4.11 VISUAL CONTRAST AND IMPACT CONCLUSIONS

The visual simulations and contrast ratings indicate strong visual contrast between views of the project site under preexisting conditions and views under proposed project conditions. This general statement must be balanced by the low number of viewers likely to be in the study area in any given year (see section 3.3.2, above) and the relatively high sensitivity of recreationists and local users who would be in the study area.

The contrast is strong from most KOPs, particularly from the coastal corridor, decreasing with distance. The contrast remains strong in the foreground-middle ground views (up to about five miles). Views beyond five miles are less affected, and it is likely that people unaware of the project location would not immediately notice the facilities unless conditions were dark and project lights caught their attention, or reflection, dust, exhaust plume, aircraft activity, or possibly noise caught their attention and drew their eye. Virtually the entire Canning River corridor normally used by recreationists is at, or beyond, this five-mile range.

The distances of the various KOPs indicate that all facilities in the Applicant’s proposed action would be readily visible from the coastal corridor. The East Pad location would create strong contrast and would be readily visible from the western edge of the Staines River/Canning River delta at the Arctic Refuge boundary (two miles in the distance—use Figure 5 for an indication of East Pad’s general form and massing, and use Figure 8 through Figure 10 for a sense of similar distance). However, East Pad development would be less visible at the USFWS bird research camp on the delta (6 mi.) where some recreational users fly in and out, and on the lower few miles of the Canning River corridor (Figure 13 through Figure 15 from Brownlow Spit illustrate a similar distance of 5 mi.). Central Pad and West Pad are far enough away that their contrast is substantially diminished from all but the very edge of the Arctic Refuge, but contrast is such that they would be visible during the day, and lights would strongly stand out during dim and dark periods. West Pad may be not visible except as a light during dark periods.

The other common Arctic Refuge fly-out point from the Canning River is just outside the primary study area, at 20 miles from the coast and about 17 miles from the nearest proposed project component (airstrip). The project from this KOP (the bluff immediately above the river) would be in the “seldom seen” zone from this location, if mapping were from this location only, and it is unlikely that project components would be noticed at all under most daylight conditions by most people. However, lights would be readily visible during dim and dark conditions (beginning in late August).

From the coastal corridor, the proposed facilities would be immediately visible with strong contrast over a stretch of about 10 miles of coastline. With Bullen Point development within five miles of West Pad and Badami development another six miles west, the visual effect along the coast would be altered so that the entire coastal corridor from Prudhoe Bay to the Canning River delta (Arctic Refuge) would be within view of industrial development; as one industrial feature was beginning to fade from view, another would be growing more visible.

Boaters passing by the three pads would experience visual impacts between those indicated in the Shoreline simulations (Figure 18 and Figure 19) and the Mary Sachs Island simulations (Figure 8 through Figure 10), depending on how far the boat was from shore and its location between development nodes.

For snowmachiners or hunters, the same would be true inland, with a view of the opposite sides of the facilities.

The BLM Manual 8431 visual contrast rating worksheet poses two final questions, as follows:

- Does the project design meet visual resource management objectives?
- Are additional mitigating measures recommended?

The only agency with visual resource management objectives is the USFWS/Arctic Refuge. Because the project is located outside the refuge on state land, the project is not within the direct management purview of the USFWS. However, the project is within view of the Arctic Refuge, with a moderate to strong degree of contrast from the northwest corner of the refuge. Even though there are few recreationists overall on the Canning River corridor, and even though few of them would be likely to notice the facilities immediately, the presence of industrial facilities where previously there were none is likely to be of management concern for the Arctic Refuge and its visitors.

Official mitigation measures to reduce visual impact along the coastal corridor and from the Arctic Refuge/Canning River corridor will be addressed in the EIS not only in the Visual Resources section but the Arctic National Wildlife Refuge and Recreation sections. The types of mitigation that could reduce visual impact include:

- Creating greater distance between corridors or view points and industrial facilities, particularly permanent towers (communications tower, flare stack). Possibly provide for flaring inside a low-level containment rather than on a tower.
- Reducing the potential of the project to call attention to itself by moving the airstrip and/or aircraft operations farther from corridors and view points, and by minimizing flares, exhaust plumes, and dust.
- Reducing light emissions by turning off lights when not needed, aiming lights westward and inland (away from corridors) and downward.
- Minimizing use of smooth reflective surfaces.

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Appendix A

BLM Manual 8410 - Visual Resource Inventory

Please see Instructions at bottom of page on how to rate the visual quality of scenic resources.

Illustration 1 - Scenic Quality - Explanation of Rating Criteria

1 - Scenic Quality - Explanation of Rating Criteria
Landform
Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental, as the Grand Canyon, the Sawtooth Mountain Range in Idaho, the Wrangell Mountain Range in Alaska, or they may be exceedingly artistic and subtle as certain badlands, pinnacles, arches, and other extraordinary formations.
Vegetation
Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Consider also smaller scale vegetational features which add striking and intriguing detail elements to the landscape (e.g., gnarled or windbeaten trees, and Joshua trees).
Water
That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.
Color
Consider the overall color(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "color" are variety, contrast, and harmony.

Adjacent Scenery
Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-5 miles, depending on the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units which would normally rate very low in score, but he influence of the adjacent unit would enhance the visual quality and raise the score.
Scarcity
This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.
Cultural Modifications
Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. Rate accordingly.

Illustration 2 - Scenic Quality Inventory and Evaluation Chart

Key factors	Rating Criteria and Score	.	.
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. 5	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. 3	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. 1

Key factors	Rating Criteria and Score	.	.
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. 5	Some variety of vegetation, but only one or two major types. 3	Little or no variety or contrast in vegetation. 1
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. 5	Flowing, or still, but not dominant in the landscape. 3	Absent, or present, but not noticeable. 0
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. 5	Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element. 3	Subtle color variations, contrast, or interest; generally mute tones. 1
Influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. 5	Adjacent scenery moderately enhances overall visual quality. 3	Adjacent scenery has little or no influence on overall visual quality. 0
Scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. * 5+	Distinctive, though somewhat similar to others within the region. 3	Interesting within its setting, but fairly common within the region. 1
Cultural	Modifications add favorably to	Modifications add little or	Modifications add

Key factors	Rating Criteria and Score	.	.
modifications	visual variety while promoting visual harmony. 2	no visual variety to the area, and introduce no discordant elements. 0	variety but are very discordant and promote strong disharmony. -4

* A rating of greater than 5 can be given but must be supported by written justification.

INSTRUCTIONS

Purpose: To rate the visual quality of the scenic resource on all BLM managed lands.
How to Identify Scenic Value: All Bureau lands have scenic value.
How to Determine Minimum Suitability: All BLM lands are rated for scenic values. Also rate adjacent or intermingling nonBLM lands within the planning unit.
When to Evaluate Scenic Quality: Rate for scenery under the most critical conditions (i.e., highest user period or season of use, sidelight, proper atmospheric conditions, etc.).
How to Delineate Rating Areas: Consider the following factors when delineating rating areas.

1 Like physiographic characteristics (i.e., land form, vegetation, etc.).

2 Similar visual patterns, texture, color, variety, etc.

3 Areas which have a similar impact from cultural modifications (i.e., roads, historical and other structures, mining operations, or other surface disturbances).

Explanation of Criteria: (See Illustration 1)
NOTE: Values for each rating criteria are maximum and minimum scores only. It is also possible to assign scores within these ranges.

SCENIC QUALITY
A = 19 or more
B = 12-18
C = 11 or less

8410 Visual Resource Inventory

Illustration 11 - Determining Visual Resource Inventory Classes

1. Basis for Determining Visual Resource Inventory Classes

1. Class I. Class I is assigned to all special areas where the current management situations requires maintaining a natural environment essentially unaltered by man.

2. Classes II, III, and IV. These classes are assigned based on combinations of scenic quality, sensitivity levels, and distance zones as shown in the following matrix:

Visual Sensitivity Levels

<table>
<tr><td></td><td></td><td colspan="3">High</td><td colspan="3">Medium</td><td>Low</td></tr>
<tr><td>Special Areas</td><td></td><td>I</td><td>I</td><td>I</td><td>I</td><td>I</td><td>I</td><td>I</td></tr>
<tr><td rowspan="6">Scenic Quality</td><td>A</td><td>II</td><td>II</td><td>II</td><td>II</td><td>II</td><td>II</td><td>II</td></tr>
<tr><td rowspan="2">B</td><td rowspan="2">II</td><td rowspan="2">III</td><td>III*</td><td rowspan="2">III</td><td rowspan="2">IV</td><td rowspan="2">IV</td><td rowspan="2">IV</td></tr>
<tr><td>IV*</td></tr>
<tr><td>C</td><td>III</td><td>IV</td><td>IV</td><td>IV</td><td>IV</td><td>IV</td><td>IV</td></tr>
<tr><td></td><td>f/m</td><td>b</td><td>s/s</td><td>f/m</td><td>b</td><td>s/s</td><td>s/s</td></tr>
<tr><td></td><td colspan="7">DISTANCE ZONES</td></tr>
</table>

* If adjacent areas is Class III or lower assign Class III, if higher assign Class IV

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Appendix O

Noise Technical Report

POINT THOMSON PROJECT EIS

Noise Technical Report

U.S. Army Engineer District
Alaska Regulatory Division CEPOA-RD
Post Office Box 6898
JBER, AK 99506-0898

July 2011

Contents

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List of Acronyms and Abbreviations

AEA	Alaska Energy Authority
Arctic Refuge	Arctic National Wildlife Refuge
CPF	Central processing facility
dB	Decibels
dBA	Decibels, A-weighted scale for human hearing
EIS	Environmental Impact Statement
ExxonMobil	Exxon Mobil Corporation
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
Hz	Hertz
kHz	kilohertz
L_{10}	Sound level exceeded 10 percent of the time
L_{50}	Sound level exceeded 50 percent of the time
L_{90}	Sound level exceeded 90 percent of the time
L_{dn}	Day-night average sound level
L_{eq}	Equivalent-continuous sound level
L_{nat}	Natural ambient sound level
m/s	Meters per second
μPa	micropascal
MAF	Minimum audible field
NMFS	National Marine Fisheries Service
NPS	National Parks Service
NSB	North Slope Borough
SLM	Sound Level Meter
USFWS	U.S. Fish and Wildlife Service
Corps	U.S Army Corps of Engineers

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Chapter 1. Introduction

Exxon Mobil Corporation's (ExxonMobil's) proposed Point Thomson project is located on the northern edge of Alaska, east of the Prudhoe Bay oil fields and immediately west of the Arctic National Wildlife Refuge (Arctic Refuge). The area is principally undeveloped (no roads or communities) but sees some use for subsistence hunting and gathering, local transportation, and recreation. The project aims to produce hydrocarbons from a large, high-pressure reservoir that lies beneath a portion of the Beaufort Sea and a portion of the mainland and requires construction of multiple wells, processing facilities, housing, an airport, an elevated pipeline, and other structures. The environmental impact statement (EIS) for the project describes the proposed action and alternatives in detail.

The lead federal agency for the EIS is the U.S. Army Corps of Engineers (Corps). The following are federal and state cooperating agencies in the EIS effort: U.S. Fish and Wildlife Service (USFWS), as manager of the Arctic Refuge; the Environmental Protection Agency, because of its permit and oversight responsibilities; and the State of Alaska Department of Natural Resources, as land owner of the project site.

Because the Point Thomson project would be within a predominantly undisturbed area adjacent to the Arctic Refuge and the Beaufort Sea coast, agencies and the public have expressed concerns regarding the potential impacts of noise on the environment. The cooperating agencies requested that the Corps conduct a technical study for noise and the Corps directed HDR to perform the work.

This report describes basic acoustical concepts and methodologies used for this project, measurements of existing sound levels in the project area during winter and summer conditions in 2010, and the analysis of potential project-related noise levels for five alternative development scenarios: No Action, Applicant's Proposed Action, and three additional alternatives developed by the Corps and cooperating agencies.

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Chapter 2. Acoustics and Methodology

The project study area for the noise analysis is a portion of the Arctic Coastal Plain centered on the proposed Central Pad. The noise analysis project area extends: approximately 20 miles east and southeast; north to Mary Sachs Island; south of the Central Pad approximate 10 miles, and; west towards Badami. The broad coastal plain surrounding the project site is principally undeveloped but is known to have noise-sensitive human and wildlife uses year round.

During the scoping process, project stakeholders expressed concerns about potential project-related noise. The broad coastal plain surrounding the project area is principally undeveloped, with low levels of noise from human activity. Subsistence uses of the project area by North Slope residents and the project's proximity to the Arctic Refuge heighten sensitivity to noise effects compared to other North Slope developments. Subsistence uses include traveling, camping, fishing, hunting, and wild food gathering in winter and summer. Noise-sensitive wildlife lives in the project area, include calving caribou and denning polar bears. Due to the unique natural soundscapes in the Arctic Refuge, and concerns over noise-related disturbances to refuge wildlife, the USFWS required that National Park Service (NPS) methodologies be used for soundscape monitoring (NPS 2005). Therefore the measurements followed NPS methodologies for soundscape monitoring in "Acoustics and Soundscape Studies in National Parks (August 20, 2005)." Data collected using these methods is representative of undeveloped natural areas inside the Arctic Refuge and also in areas outside the refuge in undeveloped areas of the north slope.

Sound and wind speed and direction data were collected at six sites for 40 to 42 days in 2010 to characterize the baseline winter and summer acoustic environment in the project area (Figure 1). This baseline information was used to assess potential increases in noise from proposed project activities. Existing available marine noise data from similar North Slope oil and gas development projects was used to assess potential project-related noise in the marine environment and therefore, underwater noise levels were not measured as part of the baseline acoustic data collection (HDR 2010).

Project-related noise was assessed using the Cadna-A model, a computer-based acoustical analysis software tool that is based on international acoustical standards. Due to slight differences in noise sources and activities in winter and summer, this analysis evaluated noise from construction and operation activities in both winter and summer.

2.1 DEFINITION OF NOISE, BASIC ACOUSTICAL CONCEPTS

Noise is defined as unwanted sound. Sound is made up of tiny fluctuations in air pressure. Sound, within the range of human hearing, can vary in intensity by over one million units. Therefore, a logarithmic scale, known as the decibel scale (dB), is used to quantify sound intensity and to compress the scale to a more manageable range.

Sound is characterized by both its amplitude (how loud it is) and frequency (or pitch). The human ear does not hear all frequencies equally. In fact the human hearing organs of the inner ear deemphasize very low and very high frequencies. The A-weighted scale (dBA) is used to reflect this selective sensitivity of human hearing. This scale puts more weight on the range of frequencies where the average human ear is most sensitive, and less weight on those frequencies we do not hear as well. The human range of hearing extends from approximately 3 dBA to around 140 dBA. Table 1 shows a range of typical noise levels from common activities.

Table 1. Common Noise Sources and Noise Levels

Sound Pressure Level (dBA)	Typical Sources
120	Jet aircraft takeoff at 100 feet
110	Same aircraft at 400 feet
90	Motorcycle at 25 feet Gas lawn mower at 3 feet
80	Garbage disposal
70	City street corner
60	Conversational speech
50	Typical office
40	Living room (without TV)
30	Quiet bedroom at night

SOURCE: Environmental Impact Analysis Handbook, ed. by Rau and Wooten, 1980

Using the decibel scale, sound levels from two or more noise sources cannot be arithmetically added together to determine the overall sound level. Rather, the combination of two sounds at the same level yields an increase of 3 dB. On average, a 3-dB change in the A-weighted sound level is generally considered a noticeable change in loudness, whereas a 5-dB increase is clearly noticeable. A 10-dB change is perceived by most people as a doubling or halving of the perceived loudness.

The sounds that we hear are a combination of many sounds of different pitches. It is possible to use a frequency analyzer, and separate sound into its different frequency components. The frequency ranges are called octave bands; frequency is measured in Hertz (Hz), or cycles per second. Data that have been sorted into octave bands is called spectral data. Data that have not been sorted into octave bands is called overall or broadband sound data.

Sound pressure waves travel (propagate) away from the noise source. Atmospheric and meteorological conditions affect the way sound propagates. Wind speed and direction can affect sound propagation by inhibiting or enhancing sound propagation if the wind is blowing towards or away from the noise source, respectively. The ground surface can also affect the way sound propagates: frozen or smooth, hard surfaces can reflect sound while porous surfaces can reduce sound that travels over it. In the wintertime, frozen snow and smooth ice are two surface types that could reflect sound, and cause it to travel farther (propagate more efficiently). In the summer, soft tundra is more acoustically porous (absorptive), and therefore results in less efficient sound propagation (as sound moves away from the noise source more of the acoustical energy is absorbed by the ground cover).

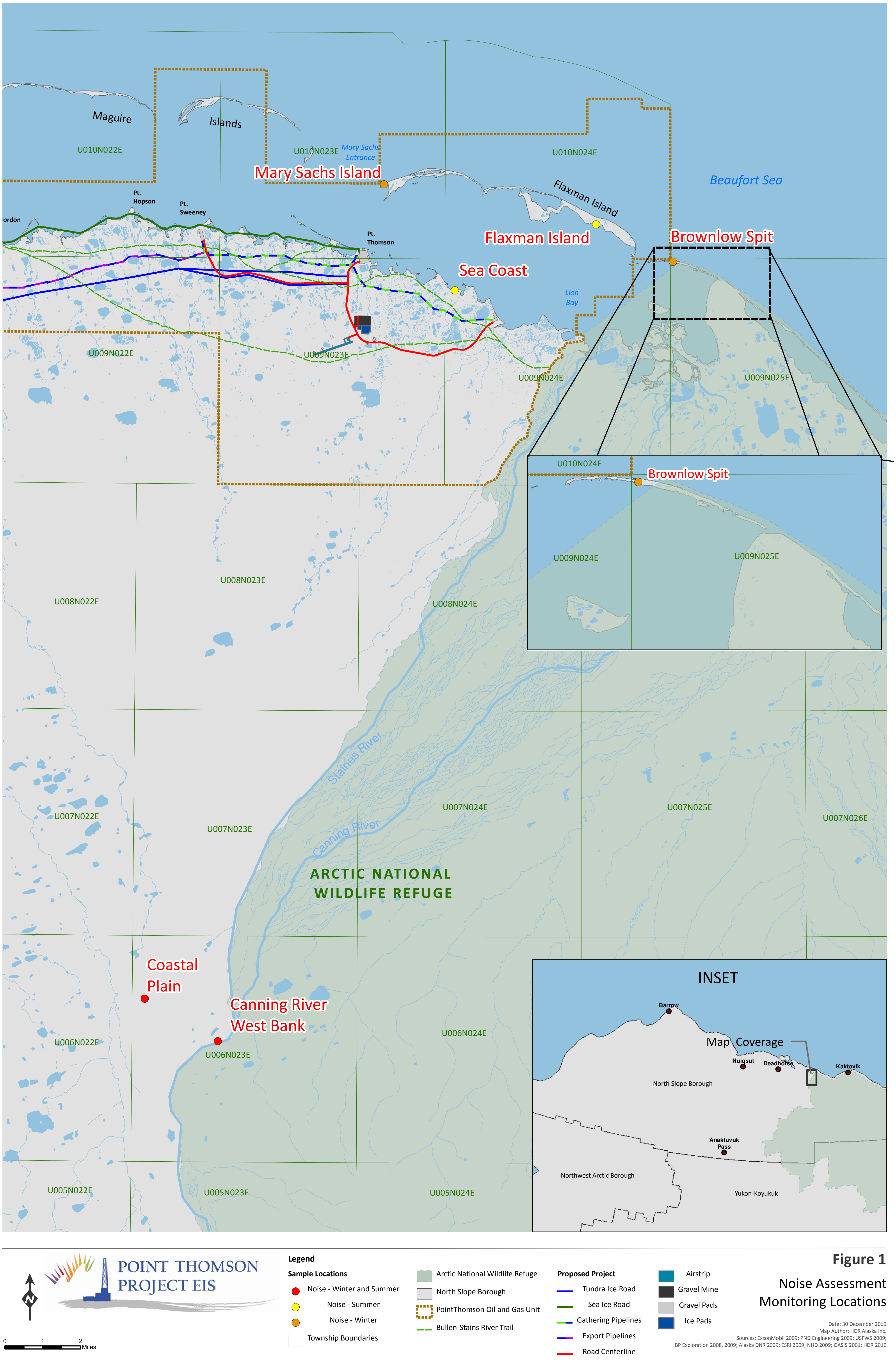

Figure 1

Noise Assessment Monitoring Locations

Date: 30 December 2010
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2010

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Environmental noise is often expressed as a sound level occurring over a stated period of time, typically one hour. When the acoustic energy is averaged over a stated period of time like one hour, the resulting equivalent sound level represents the energy-based average sound level for that one-hour period. This is called the equivalent level, or L_{eq}, and it represents an energy-based average (or mean) noise level occurring over a one-hour period. The L_{eq} represents a constant sound that, over the specified period, has the same acoustic energy as the time-varying sound. This metric is used as a baseline by which to compare project related noise levels (noise modeling results, which are also expressed as an hourly L_{eq}) and to assess the potential project-related noise increase over existing conditions. In addition to the L_{eq}, existing noise levels were also characterized using the L_{10}, L_{50}, L_{90}, Lmin, and Lmax metrics. The L_{10} is the noise level exceeded 10 percent of the hour. The L_{50} is the median noise level or noise level exceeded 50 percent of the hour. The L_{90} is the noise level exceeded 90 percent of the hour. These descriptors are used to describe the distribution of noise over a given time period. This range of metrics helps fully understand how noise levels fluctuate in the study area, and what the statistical distribution of noise levels is throughout the study area.

Another acoustical metric, the natural ambient sound level or L_{nat}, is used primarily by the NPS's Natural Sound Program as a metric to describe ambient noise levels in very remote natural settings. The L_{nat} is defined as the median noise level excluding anthropogenic noise, and also in the absence of noise from wind when wind speeds exceed 5 m/s. By screening out the influence of anthropogenic noise, and removing the influence of noise from winds greater than 5 meters per second (m/s), the L_{nat} is somewhat of an artificially determined average noise level that is intended to represent the naturally-occurring quiet ambient noise levels (in the absence of anthropogenic and wind noise). By virtue of its nature, the L_{nat} is often a very quiet noise level. USFWS required HDR to use this metric as a baseline by which to compare project-related noise levels and assess the potential increase over existing conditions within the Arctic Refuge. This comparison occurs later in this technical report. The L_{nat} appears in each discussion of existing noise data collected at each monitoring location; it is presented to establish the L_{nat} in each representative soundscape studied in this analysis. However it is only compared with potential project-related noise in the Arctic Refuge discussion later in this technical report.

2.2 SOUNDSCAPE METHODOLOGY

During project scoping and development of the DEIS, U.S. Fish and Wildlife Service and other resource agencies voiced concerns regarding the noise effects of the proposed project to the sensitive soundscape of the Arctic Refuge. In addition, cooperating agencies and project stakeholders raised concerns regarding the potential for project-related noise to disturb polar bears, caribou, bowhead whale, and other animals in the area. As a result of these concerns, HDR performed additional analysis using the natural ambient sound level, a noise metric used by the NPS Natural Sound Program, to assess noise propagation from the project area into the Arctic Refuge.

The NPS uses the natural ambient sound level, L_{nat}, to document periods of natural quiet, as part of their efforts to preserve the natural soundscape in National Parks. The study area does not include any national park lands; however, USFWS relies on NPS expertise in the field of environmental acoustics. NPS recommended to USFWS that the study area soundscape be documented using NPS methods and metrics. Due to the unique natural soundscapes in the Arctic Refuge and concerns over noise-related disturbances to refuge wildlife, the USFWS accepted the NPS recommendation and requested that the NPS Natural Sounds Program, "Acoustics and Soundscape Studies in National Parks," be used for soundscape monitoring (NPS 2005). This methodology was subsequently adopted by the Corps for the project noise assessment within the Arctic Refuge

As discussed earlier, the study area was divided into four representative soundscapes in order to estimate exiting noise levels throughout the study area both inside the Arctic Refuge and outside of it. At each monitoring location (representative of a unique soundscape), noise monitoring data was processed to identify the natural ambient sound level, or L_{nat}. The L_{nat} is the median measured noise level excluding human-caused noise and noise from high wind speeds. Because it eliminates both human-caused noise and noise from high wind speeds, it is an artificial descriptor that is intended to represent noise levels during periods of naturally-occurring quiet outdoor noise levels. Under certain circumstances, the NPS Natural Sounds methodology allows use of the L_{90} to determine the L_{nat}; however, it was not used for that purpose in this analysis except as noted below. In summary, the L_{nat} measured at each monitoring location outside of the Arctic Refuge represents the L_{nat} at locations in similar soundscapes inside the Arctic Refuge.

2.2.1 Soundscape Inventory

A preliminary survey was performed to identify the various noise environments (soundscapes) present in the study area. The project area was classified using soundscapes to represent different noise environments in the project area. The terrestrial ambient acoustic environments, or soundscapes, within the study area were identified based on GIS data, input from cooperating agencies and knowledge of existing noise sources in the project area.

The soundscapes in the Study Area can be divided into four categories: off-shore islands, coastal shoreline, upland coastal plains near surface waters, and upland coastal plains. Figure 1depicts the primary soundscapes identified in the study area. The soundscape within these four land use regimes is presumed to be relatively uniform, and therefore a measurement performed in one area of each regime will be representative of all other portions of that regime.

Following is a brief description of the monitoring sites:

Canning River West Bank (representing upland coastal plains near surface water features in summer and winter). The Canning River West Bank site is close to a recreational camp site and landing strip used during summer. Measurements at the Canning River site are representative of the upland coastal plain soundscape near surface water features. This soundscape represents areas covered with tundra, and includes the sound associated with surface water features such as rivers and streams in the summer season. Sounds from animals that travel along rivers and streams and animals near small lakes are also a component of this soundscape. During wintertime, the surface water features are frozen, minimizing the noise associated with water movement.

Coastal Plain (representing upland coastal plains in summer and winter). The Coastal Plain site was selected to be representative of the upland coastal plain soundscape in the project area without noise from currently permitted industrial activities at Point Thomson. This soundscape represents areas covered with tundra and is dominated by the sound of weather events. During summer it is dominated by sounds of wind and animals including caribou, bears, and insects. It is largely absent of noise associated with the interaction of waves and shoreline (coastal or riverine) and animals that inhabit the seashore.

Mary Sachs Island (representing off-shore islands in wintertime). This soundscape represents off-shore islands where sounds associated with wave and shoreline interaction, weather, and animals dominate the soundscape. However, during the winter the sea is frozen, so the sounds from waves are absent. Mary Sachs is representative of Flaxman Island, where polar bears den. The presence of polar bear dens on Flaxman Island precluded its use as a monitoring site during the winter; therefore Mary Sachs Island was used.

Flaxman Island (representing off-shore islands in summertime). During the summer, the monitoring equipment was moved from a lower site on Mary Sachs Island to a higher site on Flaxman Island to avoid open water reaching the equipment on Mary Sachs Island.

Brownlow Spit (representing coastal shoreline in wintertime). The Brownlow Spit site is representative of the coastal shoreline soundscape. The soundscape is similar to the off-shore island soundscape, but because there is coastal shore on only one side there may be somewhat less noise from wave and shoreline interaction during ice-free seasons than on the nearby islands. Brownlow Spit is a destination point for Kaktovik residents by boat and snowmobile and is used by other Arctic Refuge visitors.

Sea Coast (representing coastal shoreline in summertime). An additional site, the Sea Coast, was added to represent the coastal shoreline in summertime. The Brownlow Spit site was not available during the summertime due to activities unrelated to this project.

2.2.2 Measurement Season

Long-term monitoring was performed at four locations in the noise study area during the winter and summer season in 2010. Baseline noise data collection is necessary to develop a thorough understanding of the existing noise environment. The ambient noise environment in the project area is unique due to its secluded location and distance from manmade noise sources.

The area surrounding the project site is principally undeveloped but is known to have noise-sensitive human and wildlife uses year round. The Point Thomson area is known to be used for subsistence by Kaktovik residents, who use of the area for camps, travel, and hunting in winter seasons. The proximity of Flaxman Island, a known polar bear denning area, to the project area raised concerns that noise from the Point Thomson Project could cause polar bears to abandon these denning sites and move nearer Kaktovik were noted by USFWS and NSB as reasons for winter data collection.

Figure 1 depicts the locations where winter noise monitoring was performed. Exact measurement locations were documented in the field using a handheld global positioning system. The four locations are representative of the four primary ambient acoustic environments found on the North Slope of Alaska during the winter season where snow and ice cover are prevalent.

2.2.3 Measurement Duration

Long-term ambient measurements during the winter season were performed in conformance with NPS protocol. The Natural Sounds Program monitoring duration is a minimum of 25 days. This minimum duration was established by a statistician at Colorado State University, and is intended to ensure that the acoustical data has a + 3 dBA confidence interval.

The measurement durations of Point Thomson ambient noise measurements were consistent with NPS methodologies. HDR performed long-term noise measurements during wintertime between April 27 and June 8, 2010. The total duration of the measurement varied between 40 and 42 days, dependant on the monitoring location. Long-term data collection activities were repeated in the summertime between July 12 and August 30, 2010.

2.2.4 Equipment

Instrumentation used in the winter season deployment included equipment to measure and record continuous acoustical data, meteorological data and audio recordings. Equipment was contained in, powered by and mounted on custom system developed specifically for the Point Thomson project. The custom casing and mounting system was engineered to insulate and protect the equipment from the wildlife and harsh weather conditions in the project area during the winter season. Additionally HDR used consistent manufactures and models for major system components at all four monitoring locations to provide uniformity in measurement.

Figure 2 depicts the custom instrumentation casing and masts developed for the Point Thomson project.

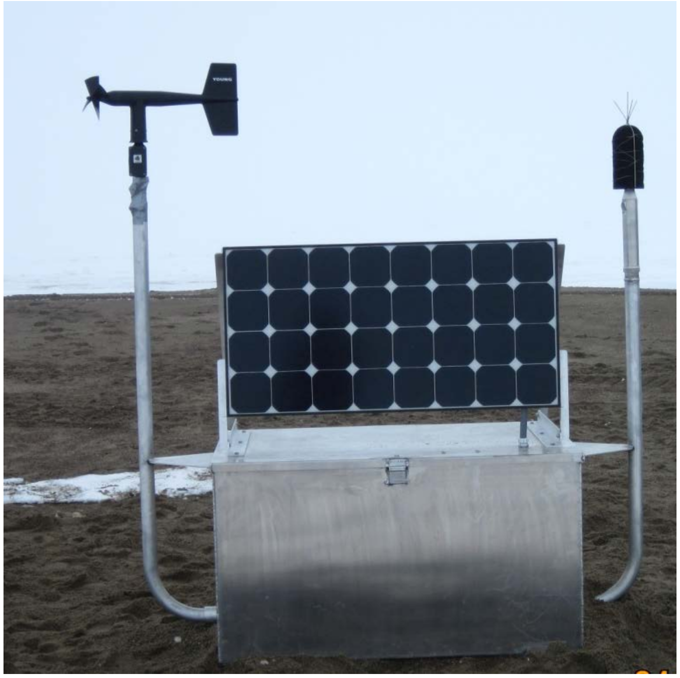

Figure 2. Winter Instrumentation Setup

Table 2 summarizes the equipment used during the winter season noise measurement.

Table 2. Noise Measurement Instrumentation

Instrument	Sound Level Meter	Microphone	Preamp	Calibrator	Audio Recorder	Wind Sensor
Manufacturer	Larson Davis	PCB Piezotronics	Larson Davis	Larson Davis	Edirol	R.M. Young
Model	LD831	377B02	426A12	CAL200	R-09	05103-45

2.2.4.1 Sound Level Meter

HDR utilized Larson Davis 831 digital sound level meters (SLM) in all monitoring systems. The 831s meet the requirements of Type 1 instruments as defined respectively by ANSI S1.4 and IEC 60651. This sound level meters conform to NPS standards for a Type I analyzer that performs true numeric integration and averaging in accordance with ANSI S1.4-1983.

2.2.4.2 Digital Recorder

Continuous digital recordings were made during the data collection periods. Digital recordings were performed at a quality sufficient to accurately record sounds between 20 dBA and 100 dBA. Additionally recordings have the capability to provide accurate frequency coverage between 20 Hz and 20,000 Hz.

2.2.4.3 Microphone

The microphones used in the winter monitoring were PCB Piezotronics 377B02, free field microphones. The microphones selected for the measurement have a nominal frequency response from 3 Hz to 20 kHz, sufficient to accurately capture the range of human hearing. The self-noise of the microphones is less than 20 dBA (re. 20 µPa). This is the lowest practical self-noise level without specialized low-noise microphones, which are disproportionately more expensive, have specialized power requirements, and are not well-suited for deployment in arctic winter conditions.

To protect the microphone from harsh weather conditions HDR utilized a microphone and preamplifier that was designed to be used in a permanent outdoor microphone system. The microphone and preamplifier are enclosed in a single stainless steel housing (vs. the plastic housing often used for common 24-hour noise measurements). The microphone system consisted of a microphone rain shield, windscreen, bird deterrent accessory, electrostatic actuator, and desiccant system. The microphone systems were positioned approximately 10 feet above the ground, mounted on a mast. The aluminum mast was custom made to be sufficiently strong to support the weight of the microphone and protective equipment mounted on it and resistant to disturbances by the wind and other natural occurrences frequent to the north slope.

2.2.4.4 Windscreen

A microphone windscreen was used to minimize the effects of wind and wind gusts on the measurements. The insertion loss of the windscreen was less than ±1 dB for each one-third octave band between 250 Hz and 1 kHz. Wind contamination was further evaluated during measurement post-processing, to further reduce the effects of wind contamination in the evaluated acoustical data.

2.2.4.5 Wind Sensor

HDR utilized R.M. Young wind sensors with the capability to record wind speed and direction at each monitoring location. The wind sensors were positioned between 5 feet and 6 feet above the ground, mounted on a mast. Wind sensors were located approximately 7 feet away from microphones to minimize contamination of the acoustical data.

2.2.4.6 Calibration

The sound measurement equipment was adjusted to a reference level traceable to the National Institute of Standards and Technology, using a battery-operated precision microphone calibrator meeting ANSI S1.40 and IEC 60942, Class 1 Sound Calibrators. The system performed calibration checks every 24-hours. Manual calibrations were performed in HDR's office prior to transportation to the measurement site. Additionally calibration checks were performed in the field before the first measurement and after completion of the measurement period.

HDR handheld calibrators receive primary calibration on an annual basis by an independent laboratory using standards traceable to the National Institute of Standards and Technology. All other HDR sound measurement equipment, including sound level meters, microphones, preamplifiers, is calibrated on a biannual basis.

2.2.5 Data collected

Data collected in the field included acoustical data, meteorological data and audio recordings at four sites. Data acquired by the sound level meters and wind sensors were stored in the meters, and later downloaded for post-measurement analysis. Table 3 summarizes the data collected in the field and the metrics computed during post-processing.

Table 3. Measurement Data

Data Collected Onsite	Calculated Metrics	
Wind Speed and Direction (1 second intervals)		
Sound Pressure Level (1-second L_{eq})	• L_{10} • L_{50} • L_{90}	• L_{eq} • L_{nat} • L_{min}, L_{max}
Audio Recordings	Time audible (non-natural sources)	

2.2.5.1 Wind Speed and Direction

Continuous, one-second wind speed and wind direction measurement data was collected using on-site wind sensors. Wind speed data collected onsite was entered into a database and later used to identify hours contaminated with high winds. Hours containing winds speeds greater than 5 m/s for more than 25 percent of the hour were considered invalid and excluded from the analysis. Contaminated data was not included in the calculation of acoustical metrics or audio review.

Refer to Appendix A for a summary of wind speed and wind direction measurement data.

2.2.5.2 Sound Pressure Level

Sound level meters collected and stored broad-band and spectral sound pressure levels on a 1-second basis. The one second noise monitoring data was post-processed to calculate a number of statistical metrics to describe the ambient noise environment throughout the project area. Calculated metrics include L_{eq}, L_{nat}, L_{10}, L_{50}, $L_{90,}$ L_{min} and L_{max}.

2.2.5.3 Audio Recordings

Continuous MP3 quality audio recordings were captured for the first 30 days of the measurement period at the measurement sites. Audio recordings were used to perform an in-office audio review. Anthropogenic sources were identified through a selective review of the audio recordings.

HDR selectively reviewed eight days of audio recording for each monitoring location. Audio files were subsampled using a scheme of 10 seconds for every 2 minutes. Audio review included listening to 720 audio files with a duration of 10 seconds each for selected days. The noise events in each clip were documented in a spreadsheet, logging the presence of human created sound.

2.3 PROJECT-RELATED NOISE MODELING AND ASSESSMENT METHODOLOGY

Details on equipment and scheduling of construction, drilling, and operations, and the associated noise levels were collected from the following:

- The Applicant's description of the proposed action (ExxonMobil 2009).
- The typical construction, drilling and operations methods and equipment (Appendix G, North Slope Construction Methods).
- The type and number of mobile vehicles and equipment used in the Applicant's proposed action (Appendix D, RFI 30).
- The logistics and timing of activities associated with the proposed action (Appendix D, RFI 55).
- Estimates of the number and types of equipment that is likely to be used each month (Appendix D, RFI 78).
- The sound power and pressure levels for common construction, drilling and operations, blasting and other activities (FHWA 2006).

Sound power levels from pertinent equipment were entered into a noise model (Cadna-A) designed for evaluating environmental noise from stationary and mobile sources on land and water (Computer Aided Noise Abatement, version 4.0.136, DataKustik GmbH). These results were combined with noise from project-related use of airplanes and helicopters (FAA 2009). In this manner, noise from all aspects of the proposed project was included.

Increased noise levels from construction, drilling, and operations during summer and winter conditions were calculated and compared to baseline (measured) conditions. Baseline conditions include existing median noise levels (in 2010) from currently permitted Point Thomson activities and other human-caused noise in the area (expressed as the equivalent noise level or L_{eq}), and the natural median ambient sound levels which exclude all human-caused noise (L_{nat}). Dominant sources of noise from operations were identified. Noise contours for noise predicted from each action alternative were mapped to show the magnitude and geographic extent of project noise. Assumptions used in the modeling were largely based on average project area conditions (Table 4).

Table 4. Assumptions for Noise Modeling

Factor	Winter	Summer
Terrain	Flat	Flat
Ground attenuation factor[a]	0.40	1.0
Temperature[b]	-8°F	46°F
Humidity[c]	80%	78%
Prevailing wind direction[d]	240°	80°
Wind speed[e]	4.4 m/s	4.4 m/s
Atmospheric stability class[d,f]	E	D

[a] This analysis assumed the ground is covered with snow in winter and covered with moist/wet tundra in summer. A ground attenuation factor of 1.0 is representative of 100% porous ground. A ground attenuation factor of 0.40 is representative of 40% porous ground.

[b] Based on the average temperature in Deadhorse during the months of July and January.

[c] Based on the average humidity in Deadhorse during the months of July and January.

[d] Alaska Energy Authority 2008.

[e] Faster wind speeds occur in the project area (AEA 2008), but data collected during high winds (>11 mph) were not useable, and higher winds can mask human-caused noise.

[e] Atmospheric stability class is a categorization of atmospheric turbulence. Class A represent a very unstable atmosphere, Class C in neutral and Class F is very stable.

2.3.1 Construction and Drilling Noise Assessment Methodology

The construction and drilling noise assessment is a conservative attempt at predicting the noise level during the loudest months of construction and drilling in both the summer and winter. The sources, duration, and sound pressure levels from construction and drilling activities are the same for each of the alternatives. Noise emissions were assigned to each piece of equipment proposed for each construction activity listed below. Then an overall noise emissions value was calculated for each month of the multiyear construction and drilling phase.

The construction activities were categorized as follows:

- Sea ice roads
- Civil and ice roads
- Export pipeline
- Logistics and drilling
- Piling
- Infrastructure
- Facilities and sealift
- Camps
- Engineering, planning, and construction support

Results of these calculations determined that the loudest summertime and wintertime months of construction and drilling noise would likely be July and February of Year 3 construction of the proposed action. Therefore, these two months were the basis for the analysis of construction and drilling noise in summer and winter, respectively, for each action alternative. The construction noise analyses assumed that drilling occurs in the wintertime on the East Pad, while other construction activities occur elsewhere. However, the location of some construction and drilling activities actually differs among the alternatives. Noise from construction and drilling is temporary, and would be lower in some months than is depicted in this assessment.

Table 5 presents the equipment modeled in the assessment of noise from construction activities and the sound power level used to represent each piece of equipment (FHWA 2006).

Table 5. Construction Noise Equipment List

Equipment	Sound Power Level (dBA)	Equipment	Sound Power Level (dBA)
Cat D399TA	115.6	Fuel Truck	90
Cat D3304(135hp)	106.9	Generator 100KW	117
Cat D3306TA	108.6	Generator 20KW	105
Wauk VR330	104.6	Generator 300KW	117
Wauk VRD31	103.5	Generator 40KW	117
Cat D3304 (200hp)	108.6	Generator 450KW	117
JA306	105.7	Generator 500KW	117
Ambulance	90	Generator 750KW	120
APE 200-6 Vibratory Hammer	130	Generators MOD 111	117
Mini Excavator	115	Heaters Tioga	125
Backhoe 325	115	Road Grader 14G	120
Backhoe 330	115	Impact Hammer	125
Blasting	129	Incinerator	115
Bombardier	35	Light Plant	117
Boom Truck	120	Loader: Caterpillar 966	115
Box Van	90	Loader: Caterpillar 988	115
Buff Truck	90	Man Lift 80ft	120
Bus	122	Mechanic Truck	90
CAT Motor Grader 16G	120	Norland Snow Blower	127
Chipper	120	Office Trailer	80
Compactor	115	Pickup	90
Compressor 1300	115	Heating Truck	90
Compressor 1600	115	Service Truck	90
Compressor 185	110	Shovel Loader: Hitachi 1600	115
Crane	120	Suburban	90
Crane 300T	120	Sideboom 583	120
Crane 40T	120	Snowmobile	35
Crane 45T	120	Tack Truck	90
Crane 888	120	Tanker 100 bbl	105
Crane 90T	120	Tanker 300 bbl	105
CTI 1040 Roto Trimmer	120	Tire Truck	90

Table 5. Construction Noise Equipment List

Equipment	Sound Power Level (dBA)	Equipment	Sound Power Level (dBA)
Dozer 6 LGP	120	Tool Van	90
Dozer D7G	120	Tractor Gen	119
Dozer: Caterpillar D10	127	Tractor & Maxi-haul End Dump w/ C-500	119
Dozer: Caterpillar D9	120	Tractor Trailer	100
Drill: Texoma 700	120	Tractor Trailer/100 T Lowboy	119
Drill: Watson 3000	120	Transfer Pump	110
Dump Truck	119	Vac Truck	120
End Dump 12 CY	119	Volvo A35	119
End Dump 20CY	119	Water Truck	120
Fire Truck	90	Welding Machine	108
Flat Bed Truck and trailer	119	Welding Machine	108

2.3.2 Operations Noise Assessment Methodology

The operational noise assessment evaluated noise emissions associated with the following aspects of the proposed project:

- CPF on the Central Pad
- Aircraft transportation
- Roadway transportation
- Road maintenance (summer)
- Snow removal (winter)

The analysis of noise from operations was based on published noise emissions data (FHWA 2006), as well as equipment noise data provided by the Applicant. Noise sources during operations include both stationary equipment and mobile sources; some vary by season, others are in use year-round.

The primary stationary noise sources included gas or oil-fired turbines, generators, boilers, heaters, and process equipment. The loudest sources are associated with the CPF. To simplify the analysis, the Applicant identified sources associated with the CPF with noise emissions equal to or louder than 80 dBA. Only this subset was included in the noise analysis. These noise sources dominate the noise emissions from the CPF; therefore this screening step was reasonable.

- Mobile noise sources include small planes, helicopters, sea barges, passenger vehicles, water trucks, front-end loaders, and other sources. Vehicular traffic was modeled as evenly distributed on all roadways, including both infield gravel roads in the summer season and ice roads during the winter season.
- In addition to year-round activities, the assessment of summertime noise included tug boat noise, and road maintenance activities with motor graders, front-end loaders, backhoes, and water trucks.

The assessment of wintertime operational noise included snow removal activities with front end loaders and motor graders.

Table 6 presents the equipment modeled in the assessment of noise from operations and the sound power level used to represent each piece of equipment. The Applicant provided this information.

Table 6. Noise Sources in Operational Noise Assessment

Module	Equipment	Quantity	Sound Power Level, dBA
101	Air Handling Unit	2	93
101	Exhaust fan	2	93
103	Air Handling Unit	2	89
103	Exhaust fan	2	90
104	Air Coolers	18	97
104	Air Handling Unit	2	89
104	Exhaust fan	2	88
105	Waste Heat Recover Unit	1	87
105	Exhaust Gas Bypass Stack	3	104
105	Noise Enclosure Ventilation Openings	8	92
105	CTG Air Intake	4	102
105	CTG Lube Oil Cooler	4	91
105	Supply Fan	8	84
105	Exhaust Fan	8	80
109	Supply Fan	1	87
109	Exhaust Fan	1	87
109	Stack Discharge	1	92
NA	Pickup trucks	8	90
NA	Passenger van	2	90
NA	Fire truck	1	90
NA	Ambulance	1	90
NA	Water truck	2	120
NA	Vacuum truck	2	120
NA	Crane	1	120
NA	Forklift	1	88
NA	Gravel grader	1	120
NA	Snow blower	1	127
NA	Front end loader	1	115
NA	Bobcat (skid steer)	1	88
NA	Heavy truck	1	100

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Chapter 3. Existing Soundscape Conditions

This chapter describes the results of winter and summer monitoring at each of the monitoring sites. For each location and season, graphs are provided which show existing noise levels (dBA), the equivalent sound pressure level (L_{eq}), the percentage of time non-natural noise is audible, and the natural ambient sound level based on NPS methodology (L_{nat}).

3.1 WINTER SEASON

The ambient soundscape of the study area during the winter season is dominated by noise from nature: atmospheric/meteorological phenomena and animal activity. Noise from human activities is largely absent from the ambient soundscape in the project area.

3.1.1 Canning River West Bank

Measurements at the Canning River site are representative of the upland coastal plain soundscape near surface water features. The soundscape of upland coastal plains near surface water features represents areas covered with tundra, and includes the sound associated with surface water features such as rivers and streams in the summer season. Noise from wildlife that travel along rivers and streams is also a component of this soundscape.

Figure 3 summarizes existing noise levels at the west bank of the Canning River during the winter season.

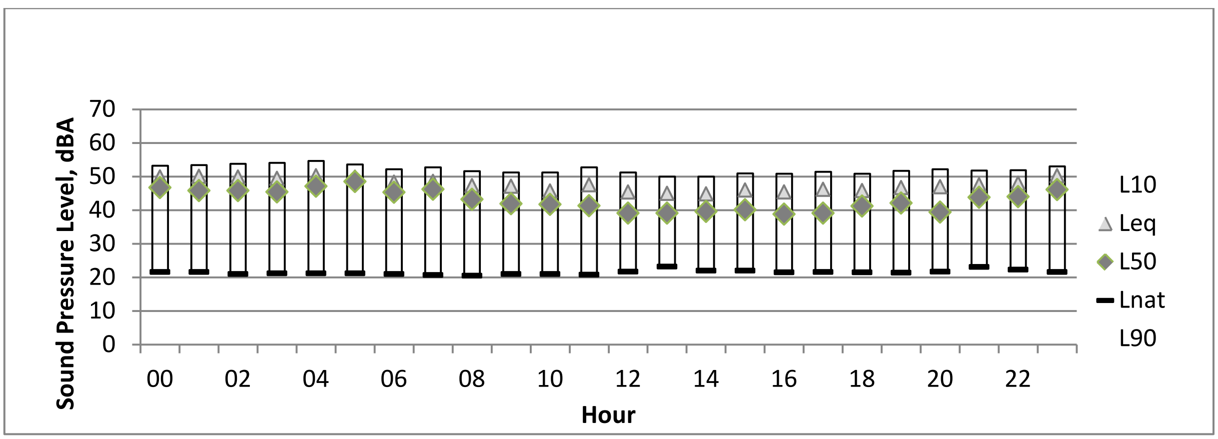

Figure 3. Canning River West Bank –Winter Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 21 to 54 dBA. Hourly mean (L_{eq}) noise levels at the Canning River monitoring site range from 45 to 50dBA. Hourly median (L_{50}) noise levels at the Canning River monitoring site ranged from 39 to 49 dBA dependant on the hour. Noise levels in this range are comparable to a quiet room.

Audio recordings at the Canning River takeout site were unavailable due to equipment failure; therefore audio review could not be performed. In the absence of observer logging and audio review, periods of anthropogenic sounds could not be identified. Therefore the L_{90} was used to conservatively estimate the natural ambient sound level in accordance with NPS methods. Hourly natural ambient (L_{nat}) noise levels at the Canning River location ranged from 21 to 23 dBA. Noise levels approaching 20 dBA are likely influenced by instrumentation noise. Noise levels below 20 dBA were not measured due to instrumentation noise. This is the lowest practical self-noise level without specialized low-noise microphones. Due to the harsh environmental conditions and power requirements, a low noise microphone was not utilized. Therefore it is likely that existing noise levels at the Canning River site are sometimes lower than 20 dBA perhaps as low as 17 dBA.

Figure 4 compares the daytime and nighttime L_{eq} measured during the winter season by plotting it on equal-loudness contours (equal-loudness contours according to ISO 226:1987) using units called phons (pronounced fones). The purpose of the phon scale is to compensate for the effect of frequency on the perceived loudness of tones. This helps us assess loudness in a way that accounts for the frequencies of a given sound relative to the way human ears perceive different frequencies and volume levels. By definition, 1 phon is equal to a sound pressure level of 1 dB at a frequency of 1 kHz. The equal-loudness curves or contours are a way of mapping the sound pressure level of a pure tone to the perceived loudness level in phons. These represent the sensitivity of the human ear to each frequency. Each contour is an equal loudness level measured in phons. The lowest contour is the Minimum Audible Field (MAF) and represents the median threshold of hearing for each frequency.

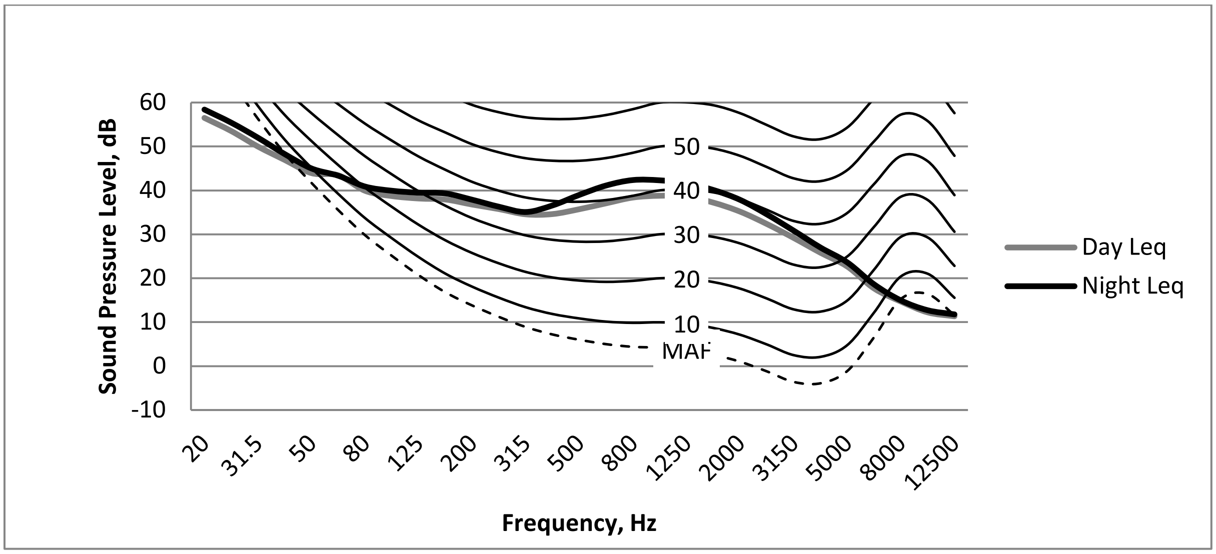

Figure 4. Canning River West Bank – Winter Season Equivalent Sound Level

Equivalent sound levels during the daytime and nighttime hours are very similar, indicating that noise producing activities in the area are fairly consistent throughout the day. The loudest sounds occur between 500 Hz and 1000 Hz, where the loudness exceeds 40 dB.

Figure 5 summarizes the natural sound level for daytime and nighttime hours measured during the winter season.

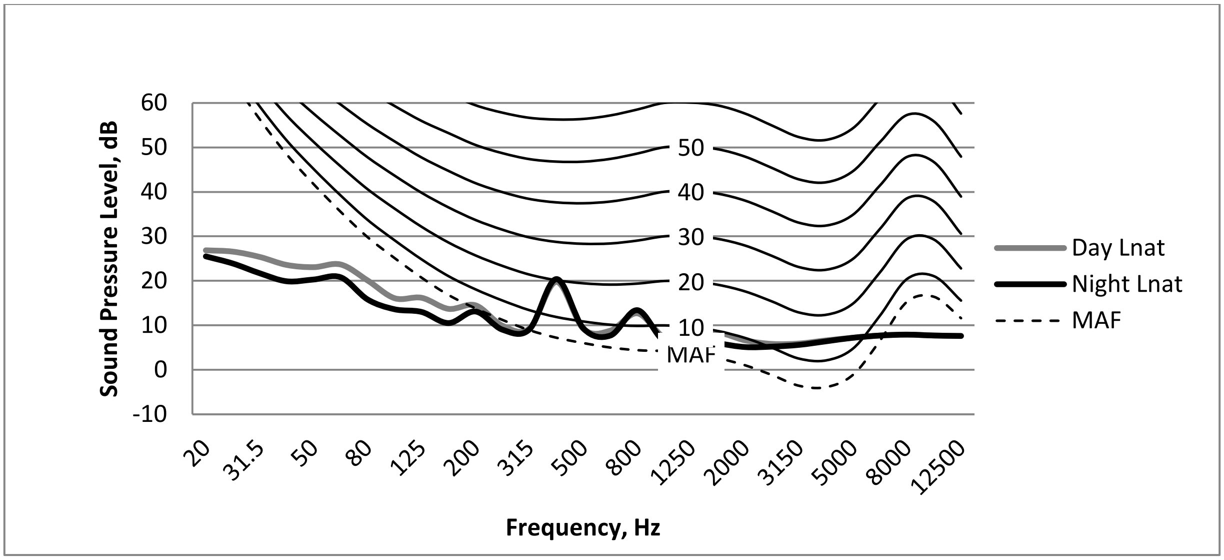

Figure 5. Canning River West Bank – Winter Season Natural Sound Level

Natural ambient sound levels at the Canning River monitoring location are very low and approach the minimum audible field, MAF. Sound levels below the MAF would be inaudible to most humans. As shown in Figure 5 natural ambient noise levels at the Canning River takeout site are low, in the mid and high frequencies, and likely influenced by the instrumentation noise floor. The peaks in the 400 and 800 Hz bands are indicative of the instrumentation noise floor, not the existing environment.

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or "gust" speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was performed.

3.1.2 Coastal Plain

The coastal plain site is representative of the upland coastal plain soundscape throughout the project area. The upland coastal plain soundscape represents areas covered with tundra and largely absent of noise associated with the interaction of waves and shoreline, and animals that inhabit the seashore. This soundscape is dominated by the sound of atmospheric/meteorological phenomena, and noise from insects and animals including caribou and bears. The monitoring location is representative of areas on the upland coastal plain without the influence of currently permitted industrial activities at Point Thomson.

Figure 6 summarizes existing noise levels at the Coastal Plain during the winter season.

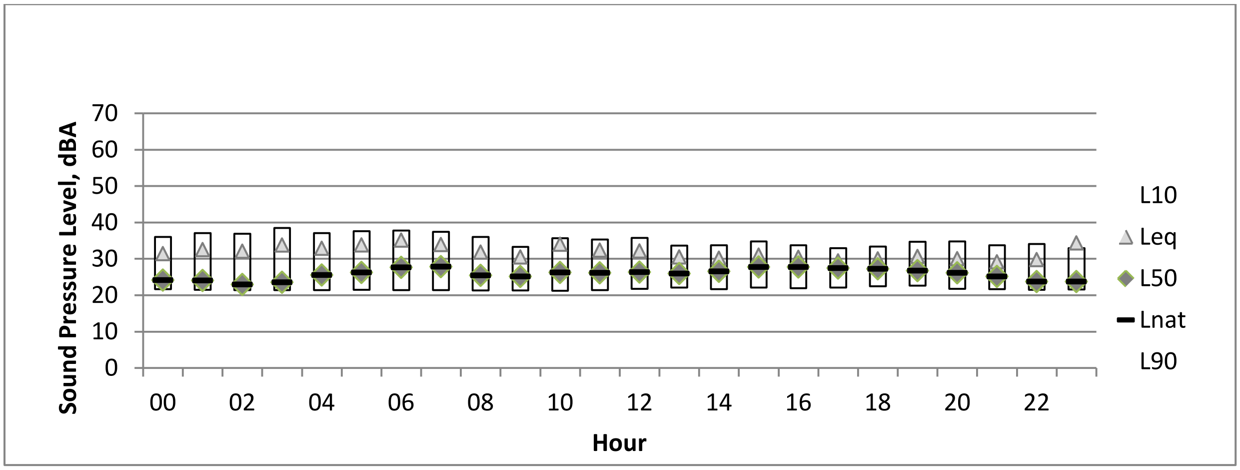

Figure 6. Coastal Plain – Winter Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 21 to 39 dBA. Hourly mean (L_{eq}) noise levels at the Coastal Plain monitoring site range from 29 to 35 dBA. Hourly median (L_{50}) noise levels at the Canning River monitoring site ranged from 23 to 28 dBA dependant on the hour. The range of noise levels recorded at the Coastal Plains location is 11 to 17 dB, between the L_{10} and L_{90}. The narrow range of noise levels indicates that noise sources are fairly consistent with few loud events are present.

Figure 7 depicts the equivalent daytime and nighttime sound level of the upland coastal plain soundscape during the winter season.

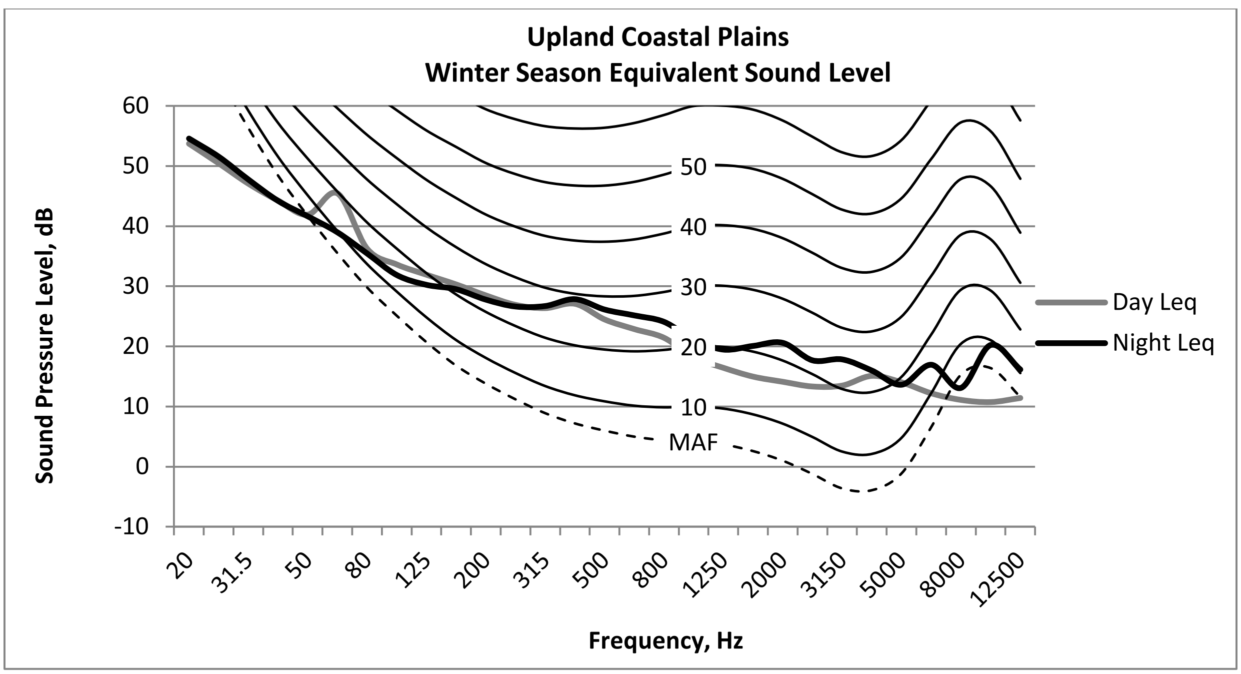

Figure 7. Coastal Plain – Winter Season Equivalent Sound Level

Equivalent sound levels at the Coastal Plain monitoring location are low and are below the threshold of hearing (MAF) in the low and high frequency ranges. Noise levels during the daytime hours are higher than nighttime hour, due to the increased presence of wildlife (based on selective audio review).

Figure 8 summarizes the results of the audibility study performed for the Coastal Plain monitoring location during the winter.

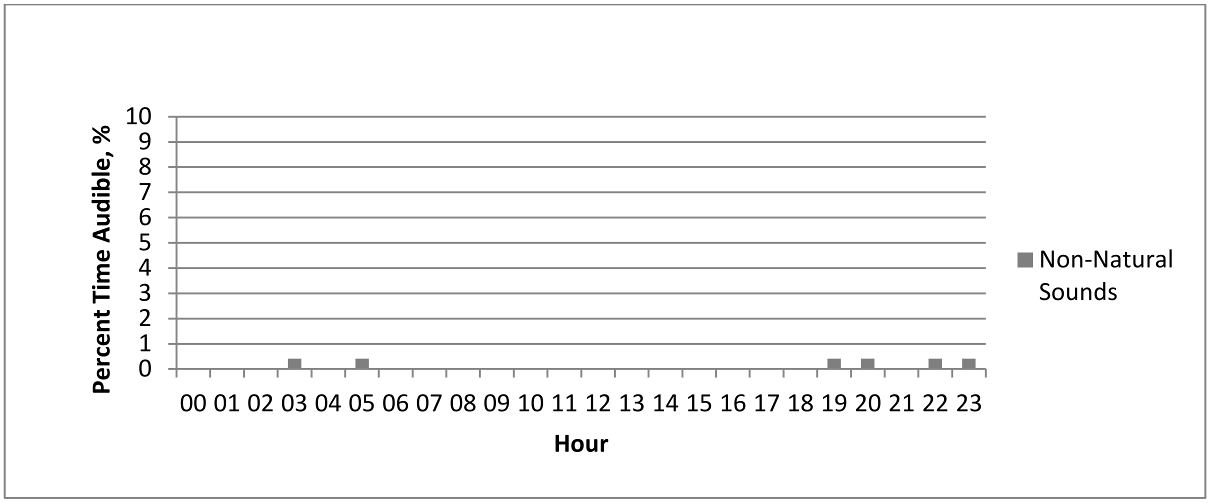

Figure 8. Coastal Plain – Winter Season Percent Time Audible

Manmade noise identified through audio review ranged from 0 to 1 event per hour. The audible noise environment in the upland coastal plains during the winter season is dominated by natural sources such as wind and wildlife. Non-natural audible events included infrequent aircraft overflight. On average human created sounds were audible less than 1 percent of the time for all hours, based on selective audio review.

Figure 9 depicts the natural daytime and nighttime sound level of the upland coastal plain soundscape during the winter season.

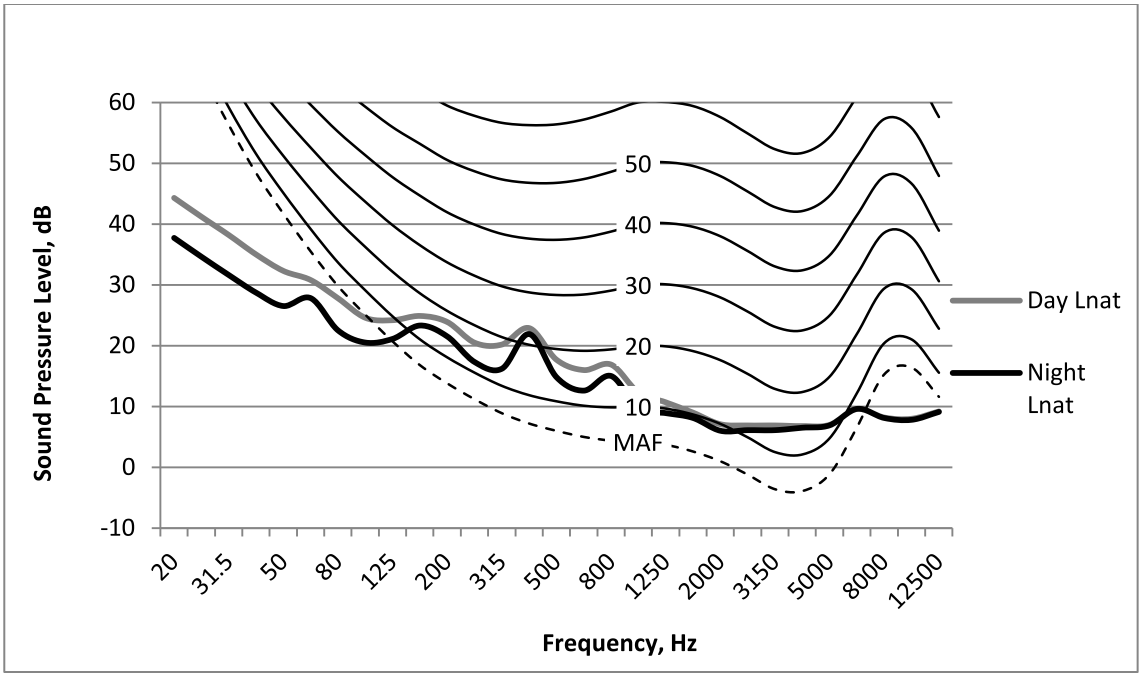

Figure 9. Coastal Plain – Winter Season Natural Sound Level

Natural ambient sound levels at the Coastal Plain monitoring location are low and are below the threshold of hearing (MAF) in the low and high frequency ranges. Noise levels during the daytime hours are higher than nighttime hour, due to the increased presence of wildlife.

As shown in Figure 8 natural ambient noise levels at the Coastal Plains site are low in the mid and high frequencies. Noise levels approaching 20 dBA and likely influenced by the instrumentation noise floor, therefore it is likely that existing noise levels at the Coastal Plains site are sometimes perhaps as low as 17 dBA. The peaks in the 400 and 800 Hz bands are indicative of the instrumentation noise floor, not the existing environment. Otherwise the loudness of the L_{nat} does not exceed 20 phons in either the daytime or the nighttime.

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or “gust” speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.1.3 Mary Sachs Island

The noise measurement at Mary Sachs Island is representative of the island soundscape. The off-shore island soundscape represents off-shore islands where sounds associated with wave and shoreline interaction, meteorological, and animal sounds dominate the ambient acoustic environment.

Additionally Mary Sachs Island is representative of polar bear denning locations on Flaxman Island. The proximity of polar bear dens precludes use of Flaxman Island as a monitoring site during winter; therefore Mary Sachs Island was used as a representative site during winter.

Figure 10 summarizes existing noise levels at Mary Sachs Island during the winter season.

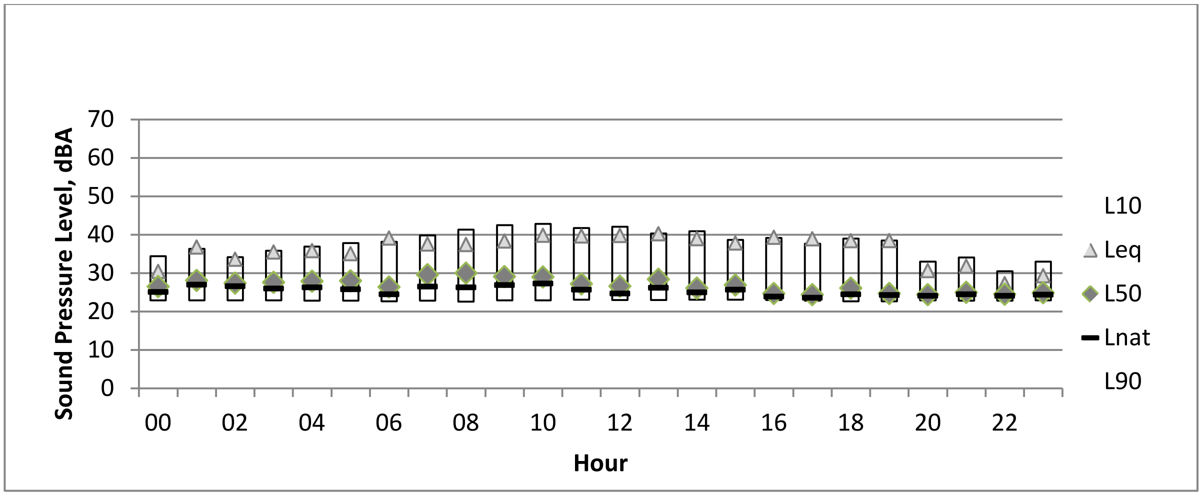

Figure 10. Mary Sachs Island – Winter Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 23 to 43 dBA. Hourly mean (L_{eq}) noise levels at the Mary Sachs Island monitoring site range from 27 to 40 dBA. Hourly median (L_{50}) noise levels at the Mary Sachs Island monitoring site ranged from 24 to 30 dBA dependant on the hour. Noise levels in this range are low and quieter than most unoccupied rooms. The range of noise levels recorded at Mary Sachs is wide ranging from 8 to 20 dB, between the L_{10} and L_{90}. The larger range of noise levels indicates that louder intermittent noise events are present. This is likely caused by current activities on the central pad.

Figure 11 depicts the equivalent daytime and nighttime sound level of the island soundscape during the winter season.

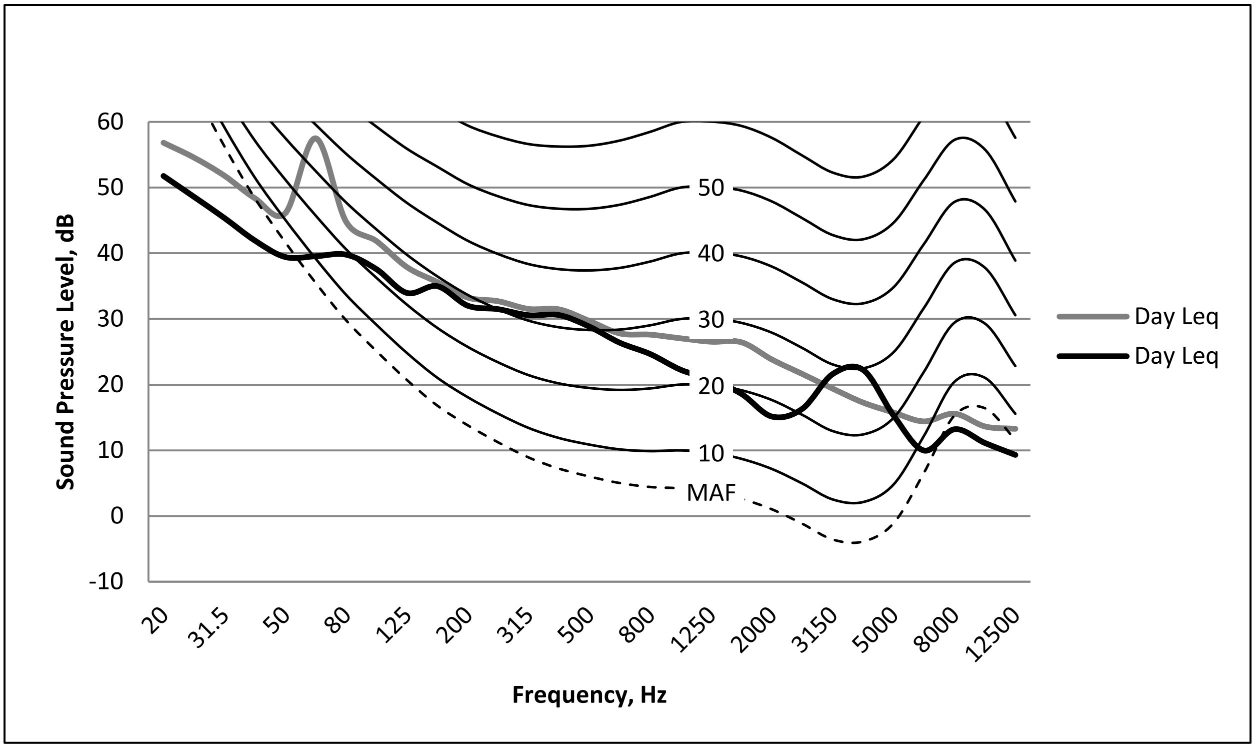

Figure 11. Mary Sachs Island – Winter Season Equivalent Sound Level

Equivalent sound levels at Mary Sachs Island are between 20 and 50 decibels higher than other locations in the project area, due to the influence of current activities on the Central Pad. With the influence of noise from current activities at the Central Pad, sound levels are above the threshold of hearing in nearly all octave bands. The loudest L_{eq} occurs around the 315 Hz band, exceeding 30 phon, and in the daytime it is accompanied with a low-frequency sound which also exceeds 30 phon.

Figure 12 summarizes the results of the audibility study performed for Mary Sachs Island.

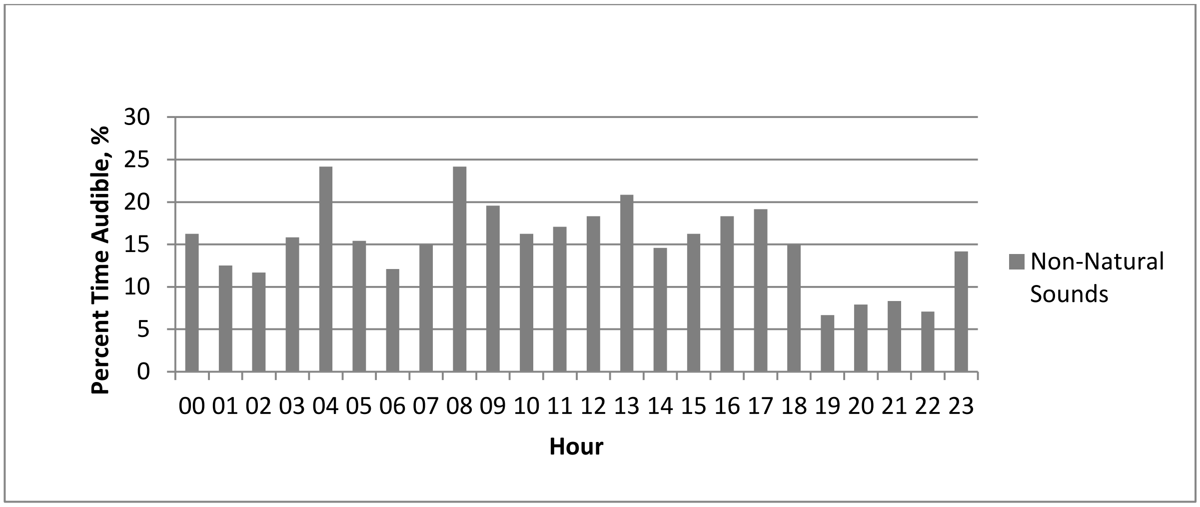

Figure 12. Mary Sachs Island – Winter Season Percent Time Audible

The ambient noise environment at Mary Sachs Island during the winter season is influences by both natural and unnatural sources. Anthropogenic noise sources influencing the ambient acoustic environment include aircraft overflight, public address systems, equipment backup alarms and other industrial noise sources.

During selective audio review non-natural sounds were audible between 0 and 100 percent of an hour. On average audible events were present between 7 and 24 percent of the time, dependent on the hour. The audible events at the Mary Sachs Island monitoring location are greater than other locations throughout the project area due to proximity to existing Point Thomson activities.

Figure 13 depicts the natural sound level of the island soundscape during daytime and nighttime in the winter season.

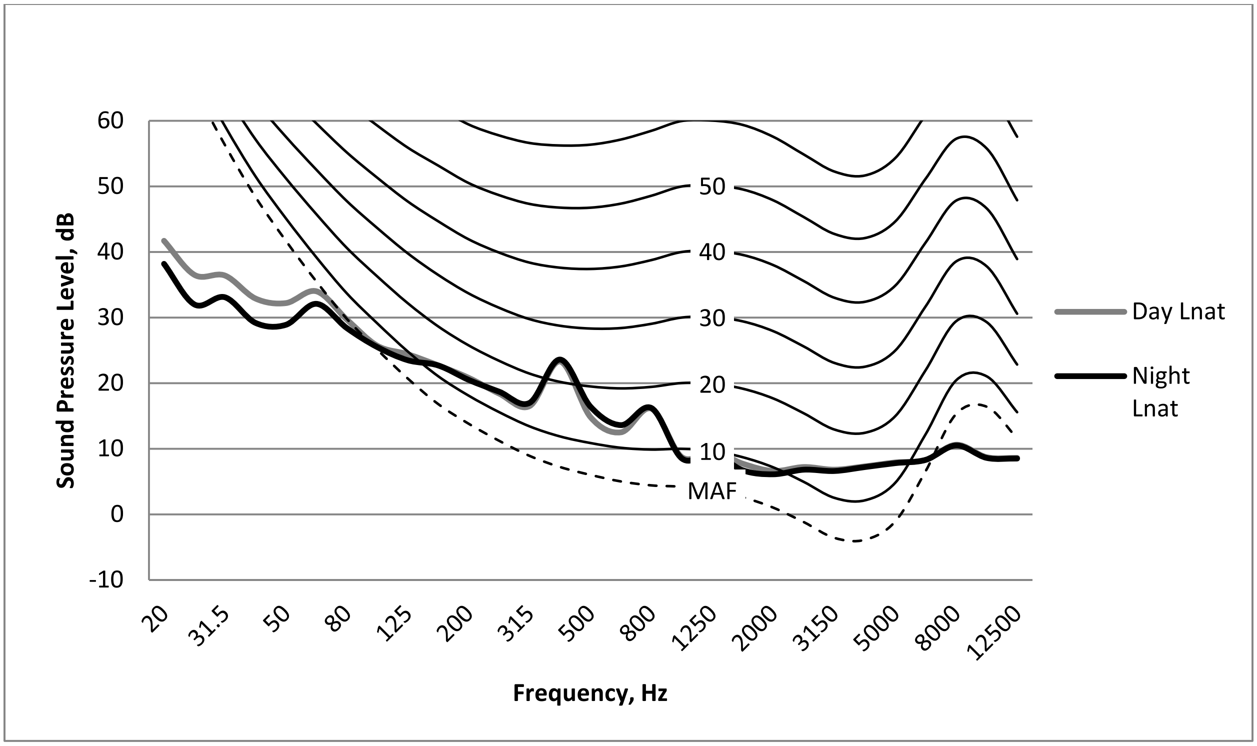

Figure 13. Mary Sachs Island – Winter Season Natural Sound Level

Ambient sound levels at Mary Sachs Island are between 10 to 20 decibels higher than other locations in the project area, due to the influence of current activities on the Central Pad. It is likely that the actual natural ambient noise level at this location is lower than presented in Figure 13, and similar to Brownlow's Spit without the influence of anthropogenic sounds. Even with the influence of current drilling sound levels are below the threshold of hearing in the very low and high frequencies.

Ambient noise levels during the daytime hours are lower than nighttime hours, unlike other monitoring locations. The increase in nighttime noise levels is due to early morning activities occurring on the Central Pad, before 7 a.m.

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or "gust" speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.1.4 Brownlow Spit

The Brownlow Spit measurement location is representative of the coastal shoreline soundscape, particularly the spit or tip. The soundscape is similar to the off-shore island soundscape, but because there is coastal shore on only one side there may be somewhat less noise from wave and shoreline interaction than on the nearby islands. Brownlow Spit is a destination point for Kaktovik residents by boat and snowmobile and used by refuge visitors.

Figure 14 summarizes existing noise levels at Brownlow Spit during the winter season.

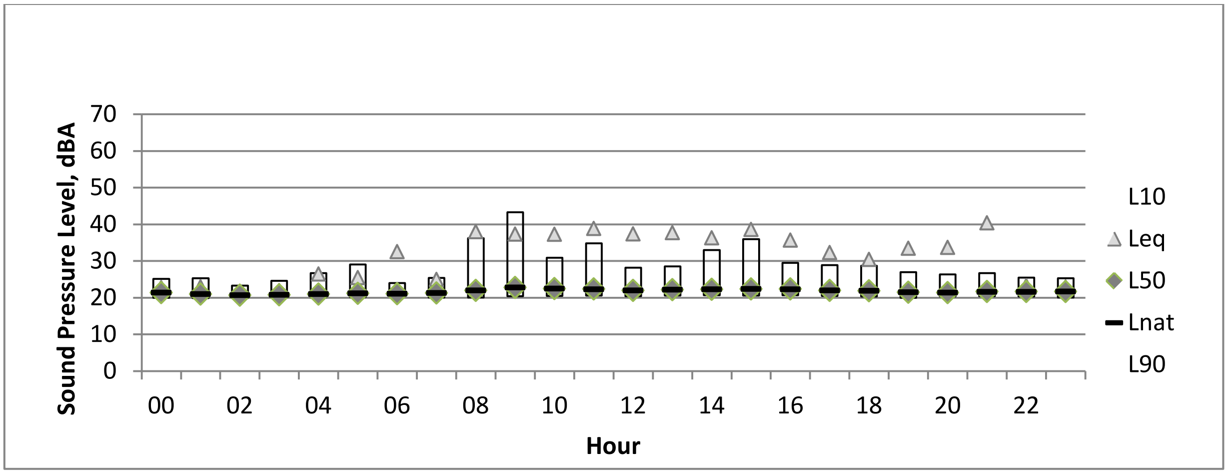

Figure 14. Brownlow Spit – Winter Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 20 to 43 dBA. Hourly mean (L_{eq}) noise levels at the Brownlow Spit monitoring site range from 22 to 40 dBA. Hourly median (L50) noise levels at the Brownlow Spit monitoring site ranged from 21 to 23 dBA dependant on the hour. Noise levels in this range are very low and quieter than most unoccupied rooms. Noise levels in this range are likely influenced by instrumentation noise; therefore it is likely that existing noise levels are lower than 20 dBA.

The range of noise levels is fairly narrow with the exception of hour 9. The narrow range of noise levels indicates that the influencing noise sources are fairly constant and there are few loud noise events in the area.

Figure 15 depicts the equivalent daytime and nighttime sound level of the coastal shoreline soundscape during the winter season.

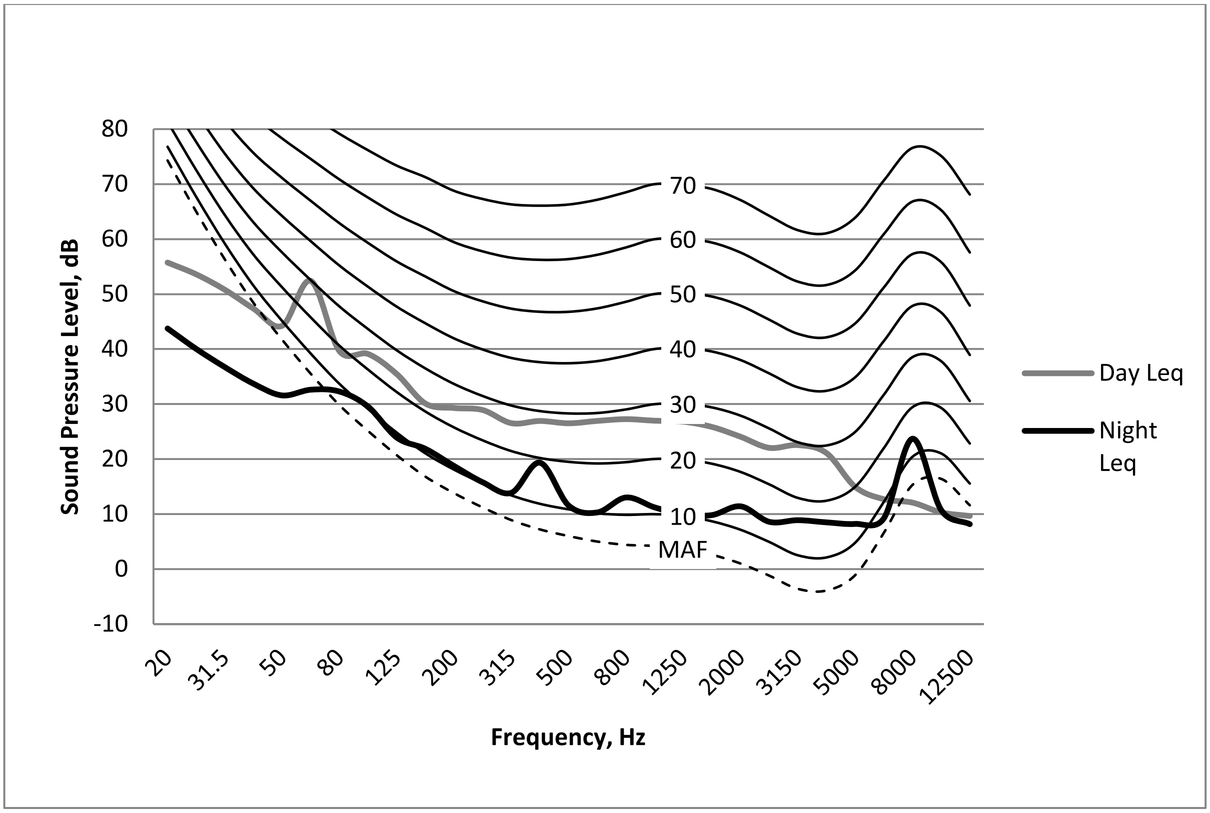

Figure 15. Brownlow's Spit – Winter Season Equivalent Sound Level

Ambient equivalent sound levels at the Brownlow Spit monitoring location are relatively low. Sound levels are below the threshold of hearing in the low and high frequencies. Noise levels during the daytime hours are higher than nighttime hour, due to the increased presence of wildlife. During the daytime, the loudness exceeds 30 phon in a low frequency band, and during the nighttime the loudness does not exceed 20 phon.

Figure 16 summarizes the results of the audibility study performed for Brownlow Spit.

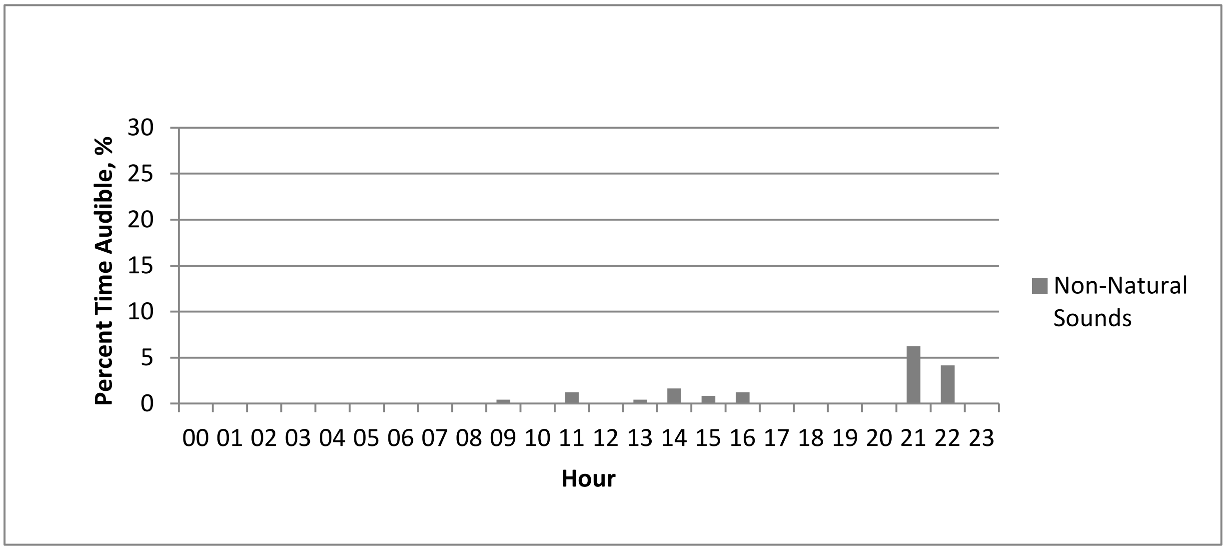

Figure 16. Brownlow Spit – Winter Season Percent Time Audible

Manmade noise identified through audio review ranged from 0 to 15 events per hour. On average human created sounds were audible between 0 and 4 percent of the time dependant on the hour, based on selective audio review.

The audible noise environment in the coastal shoreline soundscape during the winter season is dominated by natural sources such as wind and wildlife. Non-natural audible events included infrequent aircraft overflight.

Figure 17 depicts the natural daytime and nighttime sound level of the coastal shoreline soundscape during the winter season.

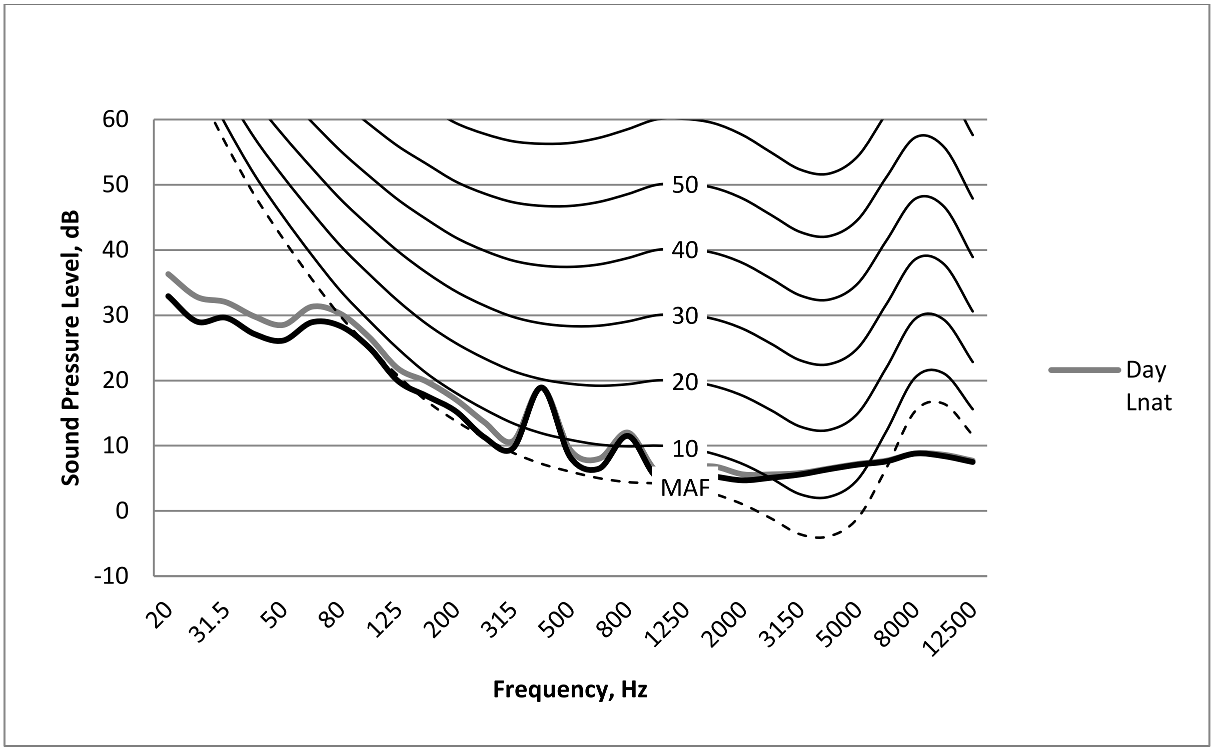

Figure 17. Brownlow Spit – Winter Season Natural Sound Level

Natural ambient sound levels at the Brownlow Spit monitoring location are relatively low. Sound levels are below the threshold of hearing in the low and high frequencies. Noise levels during the daytime hours are somewhat higher than nighttime hour, due to the increased presence of wildlife.

As shown in Figure 17 natural ambient noise levels at the monitoring location are approaching 20 dBA and likely influenced by instrumentation noise; therefore it is likely that existing noise levels at Brownlow Spit are sometimes lower than 20 dBA, perhaps as low as 17 dBA. The peaks in the 400 and 800 Hz bands are indicative of the instrumentation noise floor, not the existing environment. Aside from the instrumentation self-noise, the loudness of the natural sound level may not even exceed 10 phon.

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or “gust” speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.2 SUMMER SEASON

3.2.1 Canning River West Bank

Measurements at the Canning River West Bank site are representative of the upland coastal plain soundscape near surface water features. The soundscape of upland coastal plains near surface water features represents areas covered with tundra, and includes the sound associated with surface water features such as rivers, and streams in the summer season. During the summer season the Canning River West Bank is a common destination for recreational visitors on Canning River in summer. The facilities available for recreational activities near the Canning River West Bank include a camp site and landing strip.

Figure 18 summarizes existing noise levels at the west bank of the Canning River during the summer season.

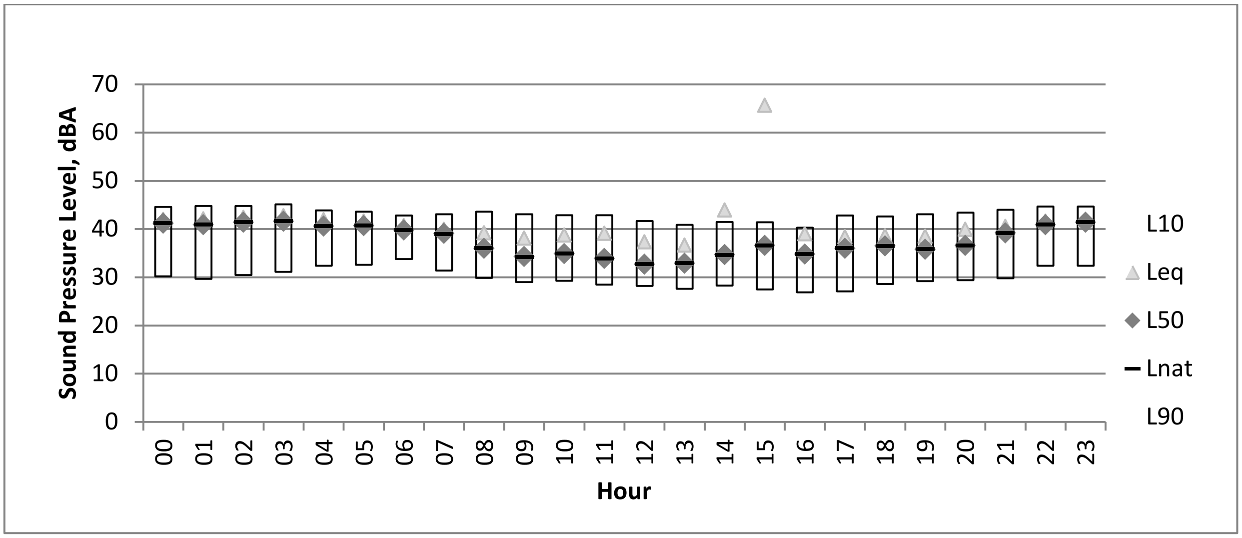

Figure 18. Canning River West Bank –Summer Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 28 to 68 dBA. Hourly mean (L_{eq}) noise levels at the Canning River monitoring site range from 38 to 44 dBA, with one spike to 68 dBA (likely due to aircraft noise). Hourly median (L50) noise levels at the Canning River monitoring site ranged from 33 to 42 dBA dependant on the hour. Noise levels in this range are comparable to an unoccupied room or a very quiet room at night..

Hourly natural ambient noise levels at the Canning River location ranged from 33 to 42 dBA.

Figure 19 summarizes the equivalent sound level for daytime and nighttime hours measured during the summer season.

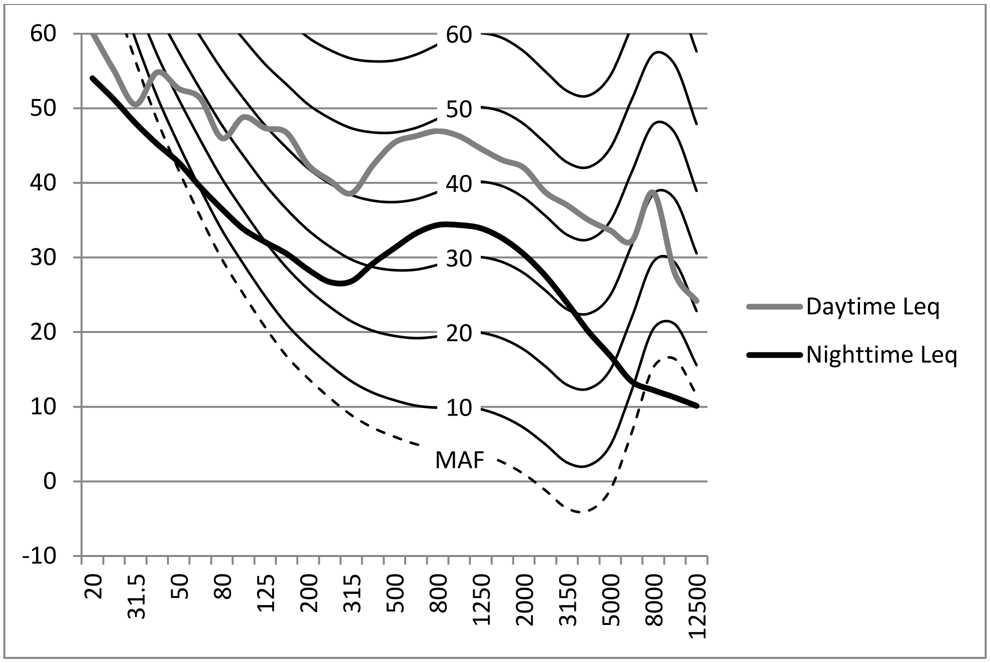

Figure 19. Canning River West Bank – Summer Season Equivalent Sound Level

Equivalent sound levels during the daytime are louder than they are at nighttime, likely due to noise from wildlife and perhaps the influence of aircraft noise. The loudness of the equivalent-average sound level approaches 50 phon in the mid-frequencies during the daytime, and approaches 37 phon in the mid-frequencies during the nighttime.

Figure 20 summarizes the results of the audibility study performed for the Canning River site during the summer season.

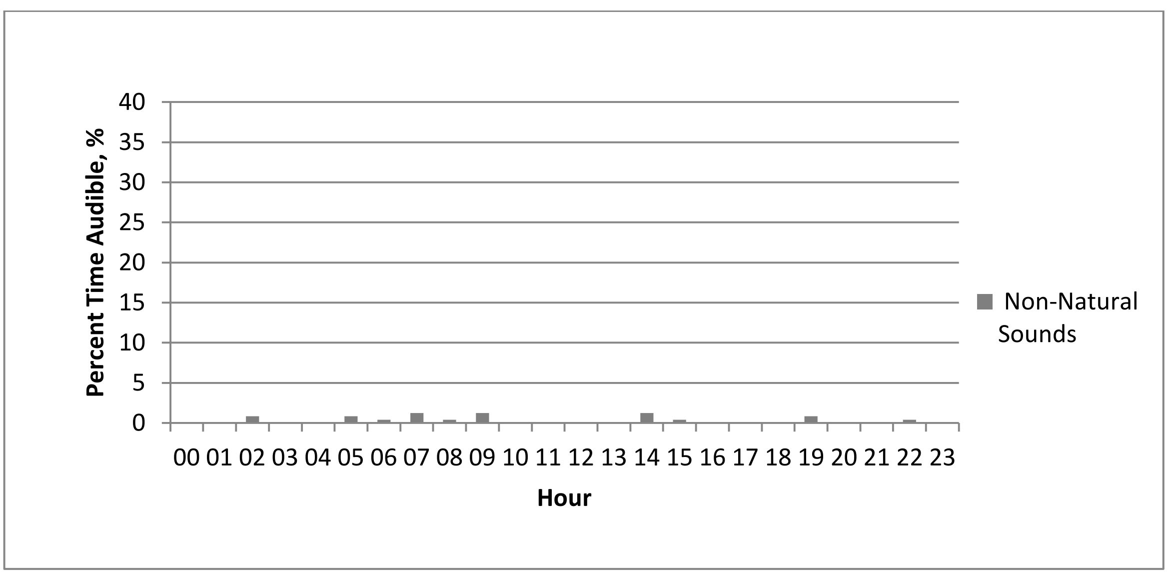

Figure 20. Canning River West Bank – Summer Season Percent Time Audible

Manmade noise identified through audio review ranged from 0 to 3 events per hour. On average human created sounds were audible between 0 and 1.3 percent of the time dependant on the hour, based on selective audio review.

The audible noise environment in the coastal shoreline soundscape during the summer season is dominated by natural sources such as wind and wildlife. Non-natural audible events included infrequent aircraft overflight.

Figure 21 summarizes the overall equivalent sound level for daytime and nighttime hours measured during the summer season.

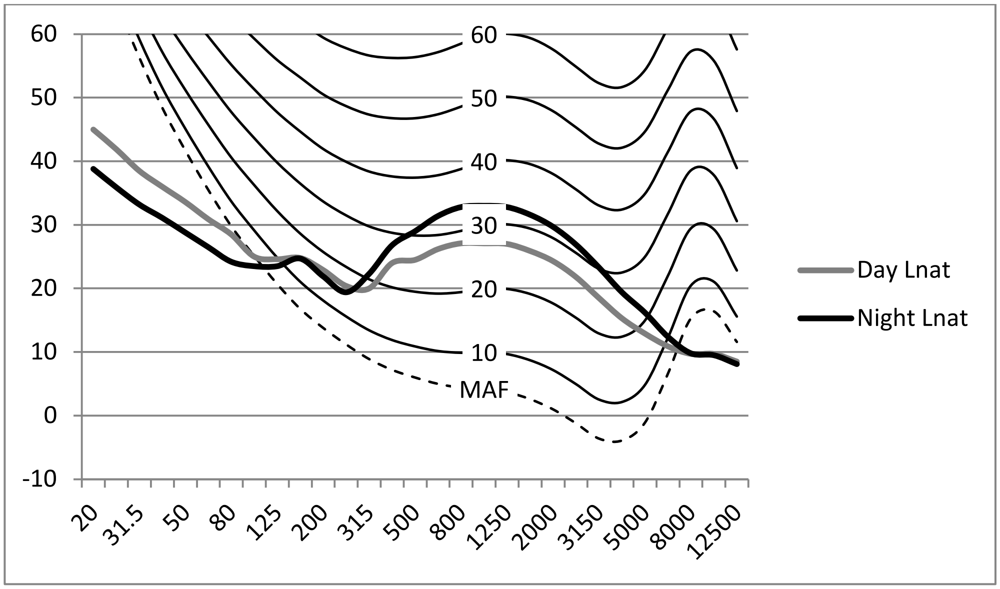

Figure 21. Canning River West Bank – Summer Season Natural Sound Level

Natural ambient sound levels at the Canning River monitoring location are very low and approach the minimum audible field, MAF in the lowest and highest portions of the frequency range. The minimum audible field represents the absolute threshold of hearing; therefore sound pressure levels below the MAF would be inaudible to most humans. The loudness of the natural sound level approaches 30 phon in the mid-frequencies during the daytime, and exceeds 30 phon in the mid-frequencies during the nighttime

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or “gust” speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.2.2 Coastal Plain

The coastal plain site is representative of the upland coastal plain soundscape throughout the project area. The coastal plain soundscape represents areas covered with tundra and largely absent of noise associated with the interaction of waves and shoreline, and animals that inhabit the seashore. This soundscape is dominated by the sound of atmospheric/meteorological phenomena, and noise from insects and animals including caribou and bears. The chosen monitoring is representative of the coastal plain without the influence of currently permitted industrial activities at Point Thomson.

Figure 22 summarizes existing noise levels at the Coastal Plain during the summer season.

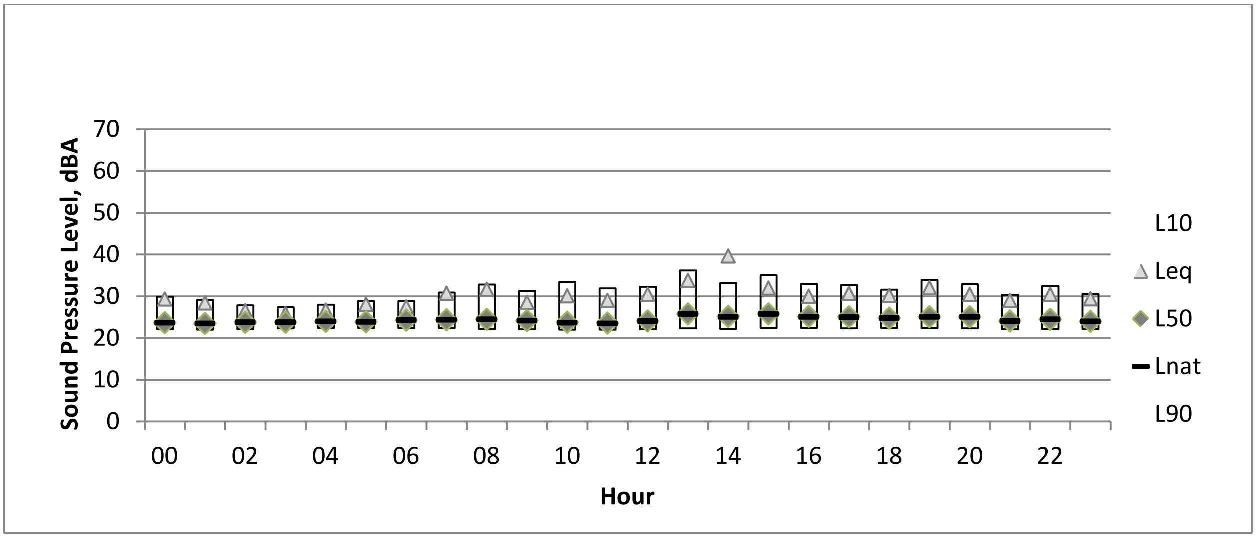

Figure 22. Coastal Plain – Summer Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 24 to 40 dBA. Hourly mean (L_{eq}) noise levels at the Coastal Plain monitoring site range from 26 to 40 dBA. Hourly median (L_{50}) noise levels at the Coastal Plains monitoring site ranged from 24 to 26 dBA dependant on the hour. Noise levels in this range are low and quieter than most unoccupied rooms.

The range of noise levels recorded at the Coastal Plains location is fairly narrow ranging from 5 to 14 dB, between the L_{10} and L_{90}. The narrow range of noise levels indicates that noise sources are fairly consistent with few loud events are present.

Figure 23 depicts the equivalent sound level of the upland coastal plain soundscape during the daytime and nighttime in summer season.

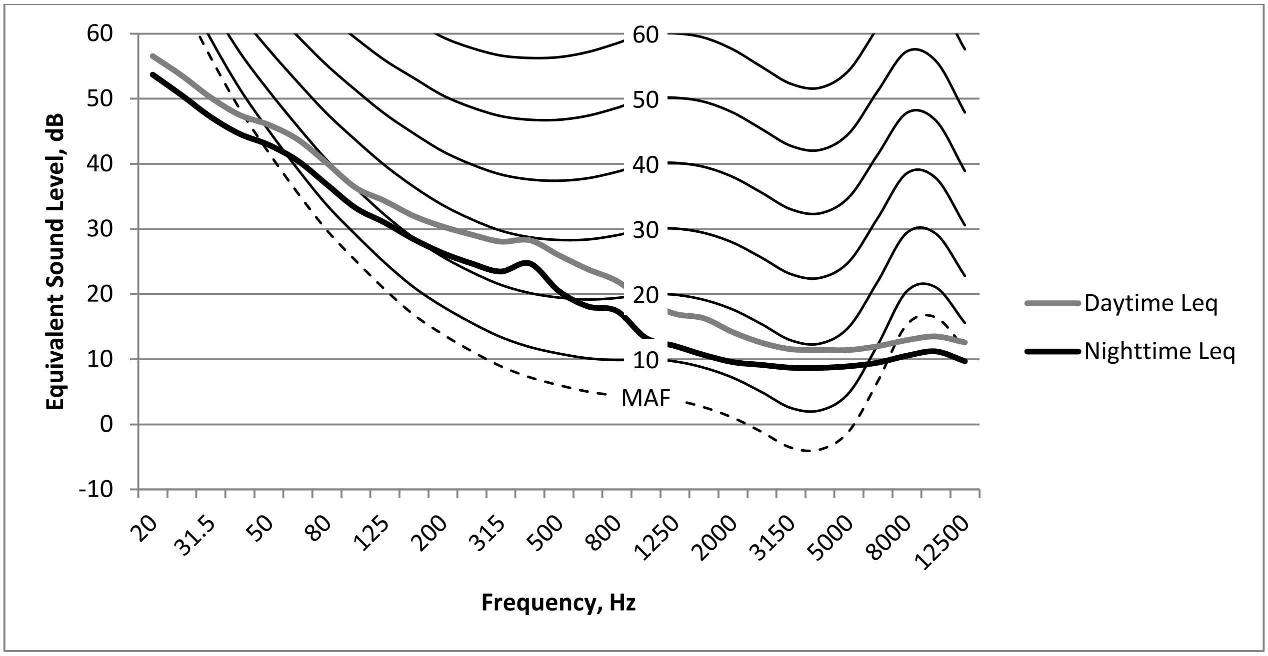

Figure 23. Coastal Plain – Summer Season Equivalent Sound Level

Equivalent sound levels at the Coastal Plain monitoring location are low and are below the threshold of hearing in the low and high frequency ranges. Noise levels during the daytime hours are slightly higher than nighttime hour, due to the increased presence of wildlife. The loudness of the equivalent-average sound level exceeds 30 phon in the 315 Hz band during the daytime, and exceeds 20 phon during the nighttime in the same band and in several lower bands.

Figure 24 summarizes the results of the audibility study performed for the Coastal Plain monitoring location during the summer .

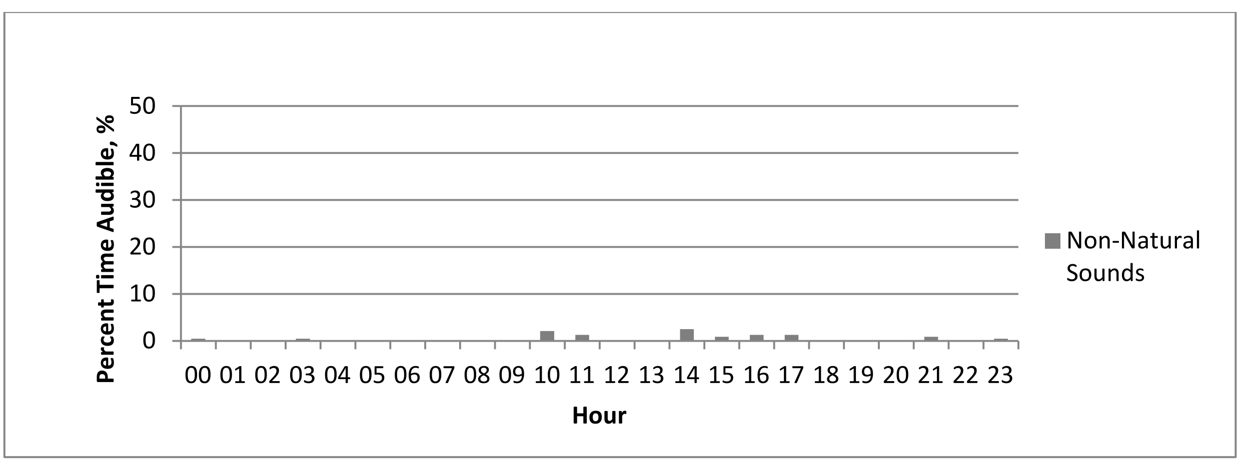

Figure 24. Coastal Plain – Summer Season Percent Time Audible

Manmade noise identified through audio review ranged from 0 to 4 event per hour. The audible noise environment in the upland coastal plains during the summer season is dominated by natural sources such as wind and wildlife. Non-natural audible events included infrequent aircraft overflight. On average human created sounds were audible less than 1 percent of the time for all hours, based on selective audio review.

Figure 25 depicts the natural sound level of the upland coastal plain soundscape during the daytime and nighttime in the summer season.

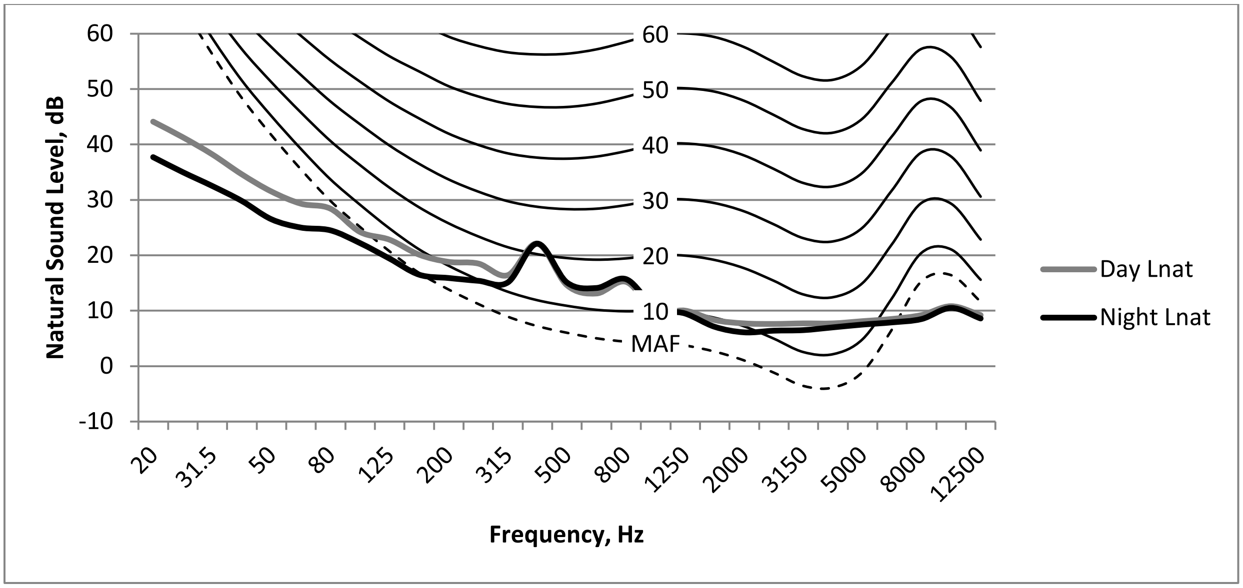

Figure 25. Coastal Plain – Summer Season Natural Sound Level

Natural ambient sound levels at the Coastal Plain monitoring location are low and are below the threshold of hearing in the low and high frequency ranges. Noise levels during the daytime hours are slightly higher than during nighttime hours, due to the increased presence of wildlife.

As shown in Figure 25 natural ambient noise levels at the Coastal Plain takeout site are below 10 dB in the highest frequencies. Spectral measurements below 10 dB are likely influenced by the instrumentation noise floor; therefore it is likely that existing noise levels in these bands at the Coastal Plains site are sometimes lower than 10 dB. The peaks in the 400 and 800 Hz bands are also indicative of the instrumentation noise floor, not the existing environment. Aside from instrumentation noise, the loudness of the natural sound level exceeds 10 phon in some mid-frequency bands during both daytime and nighttime

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or "gust" speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.2.3 Flaxman Island

The noise measurement at Flaxman Island represents the off-shore island soundscape, where sounds associated with wave and shoreline interaction, meteorological, and animal sounds dominate the ambient acoustic environment. Additionally Flaxman is representative of polar bear denning locations on off-shore islands.

Figure 26 summarizes existing noise levels at Flaxman Island during the summer season.

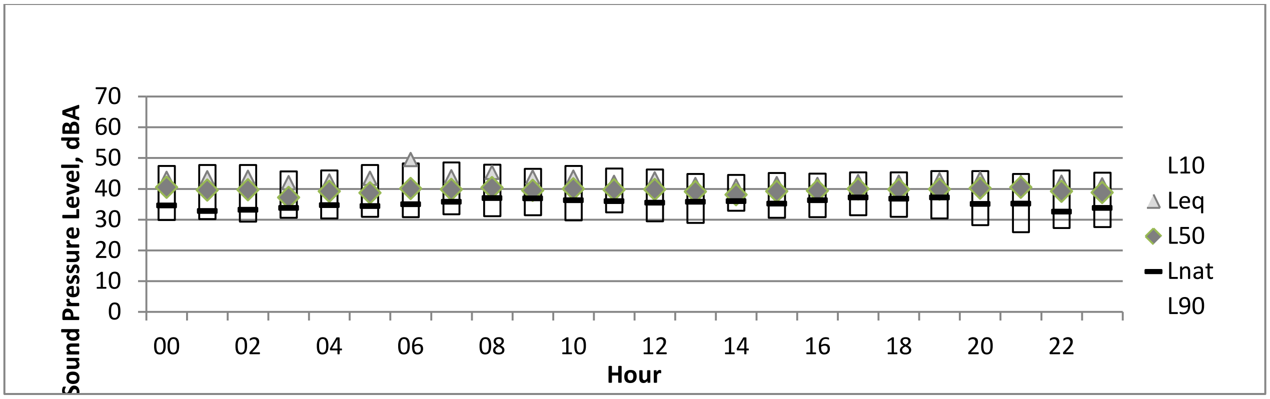

Figure 26. Flaxman Island – Summer Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 26 to 50 dBA. Hourly mean (L_{eq}) noise levels at the Flaxman Island monitoring site range from 41 to 50 dBA. Hourly median (L_{50}) noise levels at the Flaxman Island monitoring site ranged from 37 to 41 dBA dependant on the hour. Noise levels in this range are comparable to an unoccupied room or a very quiet room at night.

The range of noise levels recorded at Flaxman Island is wide ranging from 12 to 19 dB, between the L_{10} and L_{90}. The larger range of noise levels indicates that louder intermittent noise events are present. This is likely caused by current activities on the central pad.

Figure 27 depicts the equivalent sound level of the island soundscape during the daytime and nighttime in the summer season.

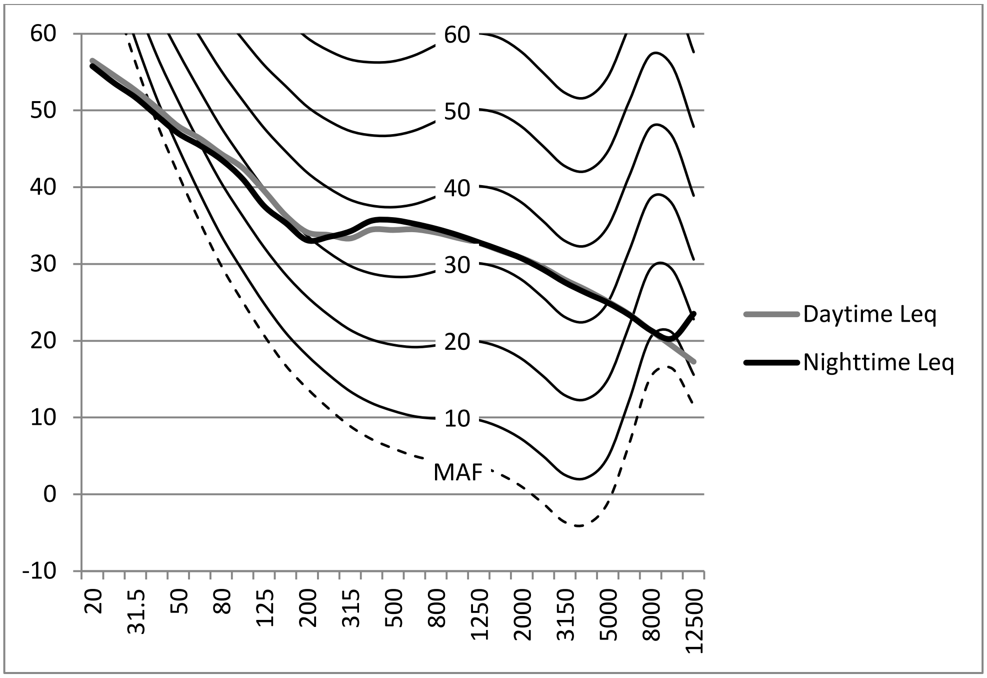

Figure 27. Flaxman Island – Summer Season Equivalent Sound Level

Equivalent sound levels at Flaxman Island are between 20 and 50 decibels higher than other locations in the project area, due to the influence of current activities on the Central Pad. With the influence of current activities on the Central Pad, sound levels are above the threshold of hearing in all octave bands except the very lowest. The loudness of the equivalent-average sound level approaches 40 phon in some mid-frequency bands during both daytime and nighttime.

Figure 28 summarizes the results of the audibility study performed for Flaxman Island.

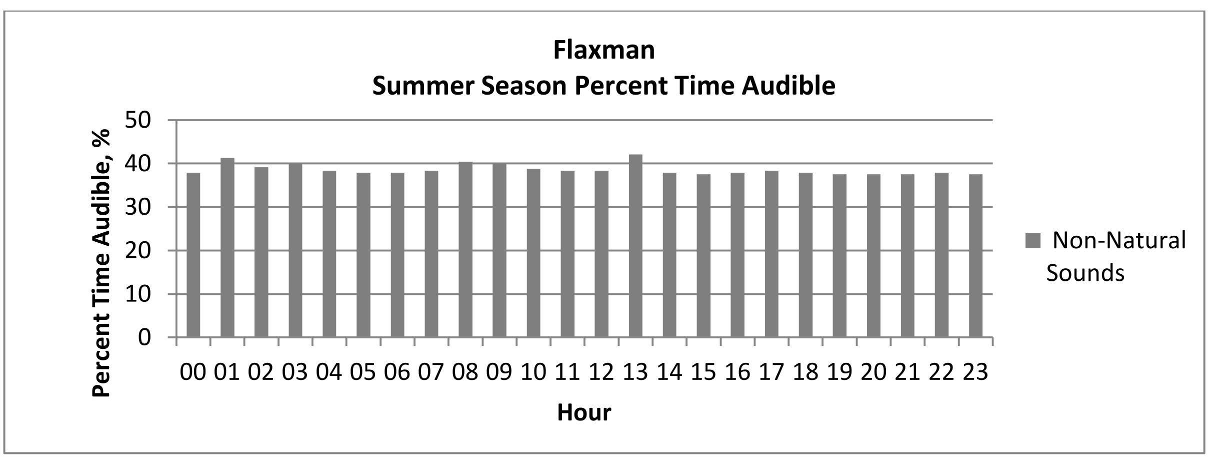

Figure 28. Flaxman Island – Summer Season Percent Time Audible

The ambient noise environment at Flaxman Island during the summer season is influenced by both natural and unnatural sources. Anthropogenic noise sources influencing the ambient acoustic environment include aircraft overflight, equipment backup alarms and other industrial noise sources.

During selective audio review non-natural sounds were audible between 0 and 100 percent of an hour. On average audible events were present between 38 and 42 percent of the time, dependent on the hour. The audible events at the Flaxman Island monitoring location are greater than other locations throughout the project area due to proximity to existing Point Thomson activities.

Figure 29 depicts the natural daytime and nighttime sound level of the island soundscape during the summer season.

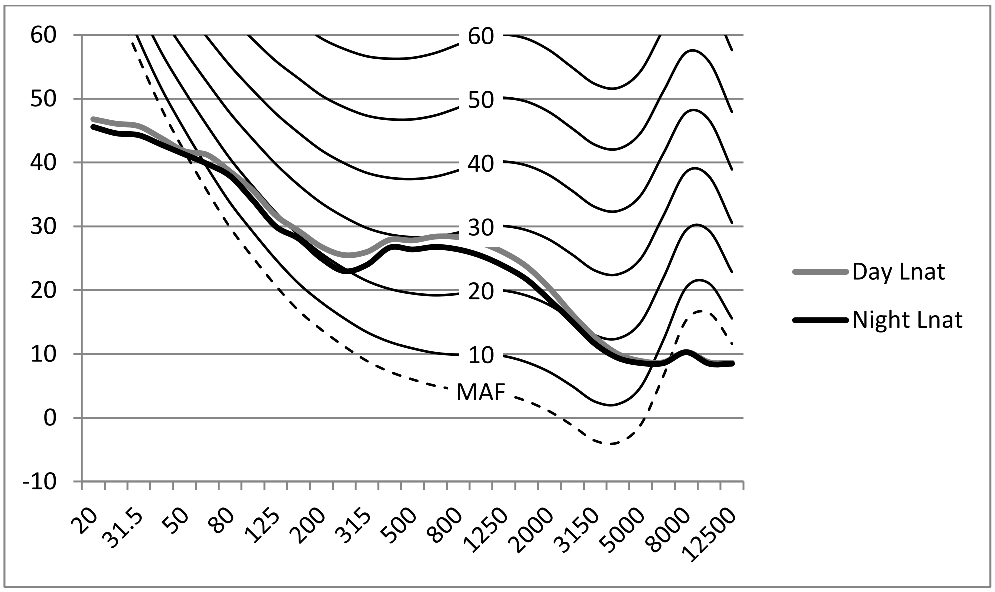

Figure 29. Flaxman Island – Summer Season Natural Sound Level

Ambient sound levels at Flaxman Island are between 10 and 20 decibels higher than other locations in the project area, due to the influence of current activities on the Central Pad. It is likely that the natural ambient noise level at this location is lower than presented in and similar to Brownlow Spit without the influence of anthropogenic sounds. Even with the influence of sound from current activities at the central pad, noise levels are below the threshold of hearing in the very low and high frequencies. The loudness of the natural sound level approaches 30 phon in some mid-frequency bands during both daytime and nighttime.

Appendix B contains graphs which present a time-profile of the noise measurements and corresponding wind measurements. These profiles illustrate how wind speeds and measured noise levels relate to each other. The data are based upon hourly intervals and show the equivalent-average sound level (L_{eq}) with the minimum and maximum sound level measured during each hour. The wind data show the average wind speed and the maximum wind speed (or “gust” speed) each hour. The data are otherwise unprocessed and have not been screened or filtered. The time-profile graphs are shown for illustration purposes only; no analysis was done on them.

3.2.4 Sea Coast

The Sea Coast measurement location is representative of the coastal shoreline soundscape. The soundscape is similar to the off-shore island soundscape, but because there is coastal shore on only one side there may be somewhat less noise from wave and shoreline interaction than on the nearby islands.

Figure 30 summarizes existing noise levels at the Sea Coast during the summer season.

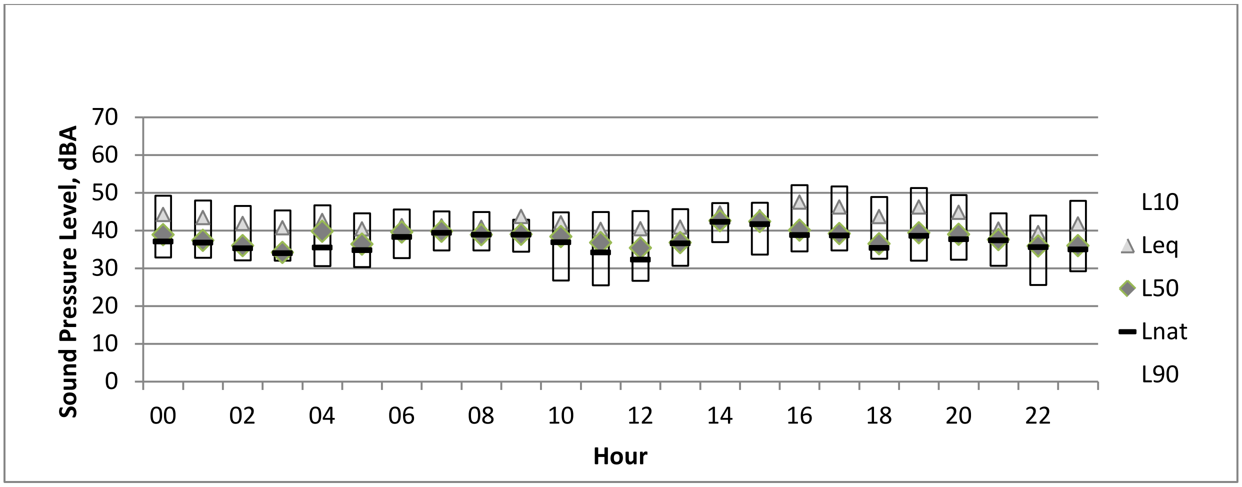

Figure 30. Sea Coast –Summer Season Broadband Noise Levels

Overall broadband noise levels ranged from approximately 25 to 52 dBA. Hourly mean (L_{eq}) noise levels at the Sea Coast monitoring site range from 40 to 48 dBA. Hourly median (L_{50}) noise levels at the Sea Coast monitoring site ranged from 34 to 43 dBA dependant on the hour. Noise levels in this range are comparable to the noise levels found in an unoccupied room. The range of noise levels between the L10 and L90 is 9 to 19, which is fairly large. The range of noise levels indicates that the influencing noise sources are somewhat inconsistent and there are some loud noise events in the area.

Figure 31 depicts the equivalent daytime and nighttime sound level of the coastal shoreline soundscape during the summer season.

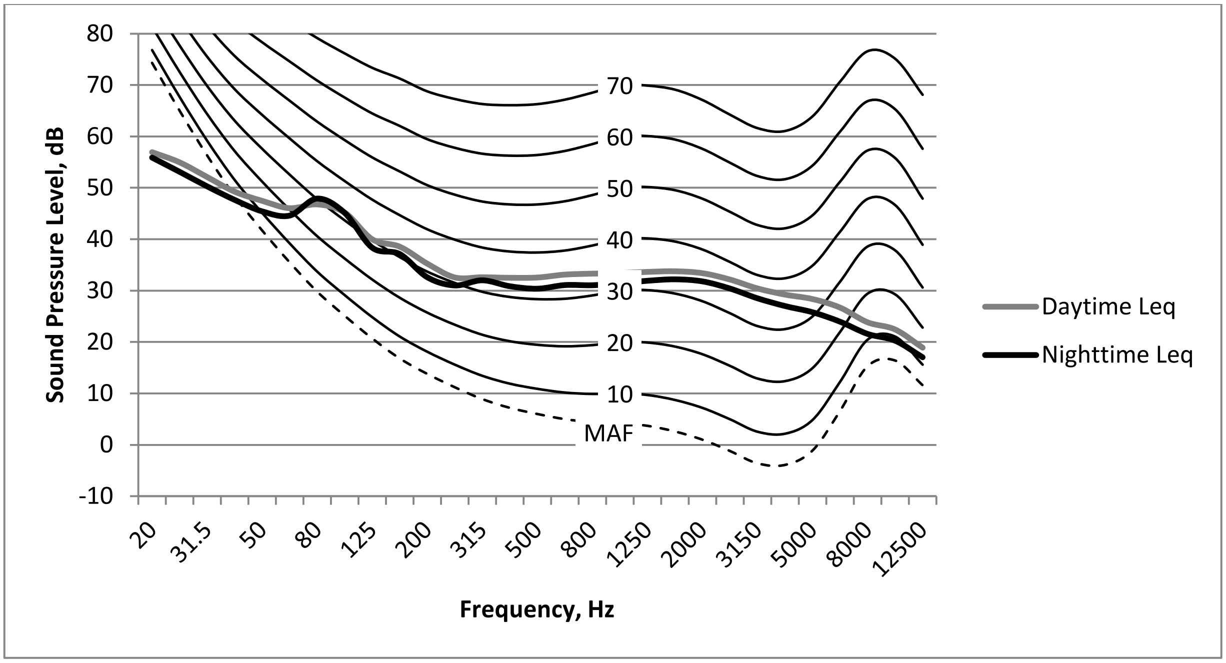

Figure 31. Sea Coast – Summer Season Equivalent Sound Level

Ambient equivalent sound levels at the Sea Coast monitoring location are moderately high. Sound levels are below the threshold of hearing in the lowest frequencies. Noise levels during the daytime hours are higher than nighttime hour, due to the increased presence of wildlife and activities at the Central Pad. Loudness of the natural sound level approaches 40 phon in some high-frequency bands during both daytime and nighttime. The mid-frequency bands and some low-frequency bands follow the 30 phon contour which sometimes results in a broadband sound which humans often don't discern.

Figure 32 summarizes the results of the audibility study performed for Sea Coast monitoring location.

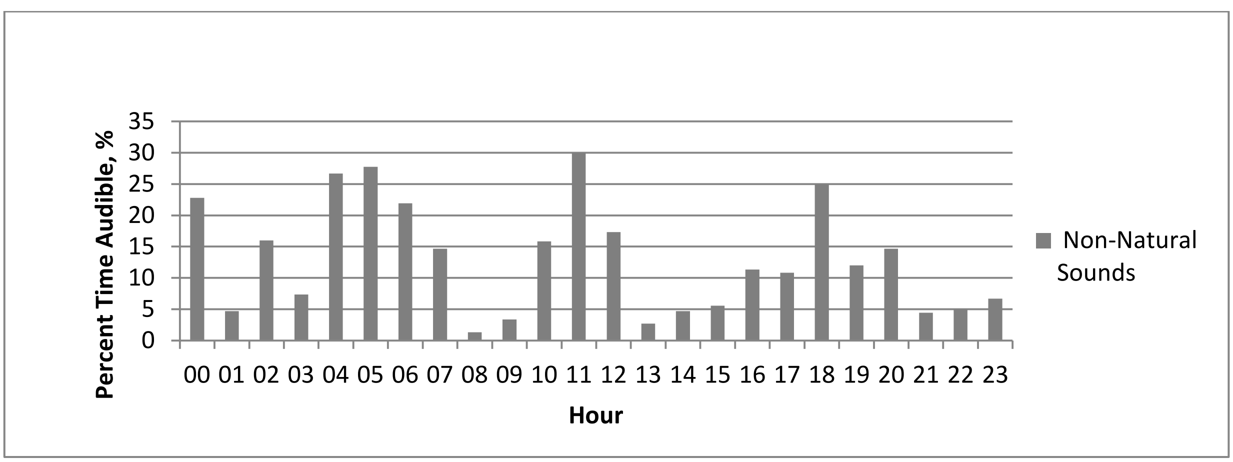

Figure 32. Sea Coast – Summer Season Percent Time Audible

Manmade noise identified through audio review ranged from 0 to 26 events per hour. On average human created sounds were audible between 1 and 30 percent of the time dependant on the hour, based on selective audio review. The audible noise environment in the coastal shoreline soundscape during the summer season is dominated by natural sources such as wind and wildlife. Non-natural audible events included infrequent aircraft overflight and noise from the Central Pad.

Figure 33 depicts the natural sound level of the coastal shoreline soundscape during the daytime and nighttime in summer season.

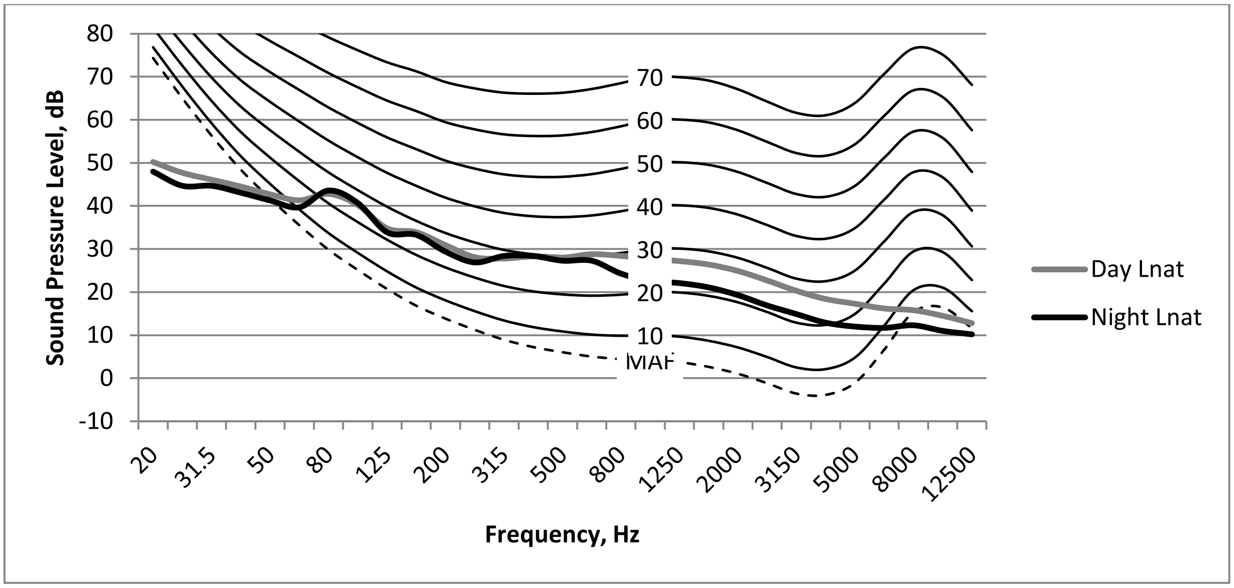

Figure 33. Sea Coast – Summer Season Natural Sound Level

Natural ambient sound levels at the Sea Coast monitoring location are relatively low. Sound levels are below the threshold of hearing in the low and high frequencies. Noise levels during the daytime hours are slightly higher than nighttime hours, due to the increased presence of wildlife. The loudness of the daytime natural sound level approaches 30 phon in many bands from low to high frequencies. The loudness of the nighttime natural sound level approaches 30 phon in some mid- and low-frequency bands.

3.3 OVERALL DATA SUMMARIES

Equivalent sound levels throughout the project area vary dependant on the time of day, season and the surrounding natural and human created environment.

Figure 34 summarizes the overall equivalent sound levels measured during the winter and summer season.

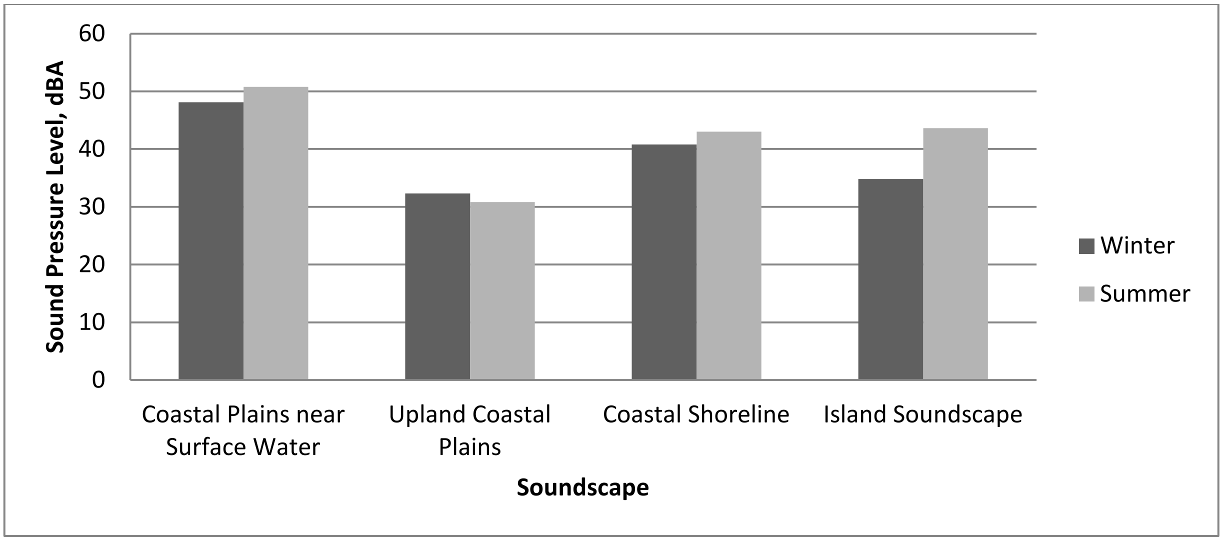

Figure 34. Equivalent Sound Level Comparison

Average existing sound levels in the project study area can vary up to 20 dB dependant on the soundscape and season. Noise levels generally increased during the summer season due to increased human activity and the influence of moving water, with the exception of the upland coastal plain soundscape.

Generally sound levels in the Coastal Plain near surface water features the loudest in the project study area, while upland coastal plains without the influence of surface water features are the lowest. Equivalent sound levels at the coastal shoreline and island soundscape are influenced heavily by both natural and human created sound, as determined in audio review.

Figure 35 summarizes the overall natural ambient sound levels measured during the winter and summer season.

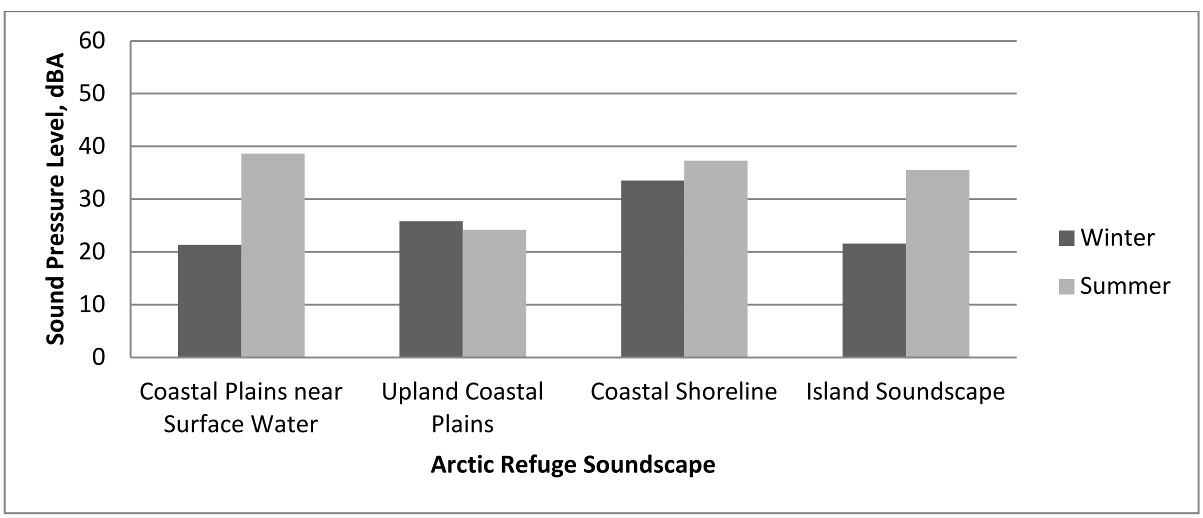

Figure 35. Natural Ambient Sound Level Comparison

Natural ambient sound levels throughout the project area are low. Sound levels, excluding distinctly audible anthropogenic noise range from 21 to 39 dBA. Noise levels in this range are likely influenced by instrumentation noise; therefore it is likely that existing noise levels are lower than presented in Figure 35. Generally natural noise levels were greater in the summer season due to the influence of water features such as the Canning River. Natural ambient noise levels at the Canning River, Coastal Plains and Brownlow's Spit monitoring location are lower than typical residential noise environments and comparable to an unoccupied building.

Ambient sound levels at the Coastal shoreline and island monitoring locations are influenced by both continuous and intermittent industrial noise sources, from current activities on the Point Thomson Central Pad. Daytime and nighttime ambient noise levels at these locations are comparable to a quiet bedroom at night. The natural ambient sound level at this location could not be accurately determined due to consistent presence of industrial activities and proximity to the Central Pad.

Figure 36 presents a summary of human created noise events for the four primary soundscapes in the Point Thomson noise study area. Audio recordings at the Canning River takeout site during the winter season were unavailable therefore audio review could not be performed during the winter season.

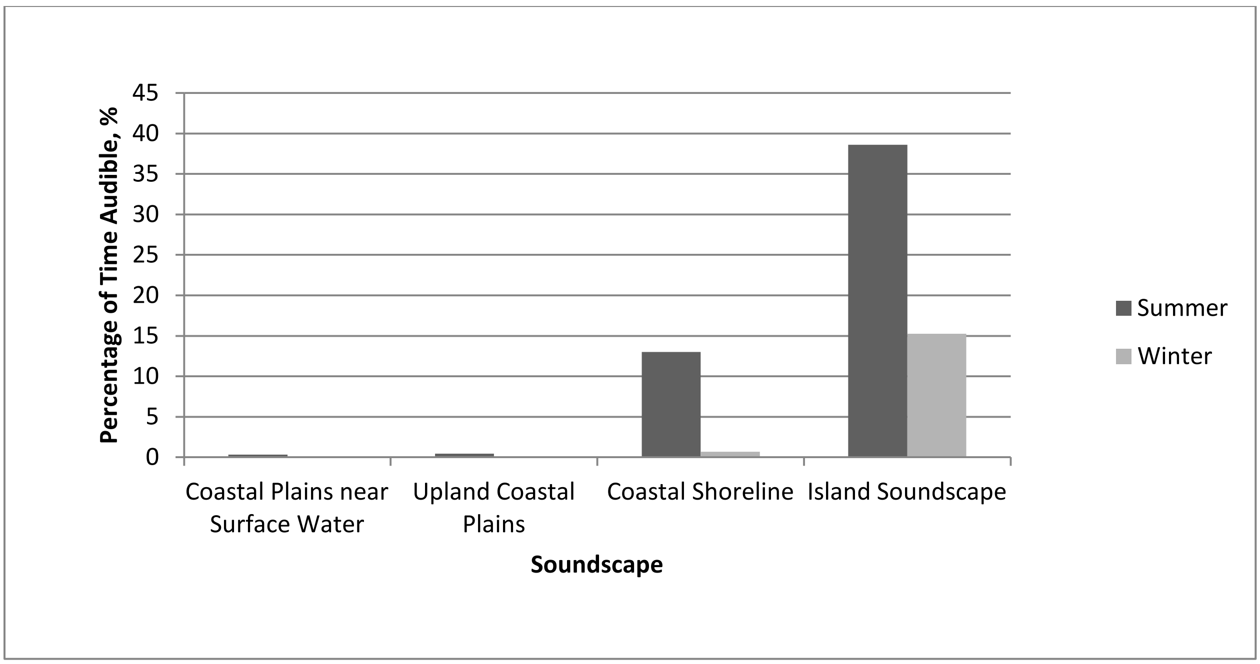

Figure 36. Audible Anthropogenic Noise Summary

As shown in Figure 36 audible anthropogenic noise is infrequent in the upland coastal plains and coastal shoreline soundscape. Human created noise was audible less than 1 percent of the time at either site. The audible anthropogenic noise events at the island monitoring locations and coastal shoreline sounds capes are much more frequent than the surround project area, with discrete noise events occurring between 10 and 40 percent of the time. Discrete audible noise events heard during audio review include aircraft overflight, PA systems, backup alarms and other equipment.[1]

The ambient soundscape in the project area is influenced by both human and natural sound sources. The four soundscapes within the noise study area, upland coastal plain; upland coastal plain near surface water features; off-shore island, and coastal shoreline vary in noise level, distribution of noise throughout the day and range of noise levels dependant on local fauna and the frequency of human created noise events.

The natural ambient soundscape of within the Arctic Refuge is dominated by noise from nature such as meteorological phenomena, animals, and insects. Noise from human activities, such as currently permitted drilling activities, are largely absent from the ambient soundscape in the Arctic Refuge.

[1] Review of spectrograms for the Mary Sachs Island monitoring location revealed the presence of continuous noise sources creating elevated background levels that would not have been recognized as human created noise events during audio review.

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Chapter 4. Project-related Noise Levels

This section describes the results of project-related noise modeling based on the action alternatives presented in the Draft EIS (Alternatives B, Applicant's Proposed Action; Alternative C, Inland Pads with Gravel Road; Alternative D, Inland Pads with Seasonal Ice Access Road; and Alternative E, Coastal Pads with Seasonal Ice Roads). The No Action Alternative (Alternative A) was not modeled and is not discussed in this noise technical report. Noise contours showing the potential distribution of project-related noise in winter and summer seasons are presented for each action alternative.

There are numerous components common to all action alternatives. Among these are wells and production pads, Central Processing Pad with main processing and utility modules, support facilities (storage, camps, water storage, water treatment system and waste disposal, communications, power generation, safety zones and storage), export pipelines, infield gathering lines, transportation facilities, and a gravel source.

4.1 ALTERNATIVE B: APPLICANT'S PROPOSED ACTION

Alternative B would configure the drilling and production facilities onto three gravel pads to facilitate evaluation of all hydrocarbon resources, and provide flexibility for future natural gas production should the currently-proposed project prove that larger-scale natural gas production was viable. This alternative would locate the onshore gravel pads near the coastline, incorporating portions of two existing gravel pads. To facilitate the transport of larger facility modules to Point Thomson, a sealift facility composed of onshore bulkheads and offshore mooring dolphins would be constructed.

Under this alternative, the Applicant proposes to: enlarge the existing Central Pad; construct several additional pads (including the East Pad, West Pad, airstrip, and more); drill additional wells; construct a new pipeline to Badami, and; construct and operate the central processing facility (CPF). Noise emissions from these and other activities were assessed in this analysis. The drilling rig is a large noise emission source during the construction and drilling phase. The turbines used during operations at the CPF are the largest noise source during operations. Noise from the proposed construction, drilling, and operations in Alternative B has the potential to dominate the ambient soundscape in the immediate vicinity (within 0.5 miles) of the noise sources, but would only occasionally punctuate the ambient soundscape at places like Mary Sachs Island and beyond (Figure 37 through Figure 40).

4.1.1 Construction and Drilling

Noise modeling results are expressed in Table 7 and also graphically in the noise contour figures (Figure 37 through Figure 40). The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. The dominant features of the figures are the noise contours from the airplane and helicopter flight path, noise from barge and other water-based activities (in summer), drilling (in winter), and noise from activities closer to the proposed pads including the Central Pad.

Noise in the project area may increase between 0 to 21 dBA depending on existing conditions and distance from the noise sources (Table 7). Construction and drilling noise may be audible in nearby areas (up to 8 miles away), represented by Brownlow Spit, Mary Sachs Island, Sea Coast, and Flaxman Island monitoring locations. The largest anticipated increase in noise would be measured at the Sea Coast monitoring location, about 2.5 miles NE of the Central Pad. This increase (21 dBA) would be perceived as more than a doubling of loudness.

This analysis conservatively assumed that drilling would occur on the East Pad during February of Year 3 based on the winter construction scenario modeled in the analysis of all of the action alternatives. This results in louder wintertime noise levels than summertime noise levels. Noise from tug boat use would dominate summertime noise levels at locations close to the shore like the Sea Coast monitoring location. Also intermittent events such as blasting may create increases in measured noise levels and may be audible on a short term basis.

Areas further away from construction and drilling activities, represented by the Canning River West Bank and Coastal Plain monitoring locations (19 to 20 miles south), would experience a 0 to 2 dBA increase over existing conditions during winter months (Table 7). Increases of <2 dBA are generally considered to be below the threshold of human perception, although a change in the spectral distribution may result in audible tones or low frequency hums during periods of low or no winds.

Table 7. Alternative B—Increases in Noise above Existing Levels from Construction and Drilling

Noise Monitoring Location	Existing Noise Level, L_{eq} dBA	Construction + Drilling Noise Level, L_{eq} dBA[e]	Existing + Construction + Drilling Noise Level, L_{eq} dBA	Increase Over Existing, dBA[f]
Winter				
Brownlow Spit	35	38	40	5
Canning River West Bank	48	29	48	0
Coastal Plain	32	29	34	2
Mary Sachs Island	37	39	41	4
Sea Coast	35[a]	56	56	21
Flaxman Island	37[b]	40	42	5
Summer				
Brownlow Spit	43[c]	19	43	0
Canning River West Bank	51	6	51	0
Coastal Plain	31	7	31	0
Mary Sachs Island	44[d]	45	48	4
Sea Coast	43	46	48	5
Flaxman Island	44	26	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Brownlow Spit (8.3 miles E of the Central Pad).

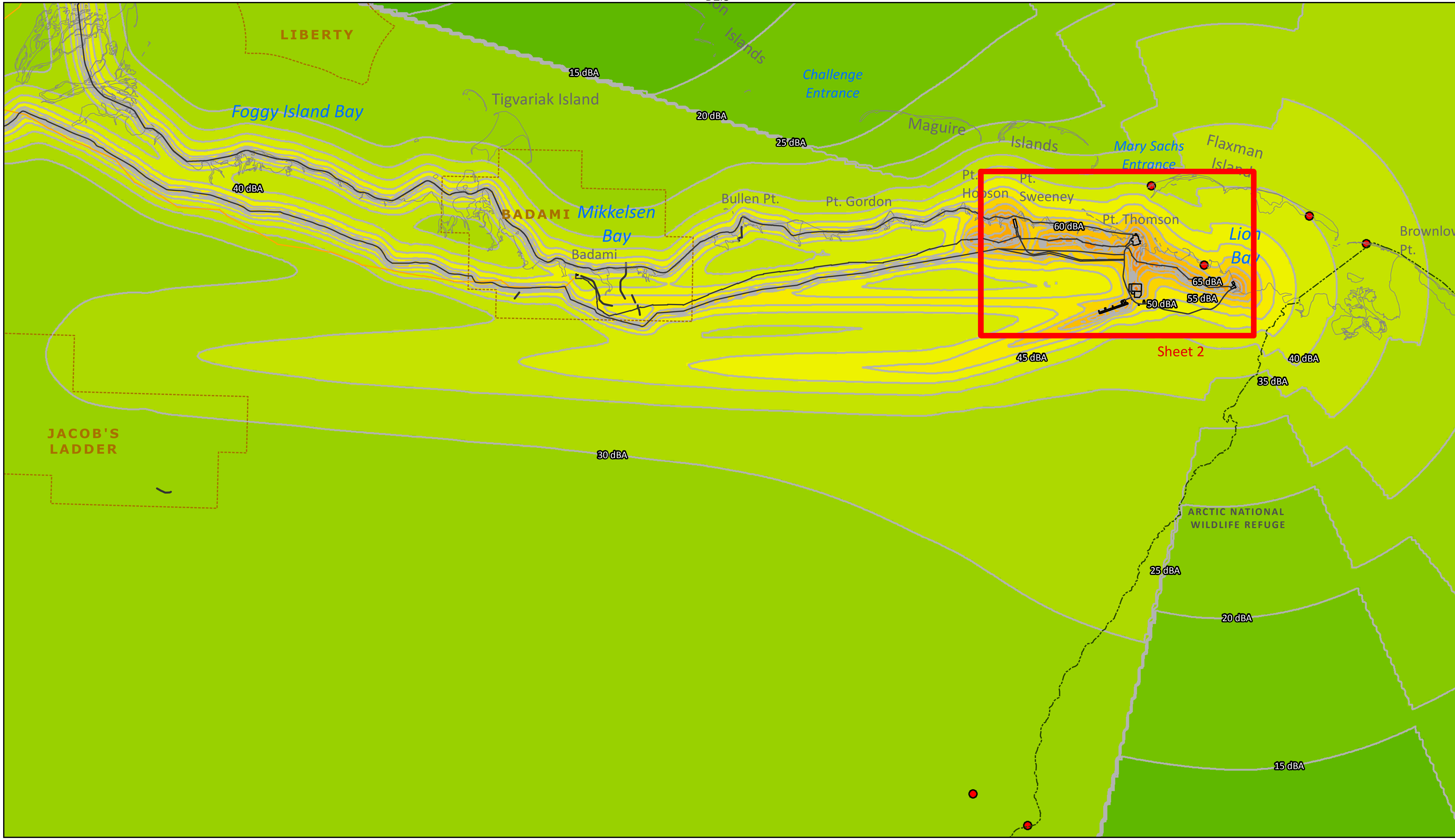
[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 mi NE of the Central Pad).

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad).

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad).

[e] The levels in this column are mapped on Figure 37 through Figure 40.

[f] The magnitude of impact for this alternative was based on the predicted increases in this column.



POINT THOMSON
PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Contours (5 dBA)
- Alternative B Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

N

0 2 4 Miles

Figure 37

Alternative B - Construction
Winter Noise Contours Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009;
BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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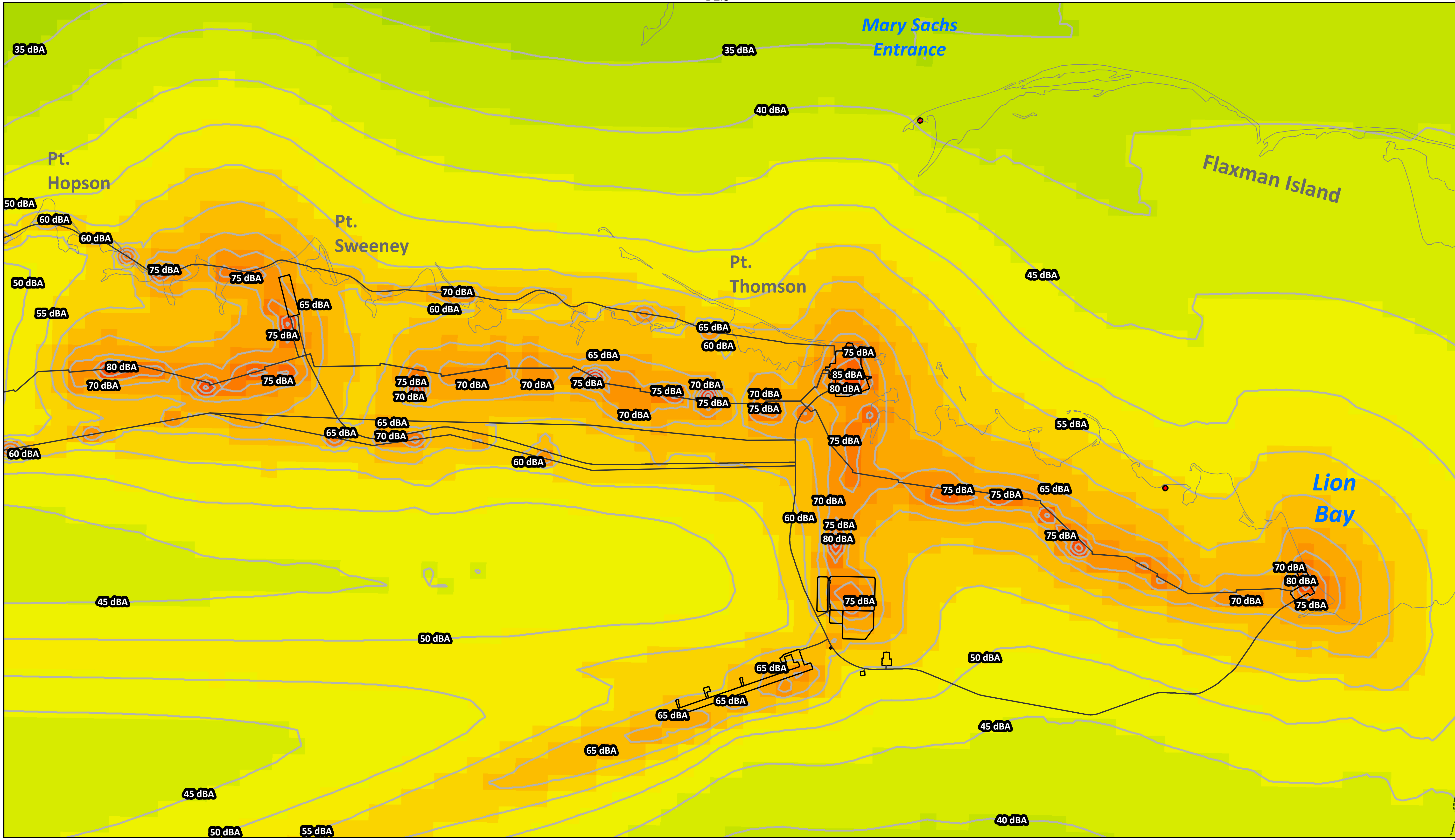

POINT THOMSON PROJECT EIS

Legend

Arctic National Wildlife Refuge
Upland
Existing Pipeline

Proposed Layout - Noise Contour Data

Noise Receptors
Contours (5 dBA)
Alternative B Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 38

Alternative B - Construction
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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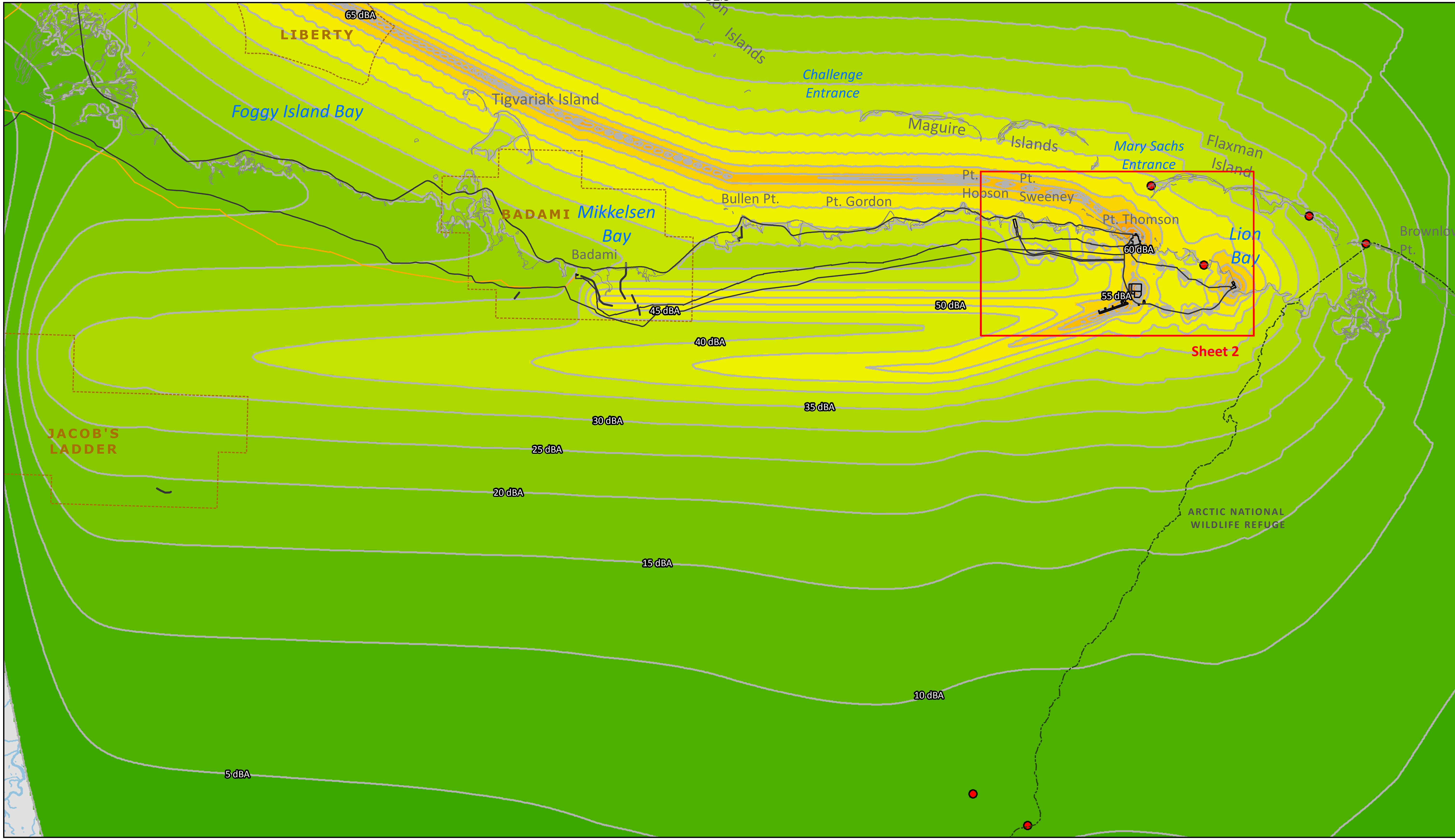

POINT THOMSON PROJECT EIS

Legend
- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data
- Noise Receptors
- Contours (5 dBA)
- Alternative B Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

0 2 4 Miles

Figure 39
Alternative B - Construction
Summer Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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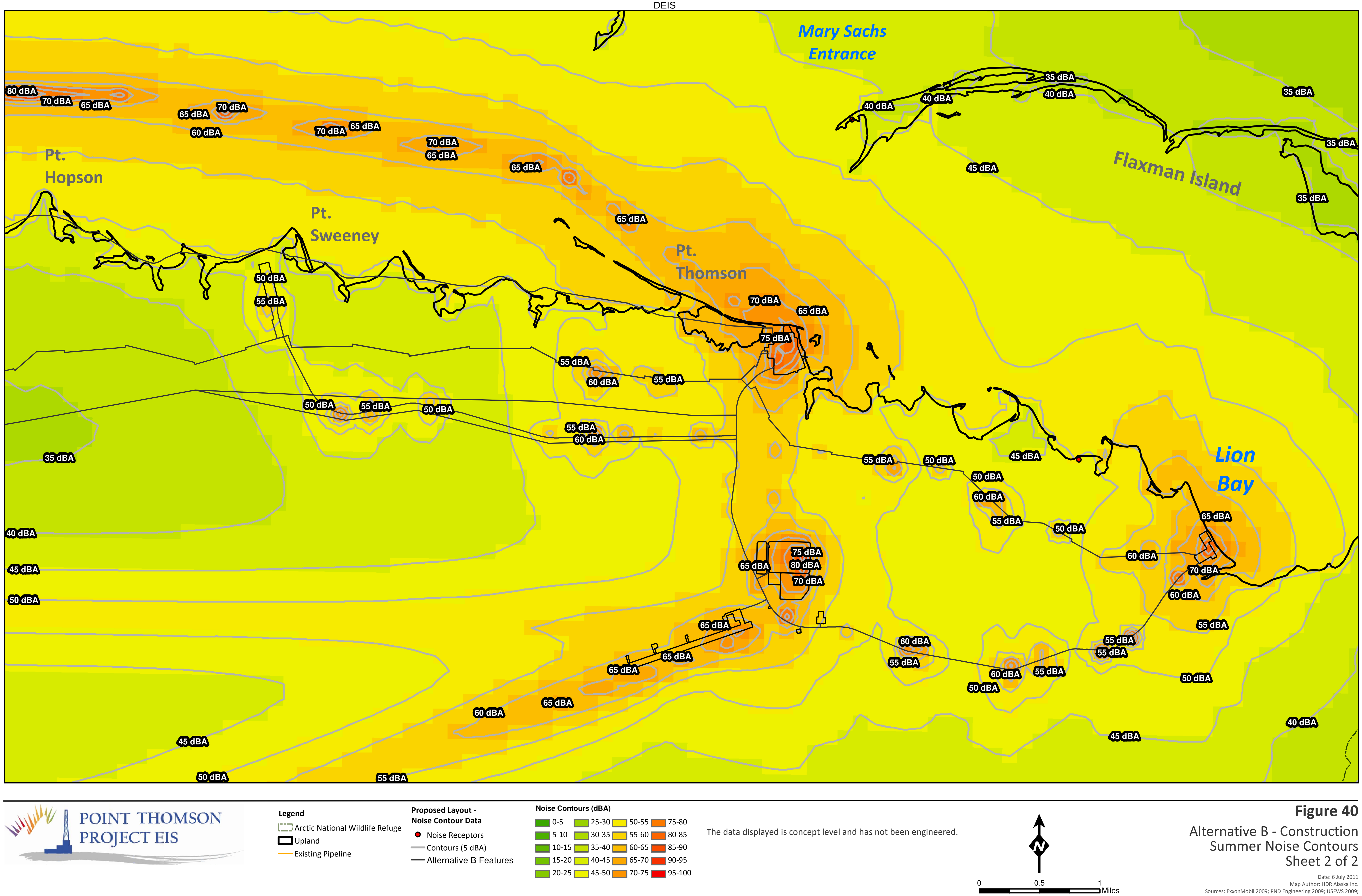
Mary Sachs
Entrance
Flaxman Island
Pt.
Hopson
Pt.
Sweeney
Pt.
Thomson
Lion
Bay
80 dBA
70 dBA
65 dBA
60 dBA
55 dBA
50 dBA
45 dBA
40 dBA
35 dBA
75 dBA
POINT THOMSON
PROJECT EIS
Legend
Arctic National Wildlife Refuge
Upland
Existing Pipeline
Proposed Layout -
Noise Contour Data
Noise Receptors
Contours (5 dBA)
Alternative B Features
Noise Contours (dBA)
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
80-85
85-90
90-95
95-100
The data displayed is concept level and has not been engineered.
N
0
0.5
1
Miles
Figure 40
Alternative B - Construction
Summer Noise Contours
Sheet 2 of 2
Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009;
BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.1.2 Operations

Noise modeling results for Alternative B operations are expressed in Table 8 and, and also graphically on Figure 41 through Figure 44. The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. The dominant features shown on the figures are the noise contours from the airplane and helicopter flight path, noise from barge and other water-based activities (in summer), and noise from activities closer to the proposed pads including the Central Pad. Noise from operations in Alternative B has the potential to dominate the ambient soundscape in the immediate vicinity of the noise sources, but would only occasionally punctuate the ambient soundscape at places like Mary Sachs Island and beyond.

Noise from operations is predicted to increase between 0 to 4 dBA above the existing noise in the project area at sites depending on existing conditions and distance from the noise sources (Table 8). Generally a 3-dBA increase is considered barely noticeable to the human ear, although this does not account for a change in the spectral distribution of the noise. Therefore, this increase may occasionally result in audible tones or low-frequency hums. Calculated noise levels from the proposed operations are lower than 2010 existing average noise levels in more distant portions of the project area represented by monitoring locations at Brownlow Spit, the west bank of the Canning River, the Coastal Plain, and Flaxman Island (Table 8).

Table 8. Alternative B – Increases in Noise above Existing Levels from Operations

Monitoring location	Existing Noise Level, L_{eq} dBA	Operations Noise Level, L_{eq} dBA	Existing + Operations Noise Level, L_{eq} dBA	Increase Over Existing, dBA[e]
Winter				
Brownlow Spit	35	15	35	0
Canning River West Bank	48	6	48	0
Coastal Plain	32	13	32	0
Mary Sachs Island	37	31	38	1
Sea Coast	35[a]	36	39	4
Flaxman Island	37[b]	18	37	0
Summer				
Brownlow Spit	43[c]	14	43	0
Canning River West Bank	51	8	51	0
Coastal Plain	31	9	31	0
Mary Sachs Island	44[d]	33	44	0
Sea Coast	43	37	44	1
Flaxman Island	44	18	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 miles NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e] The levels in this column are mapped on Figures 41 through 43 .

The dominant sources of noise from operations vary depending on season, proximity to the Central Pad, and the presence of other noise. The most common dominant sources measured at each monitoring location come from the CPF (primarily the turbines) and aircraft overflight (Table 9); this is true for all action alternatives. Other activities that may seasonally create elevated noise levels include road maintenance and snow removal activities at the East Pad (Table 9).

Noise from the CPF and roadway transportation would occur more frequently or continuously during operations. Activities such as aircraft overflight, road maintenance and snow removal activities would be intermittent and would dominate the near-field soundscape when in operation. Other intermittent noise sources not included in the operations noise assessment include public address (PA) announcements and vehicle backup beepers. These activities would occur occasionally during operations and would increase noise in the immediate vicinity (within 0.5 miles) of the Central Pad. Based on a review of the audio recorded during the winter 2010, PA announcements from the Central Pad were audible at Flaxman Island. The fact that a sound is audible does not mean it always increases the A-weighted noise level. Also, audibility is very difficult to predict over distances as large as the project area.

Table 9. Alternative B—Dominant Noise Sources from Operations

Monitoring location	CPF	Aircraft Overflight	Roadway Transportation	Road Maintenance Activities	Snow Removal Activities	Barge Traffic
Winter						
Brownlow Spit	X	X				
Canning River West Bank		X	X		X	
Coastal Plain	X	X	X		X	
Mary Sachs Island	X	X				
Sea Coast	X	X				
Flaxman Island	X	X				
Summer						
Brownlow Spit	X	X				
Canning River West Bank	X	X				
Coastal Plain	X	X				
Mary Sachs Island	X	X		X		X
Sea Coast		X		X		
Flaxman Island	X	X		X		

Based on monitoring data, noise from operations during winter and summer may be audible from 2 to 3 miles from the Central Pad (Figure 42), particularly when winds are below 11 mph. Visitors to the western-most portions of the Refuge may experience project-related noise when winds are very still. When winds are not still, there is potential that wind-induced noise may mask project-related noise; this is particularly true of winds above 11 mph from any direction. The acoustically absorptive tundra may also help reduce project-related noise levels at locations inside the Arctic Refuge during the summer. In winter, however, denser (colder) air and non-absorptive ground cover may contribute to sound propagation. In some cases winds from the west may transport noise farther eastward than would otherwise occur. It is very difficult to estimate where, or the extent to which project-related noise will be audible under various wind speeds and directions.

However it is likely that project-related noise will be lower in the eastern portions of the study area when the winds blow from the east.

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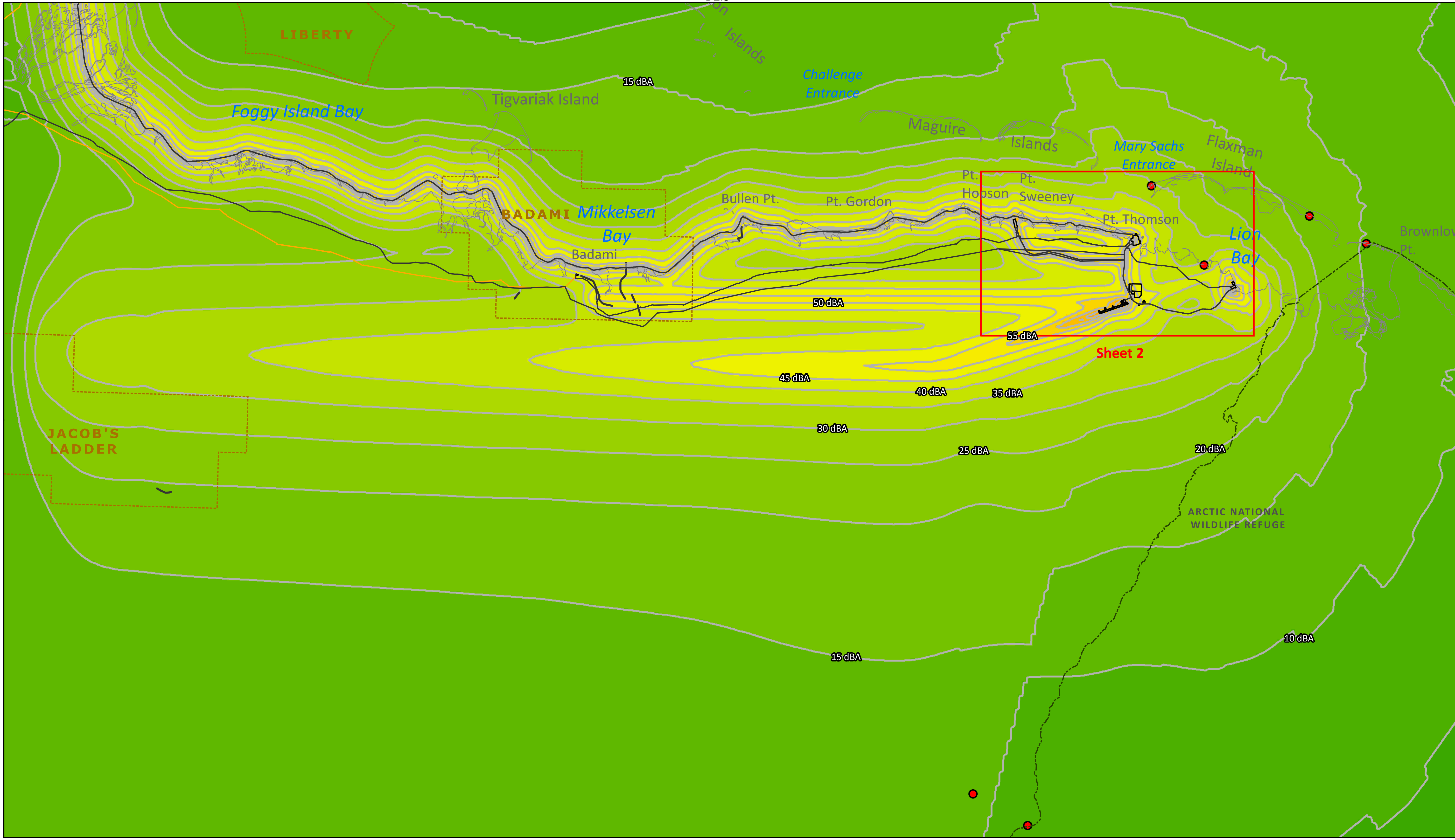

POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Contours (5 dBA)
- Alternative B Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

N

0 2 4 Miles

Figure 41

Alternative B - Operations
Winter Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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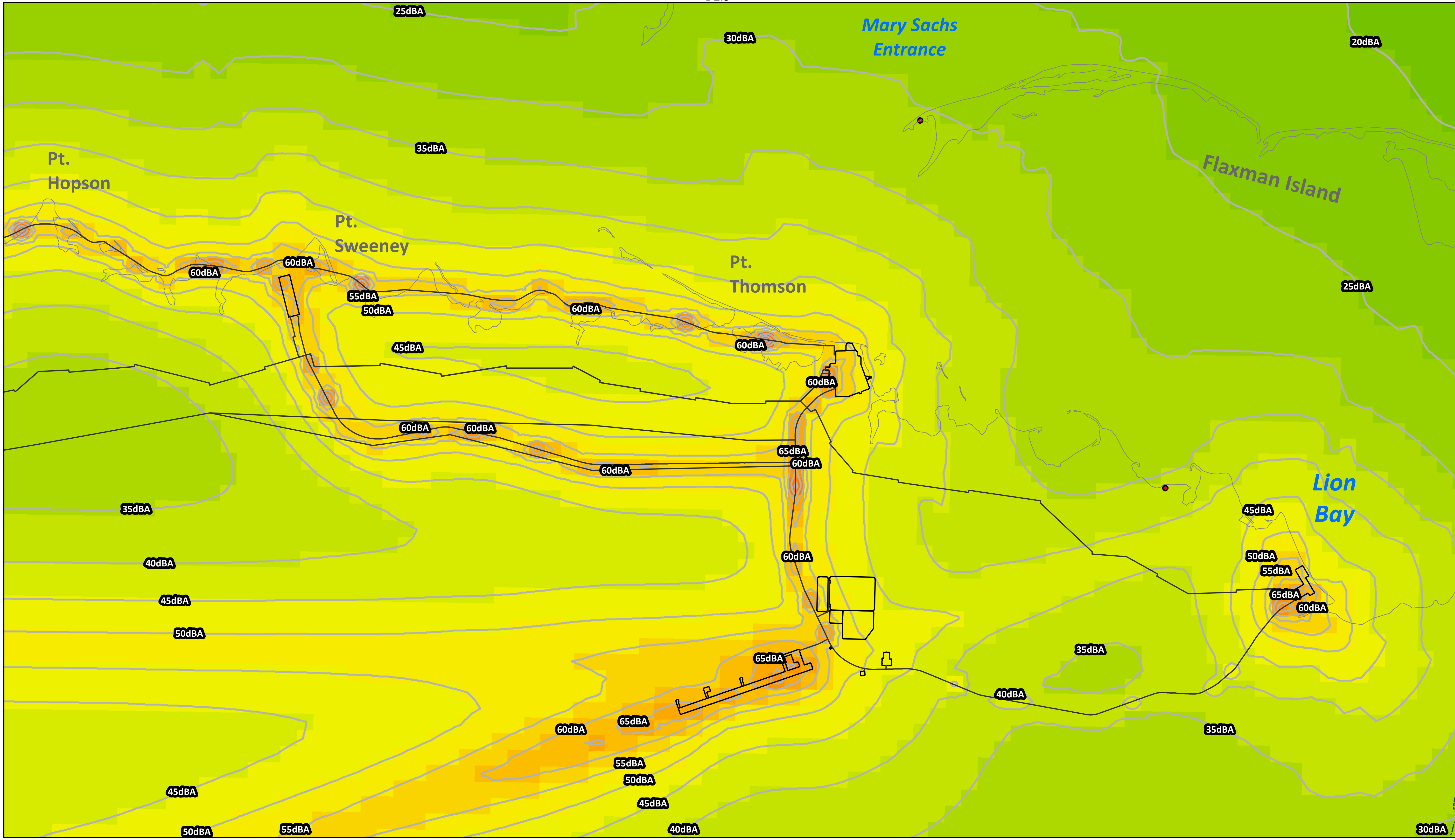

POINT THOMSON PROJECT EIS

Legend
- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data
- Noise Receptors
- Contours (5 dBA)
- Alternative B Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 42
Alternative B - Operations
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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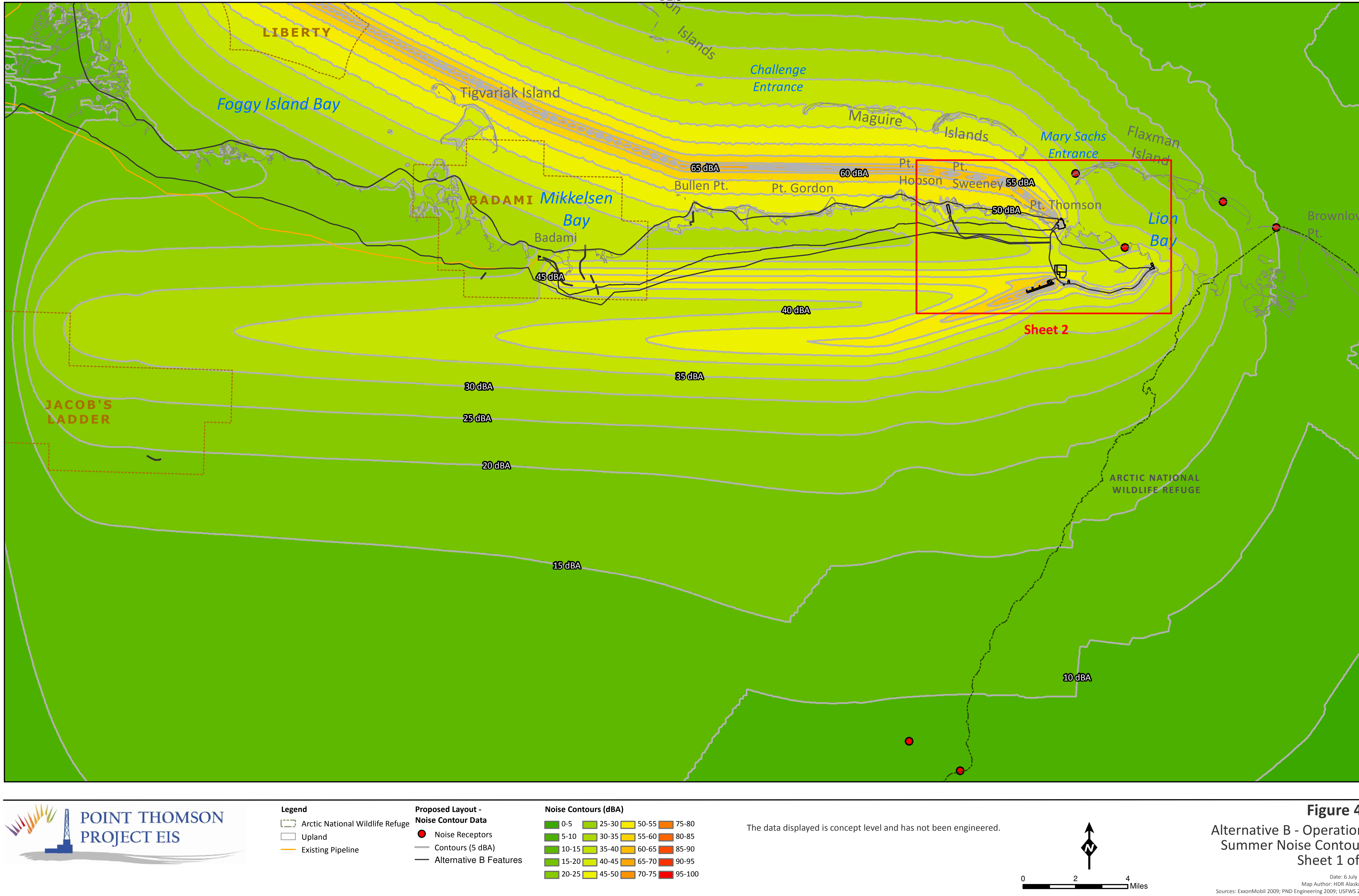

POINT THOMSON PROJECT EIS

The data displayed is concept level and has not been engineered.

Figure 43

Alternative B - Operations
Summer Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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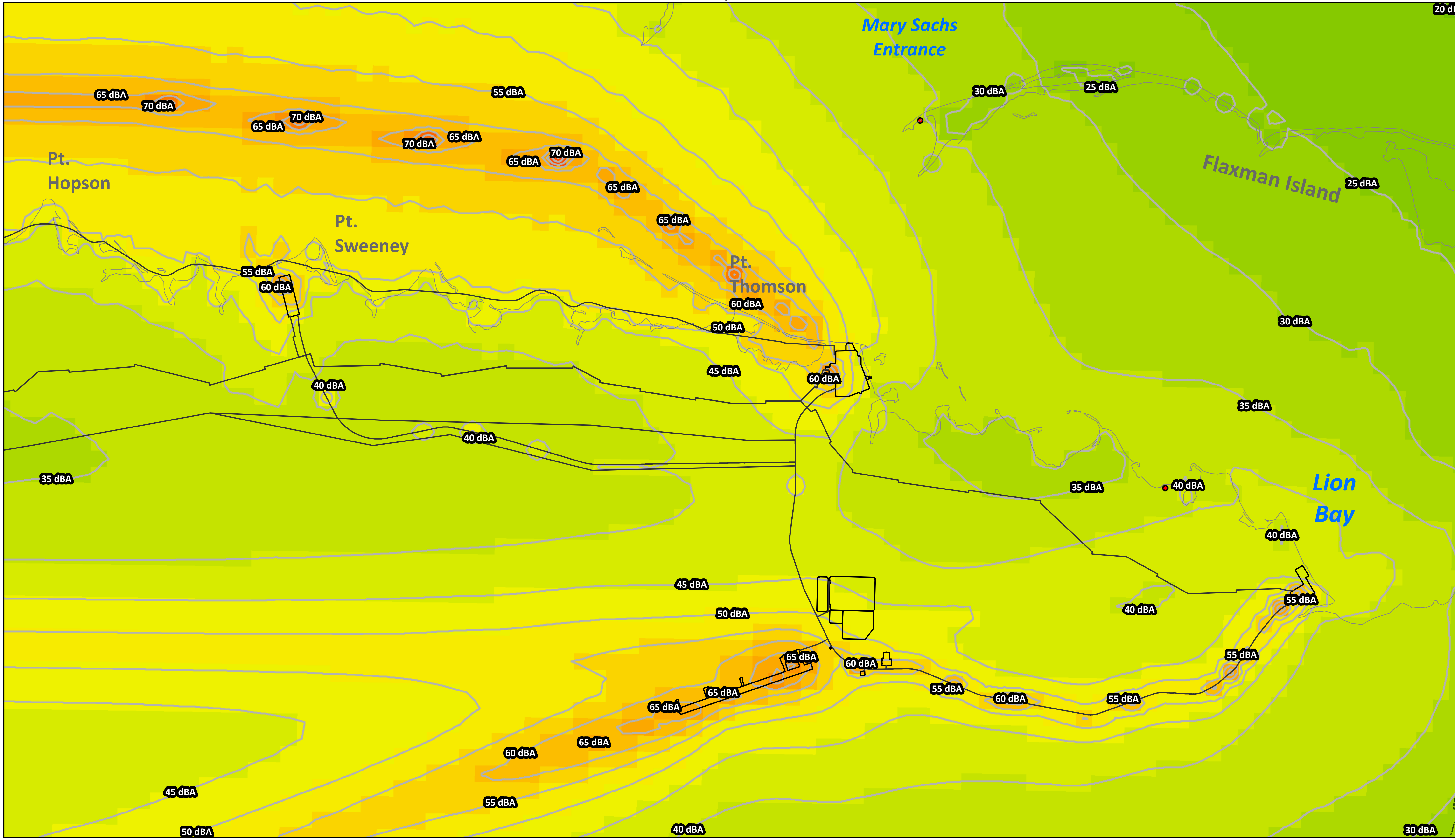

POINT THOMSON PROJECT EIS

Legend
Arctic National Wildlife Refuge
Upland
Existing Pipeline

Proposed Layout - Noise Contour Data
Noise Receptors
Contour (5 dBA)
Alternative B Features

Noise Contours (dBA)
0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

0 0.5 1 Miles

Figure 44
Alternative B - Operations
Summer Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.2 ALTERNATIVE C: INLAND PADS WITH GRAVEL ACCESS ROAD

The intent of Alternative C is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to avoid potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move project components inland and as far away from the coast as practicable and feasible. To provide year-round access to Point Thomson, this alternative would also include the construction of approximately 46 miles of all-season gravel road from Point Thomson to Endicott Spur Road. Alternative C would not include barging or associated facilities for sea access to Point Thomson. Noise emissions from these and other activities were assessed in this analysis. Large noise emissions sources under Alternative C include construction activity associated with ice roads and pipelines, gravel road construction, aviation transport, power generation at the CPF, and drilling. The turbines used during operations at the CPF are the largest noise source during operations.

4.2.1 Construction and Drilling

Noise modeling results are expressed in Table 10 and also graphically in the noise contour figures (Figure Figure 45 - Figure 48). The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. The dominant features shown on the figures are the noise contours from the airplane and helicopter flight path, drilling (during winter construction), and noise from activities closer to the proposed pads including the Central Pad.

Noise from construction and drilling in Alternative C is predicted to increase noise levels from 0 to 12 dBA, depending on existing conditions and distance from the noise sources (Table 10). Noise from construction and drilling is predicted to noticeably increase noise levels during wintertime (>3 dBA) in areas close to the construction and drilling sites (4 to 8 mi). These areas are represented by the Brownlow Spit, Mary Sachs Island, Sea Coast, and Flaxman Island monitoring locations. The largest anticipated increase in noise (12 dBA) is shown for the Sea Coast monitoring location during the winter season (Table 10). This could be perceived as a clearly noticeable increase in noise level.

Areas further from construction and drilling represented by the Canning River West Bank and Coastal Plain monitoring locations (>19 miles away), would experience a minimal increase over existing conditions. Existing noise levels during the summer season are generally louder than the winter season due to the influence of running water and increased wildlife activity. As a result, estimates of future project-related noise levels do not indicate an increase in the existing noise level during the summer season. Increases of 0 to 2 dBA are below the threshold of human perception, although a change in the spectral distribution may result in audible tones or low frequency hums. Intermittent events such as blasting may create increased noise levels and may be audible on short term basis, particularly in areas closest to the blasting site.

Table 10. Alternative C – Increases in Noise above Existing Levels Due to Construction and Drilling				
Noise Monitoring Location	Existing Noise Level, L_{eq} dBA	Construction + Drilling Noise Level, L_{eq} dBA[e]	Existing + Construction + Drilling Noise Level, L_{eq} dBA	Increase Over Existing, dBA[f]
Winter				
Brownlow Spit	35	37	39	4
Canning River West Bank	48	29	48	0
Coastal Plain	32	29	34	2
Mary Sachs Island	37	38	41	4
Sea Coast	35[a]	47	47	12
Flaxman Island	37[b]	39	41	4
Summer				
Brownlow Spit	43[c]	16	43	0
Canning River West Bank	51	6	51	0
Coastal Plain	31	7	31	0
Mary Sachs Island	44[d]	43	47	3
Sea Coast	43	48	49	6
Flaxman Island	44	24	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

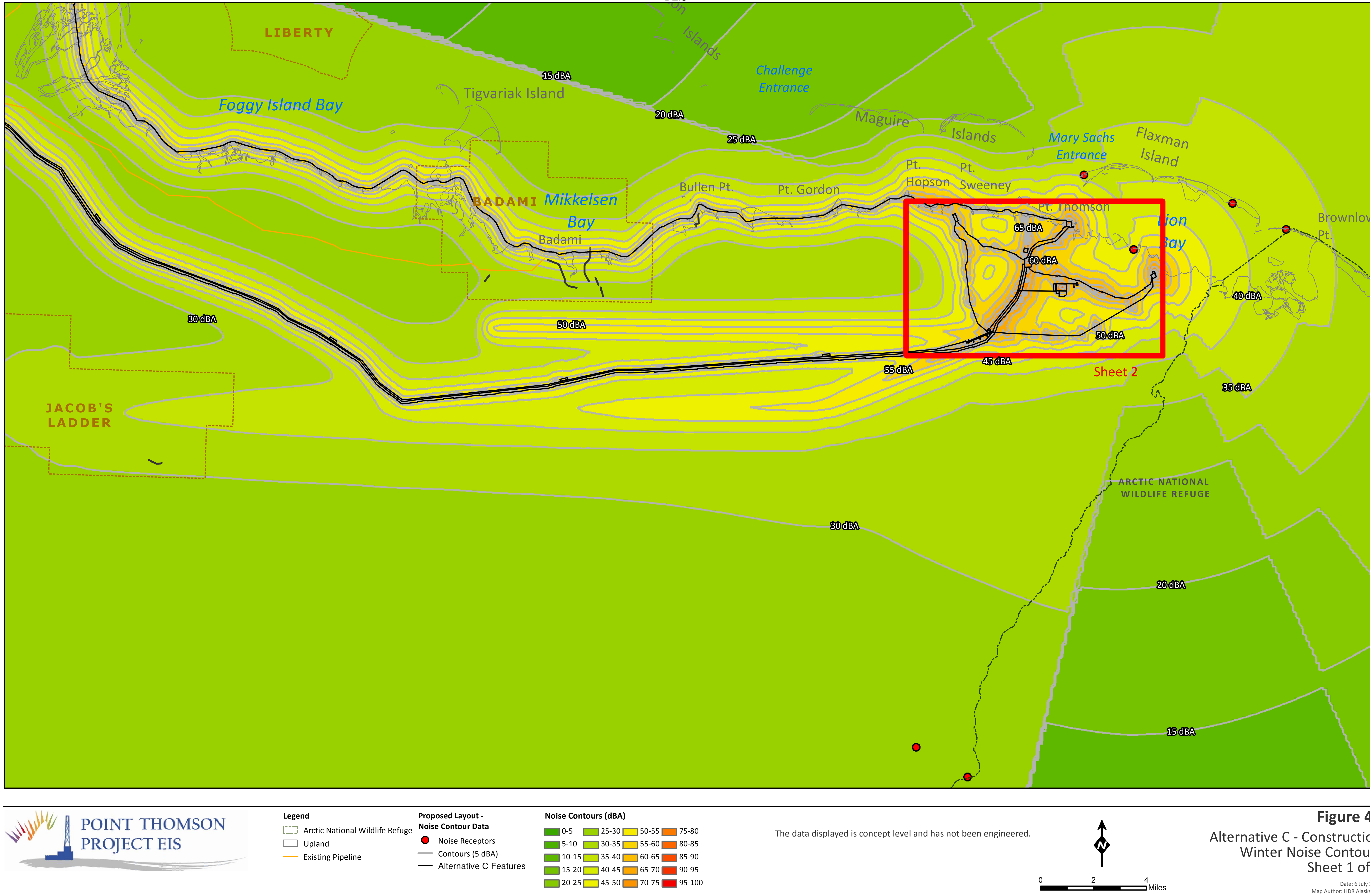
[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 mi NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e]The levels in this column are mapped on Figure 45 –Figure 48

[f]The magnitude of impact for this alternative was based on the predicted increases in this column



POINT THOMSON PROJECT EIS

The data displayed is concept level and has not been engineered.

Figure 45

Alternative C - Construction Winter Noise Contours Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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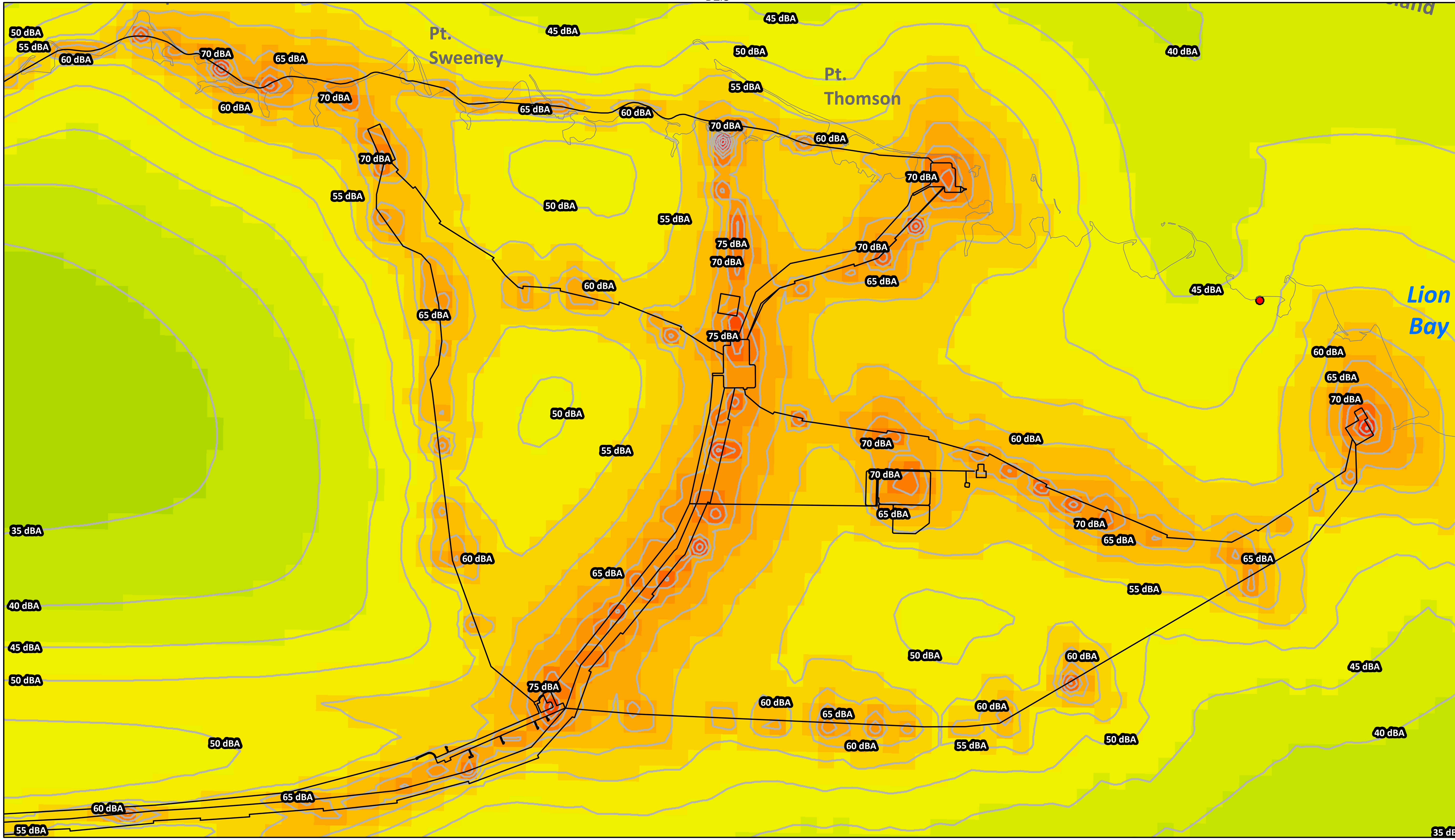

POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Contours (5 dBA)
- Alternative C Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

0 0.5 1 Miles

Figure 46

Alternative C - Construction
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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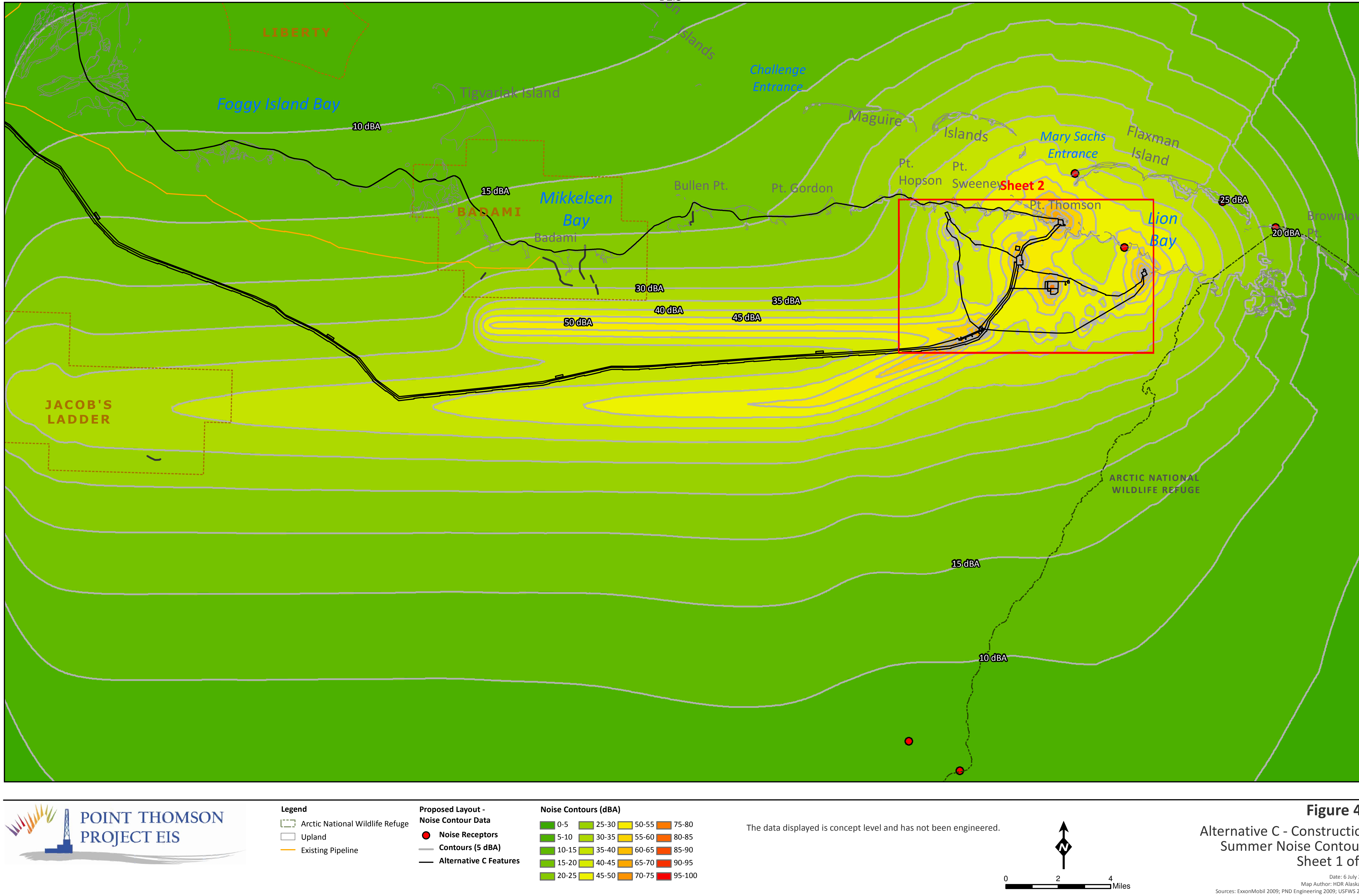

Figure 47

Alternative C - Construction
Summer Noise Contours
Sheet 1 of 2

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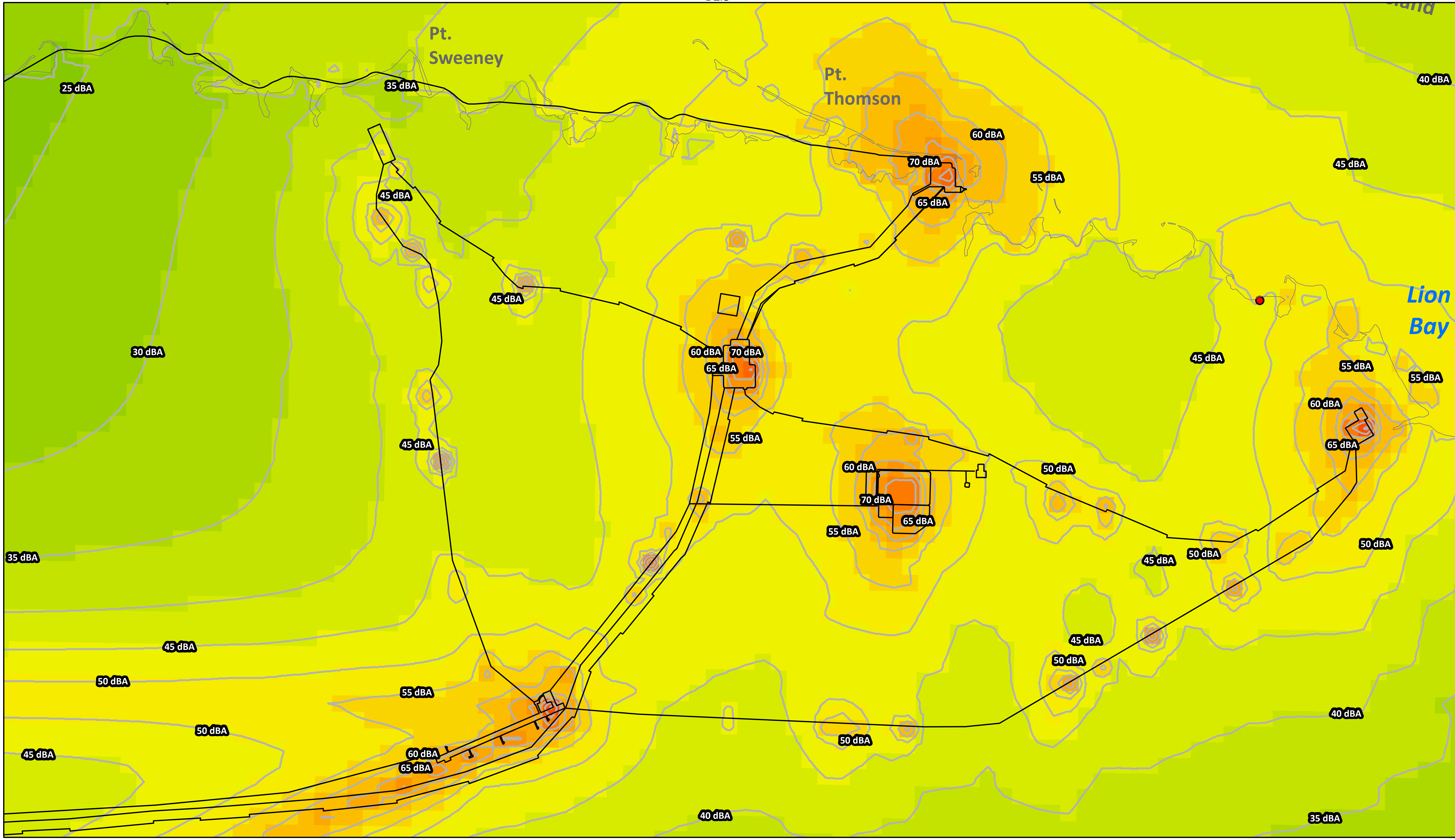

POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Contours (5 dBA)
- Alternative C Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 48

Alternative C - Construction
Summer Noise Contours
Sheet 2 of 2

Date: 29 December 2010
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2010

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4.2.2 Operations

Operational noise modeling results are expressed in Table 11 and Table 12, and also graphically in the noise contour figures (Figure 49 - Figure 52). The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. Airplane and helicopter flight path, snow removal (during winter), and noise from activities closer to the proposed pads including the Central Pad are the dominant noise sources from Alternative B.

In winter, noise from Alternative C operations in areas close to the CPF (<4 miles) are predicted to increase up to 2 dBA, represented by the Sea Coast monitoring location (Table 11). Generally a 1-dBA increase would not be considered noticeable to the human ear, although a change in the spectral distribution may result in audible tones or low frequency hums. Noise from operations are not predicted to increase above existing noise levels in areas >19 miles away, represented by the Coastal Plain and Canning River West Bank monitoring locations (Table 11). Noises from operations are not predicted to increase above existing noise level at any site during summer season, due to elevated existing noise levels.

Table 11. Alternative C– Increases in Noise above Existing Levels due to Operations

Monitoring location	Existing Noise Level, L_{eq} dBA	Operations Noise Level, L_{eq} dBA[e]	Existing + Operations Noise Level, L_{eq} dBA	Increase Over Existing L_{eq}, dBA
Winter				
Brownlow Spit	35	13	35	0
Canning River West Bank	48	7	48	0
Coastal Plain	32	8	32	0
Mary Sachs Island	37	22	37	0
Sea Coast	35[a]	33	37	2
Flaxman Island	37[b]	13	37	0
Summer				
Brownlow Spit	43[c]	12	43	0
Canning River West Bank	51	9	51	0
Coastal Plain	31	10	31	0
Mary Sachs Island	44[d]	21	44	0
Sea Coast	43	30	43	0
Flaxman Island	44	13	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 miles NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e]The levels in this column are mapped on Figure 49 – Figure 52

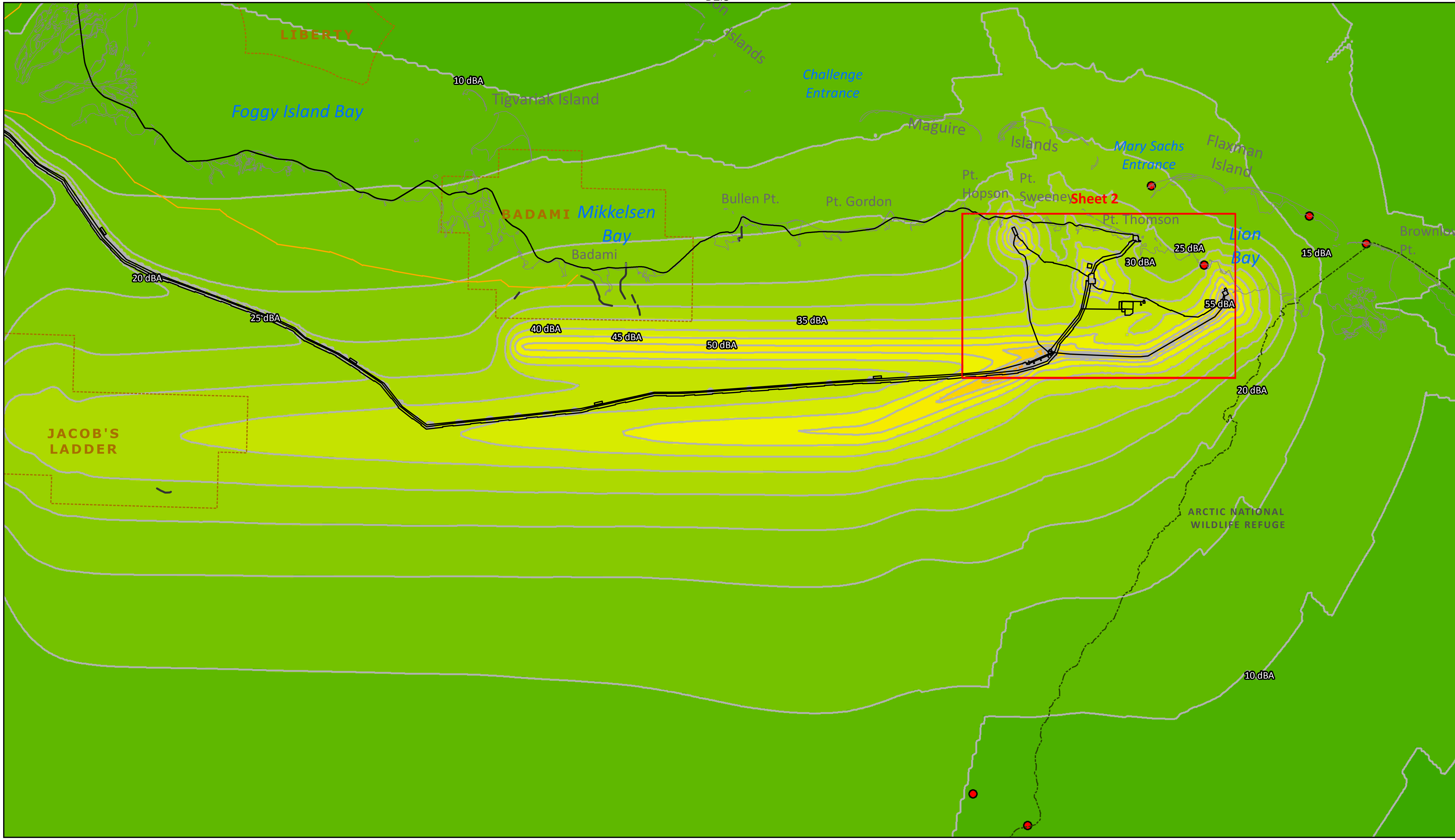
The dominant sources of noise from operations vary depending on season, proximity to the Central Pad, and the presence of other noise. The most common dominant sources at each representative monitoring location would be the CPF (primarily turbines) and aircraft overflight (Table 12). Other activities that would create elevated noise levels seasonally include road maintenance and snow removal (Table 12).

Noise from the CPF and roadway transportation would occur more frequently or continuously during operations than during construction. Activities such as aircraft overflight, road maintenance and snow removal activities would be intermittent but would dominate the soundscape when in operation. Other intermittent noise sources not included in the operations noise assessment include PA announcements and vehicle backup beepers. These activities would occur occasionally during operations and would increase noise in the immediate vicinity (within 0.5 miles) of the Central Pad. Based on a review of the audio recorded during the winter 2010, PA announcements from the Central Pad were audible at Flaxman Island.

Table 12. Alternative C – Dominant Noise Sources

Monitoring Location	CPF	Aircraft Overflight	Roadway Transportation	Road Maintenance Activities	Snow Removal Activities	Barge Traffic
Winter						
Brownlow Spit	X	X	X			
Canning River West Bank		X	X		X	
Coastal Plain		X	X		X	
Mary Sachs Island	X	X				
Sea Coast			X		X	
Flaxman Island	X	X				
Summer						
Brownlow Spit	X	X				
Canning River West Bank	X	X		X		
Coastal Plain	X	X				
Mary Sachs Island	X	X	X	X		
Sea Coast		S	X	X		
Flaxman Island	X	X	X			

Analysis results indicate that operational noise associated with Alternative C is expected to be slightly less than operational noise from Alternative B at the monitoring sites closest to the Central Pad. Visitors to the western-most portions of Arctic Refuge may experience project-related noise when winds are very still. When winds are not still, there is potential that wind-induced noise may mask project-related noise; this is particularly true of winds above 11 mph from any direction. In summer, the acoustically absorptive tundra may also help reduce project-related noise levels at locations inside the Refuge. In winter, denser (colder) air and non-absorptive ground cover may contribute to sound propagation; however, audibility is very hard to predict. In some cases winds from the west may transport noise farther eastward than would otherwise occur. It is very difficult to estimate where, or the extent to which project-related noise will be audible under various wind speeds and directions. However it is likely that project-related noise will be lower in the eastern portions of the study area when the winds blow from the east.



POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Noise Contours (5 dBA)
- Alternative C Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

0 2 4 Miles

Figure 49

Alternative C - Operations
Winter Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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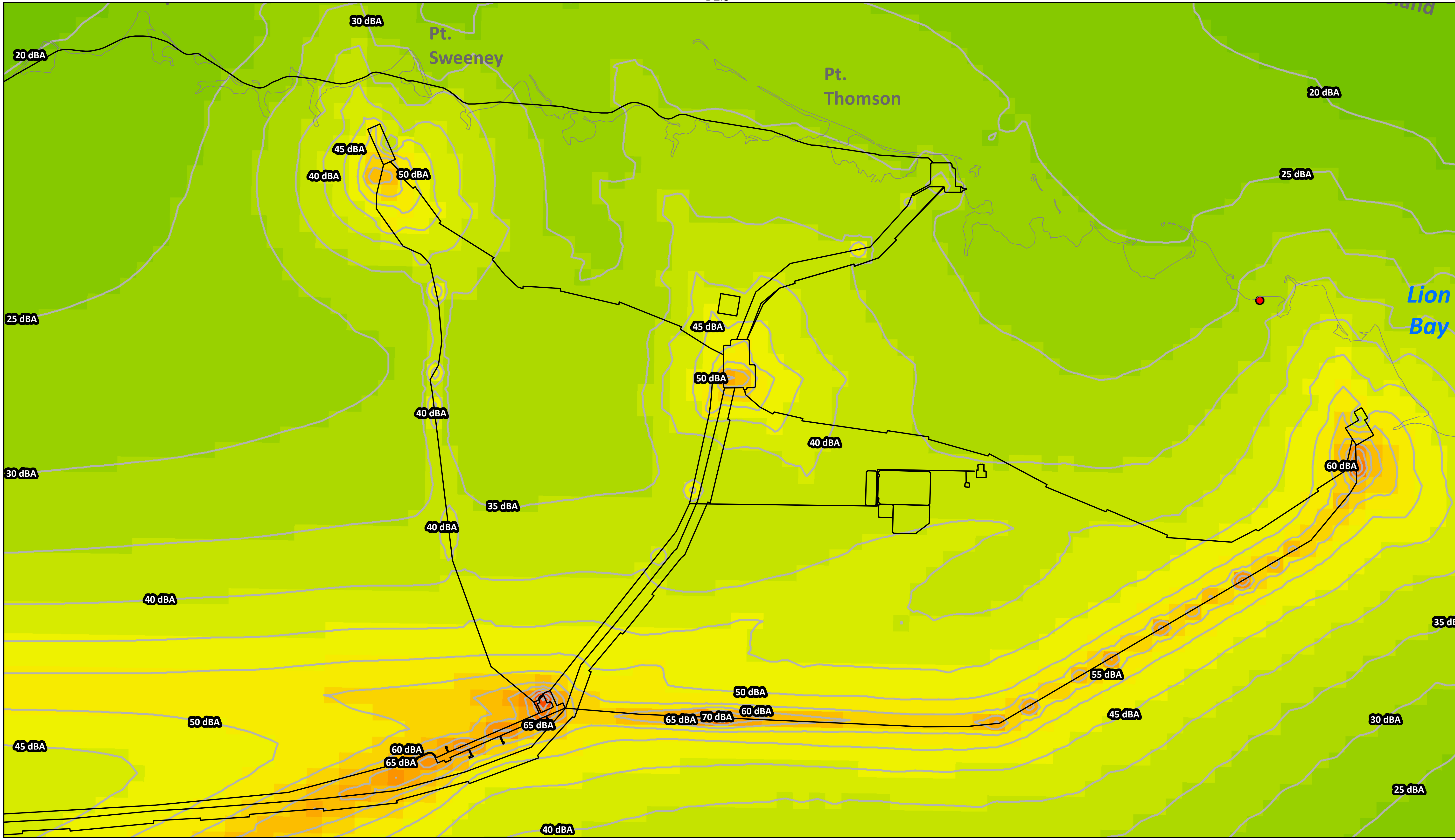

POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland

Proposed Layout - Noise Contour Data

- Noise Receptors
- Noise Contours (5 dBA)
- Alternative C Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 50

Alternative C - Operations
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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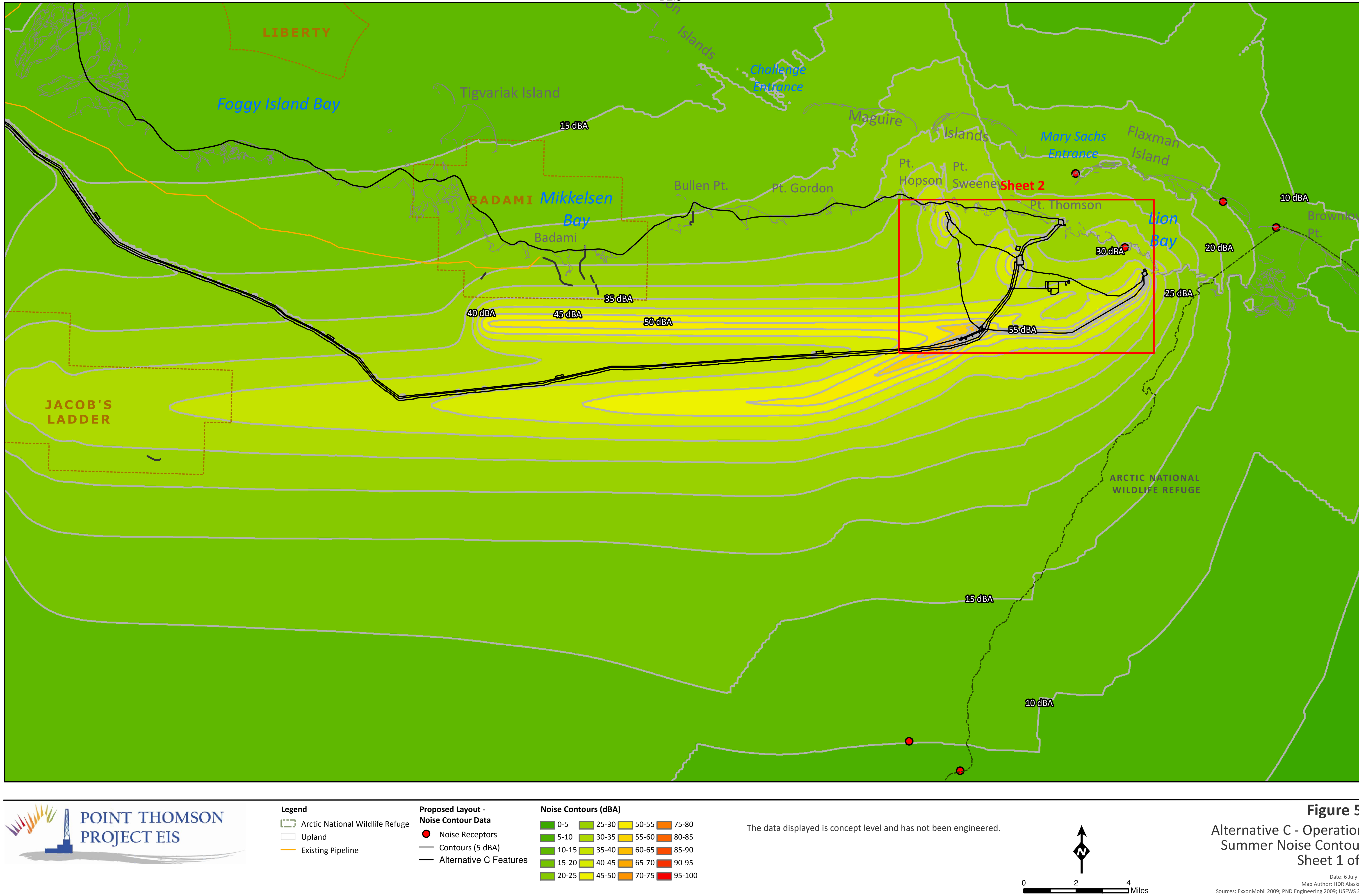

Figure 51
Alternative C - Operations
Summer Noise Contours
Sheet 1 of 2

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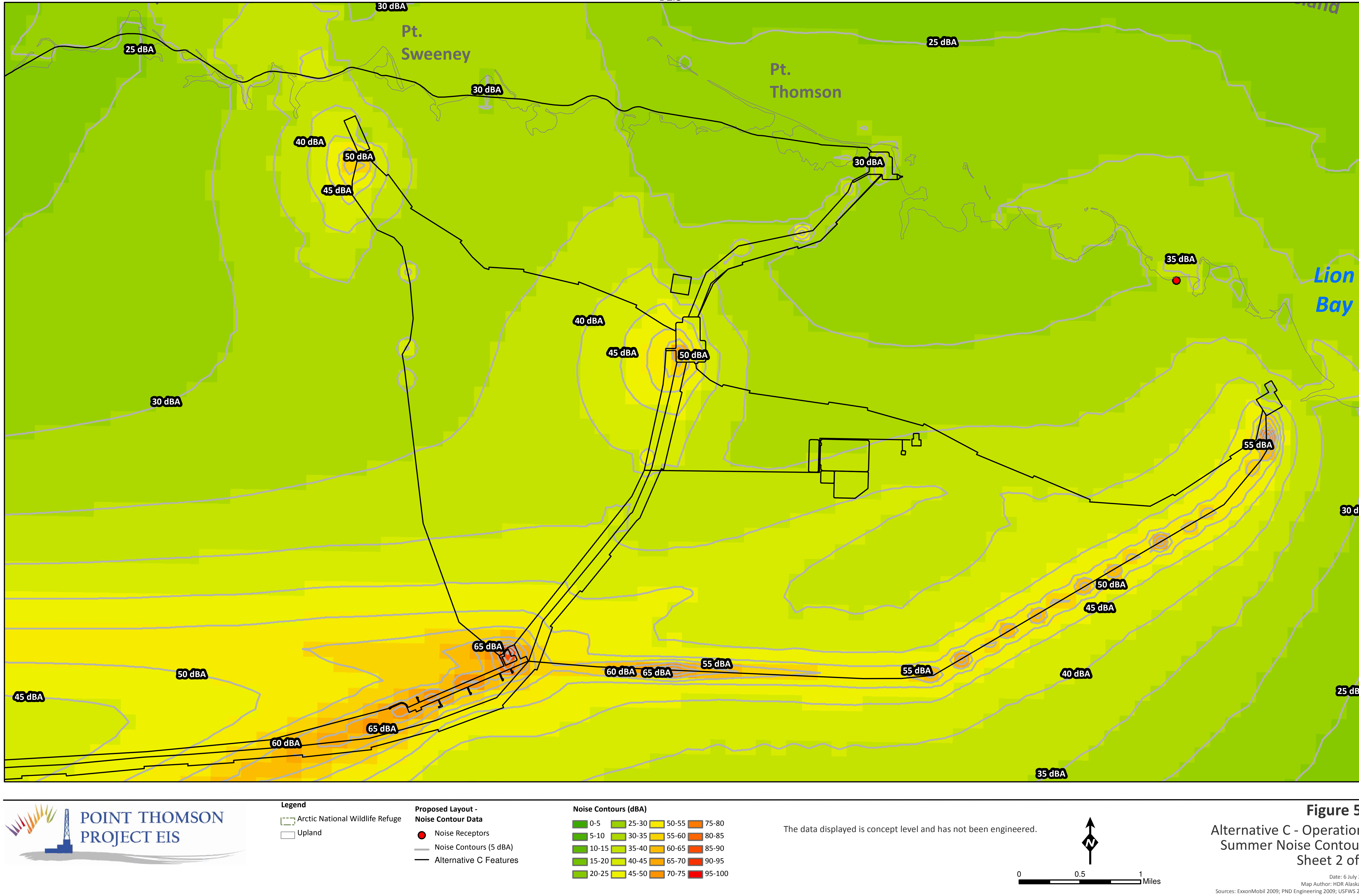

POINT THOMSON PROJECT EIS

Figure 52

Alternative C - Operations Summer Noise Contours Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.3 ALTERNATIVE D: INLAND PADS WITH SEASONAL ICE ACCESS ROAD

The intent of Alternative D is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to reduce potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move the project components inland and as far away from the coast as is practicable and feasible. This alternative is also characterized by access to and from Point Thomson occurring primarily via an inland seasonal ice road running east from the Endicott spur Road to the northern end of the Point Thomson project area.

Alternative D is similar to Alternative C; however it differs by proposing a seasonal ice access road as opposed to the inland 45-mile seasonal ice road in Alternative C. Noise emissions from the proposed activities were assessed in this analysis. Large noise emissions sources under Alternative D include construction activity associated with ice roads and pipelines, aviation transport, power generation at the CPF, and drilling. The turbines used during operations at the CPF are the largest noise source during operations.

4.3.1 Construction and Drilling

Noise modeling results for construction and drilling under Alternative D are expressed in Table 13 and also graphically in Figure 53 through Figure 56. The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. The dominant features shown on the figures are noise contours from the airplane and helicopter flight path, drilling (during winter construction), and noise from activities closer to the proposed pads including the Central Pad.

Noise in the project area would increase 0 to 18 dBA depending on existing conditions and distance from construction and drilling (Table 13). Construction and drilling noise could be noticeable in nearby areas (3-8 miles away from the CPF), represented by the Brownlow Spit, Mary Sachs Island, Sea Coast and Flaxman Island monitoring locations (Table 13). The largest anticipated increase (18 dBA) in noise would occur at the Sea Coast monitoring location during the winter season (Table 13), and would be perceived as a doubling of loudness over existing conditions. This predicted noise level would be similar to that in a typical office.

Areas further away from construction and drilling areas, represented by the Canning River West Bank and Coastal Plain monitoring locations (19 miles from the Central Pad), would experience no or a minimal increase over existing conditions (Table 13). Existing noise levels during the summer season are generally louder than the winter season due to the influence of running water and increased activity. As a result, estimates of future project-related noise levels do not indicate an increase in the existing noise level during the summer season (Table 13). Increases < 3dBA are below the threshold of human perception, although a change in the spectral distribution may result in audible tones or low frequency hums. However, intermittent events such as blasting could create elevated noise levels that are audible on short term basis.

Table 13. Alternative D—Increases in Noise above Existing Levels due to Construction and Drilling				
Noise Monitoring Location	Existing Noise Level, L_{eq} dBA	Construction + Drilling Noise Level, L_{eq} dBA[e]	Existing + Construction + Drilling Noise Level, L_{eq} dBA	Increase Over Existing, dBA[f]
Winter				
Brownlow Spit	35	37	39	4
Canning River West Bank	48	29	48	0
Coastal Plain	32	29	34	2
Mary Sachs Island	37	37	40	3
Sea Coast	35[a]	53	53	18
Flaxman Island	37[b]	39	41	4
Summer				
Brownlow Spit	43[c]	16	43	0
Canning River West Bank	51	6	51	0
Coastal Plain	31	7	31	0
Mary Sachs Island	44[d]	43	47	3
Sea Coast	43	48	49	6
Flaxman Island	44	24	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 mi NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e]The levels in this column are mapped on Figure 53 – 56.

[f]The magnitude of impact for this alternative was based on the predicted increases in this column.

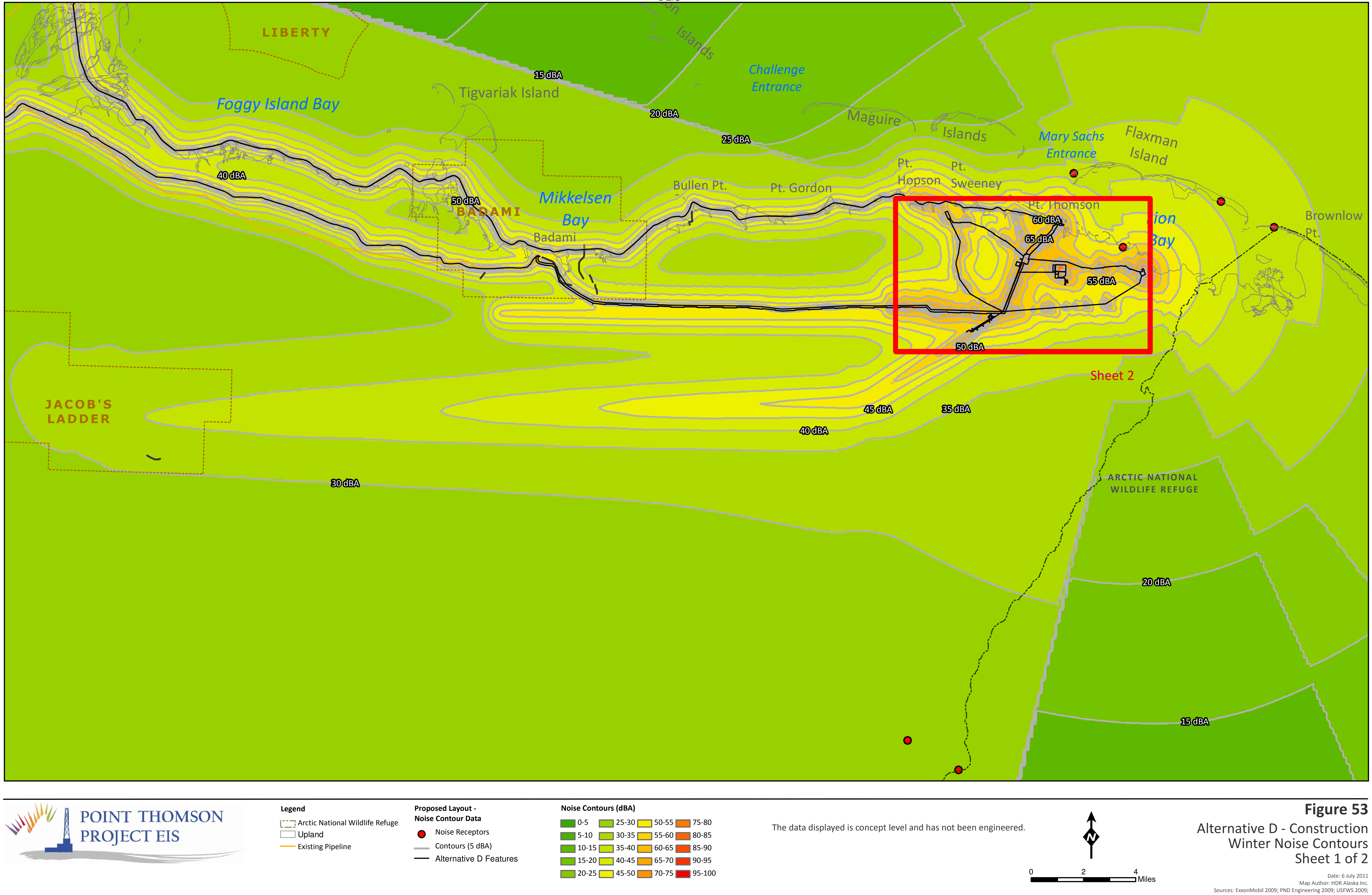

Figure 53
Alternative D - Construction
Winter Noise Contours
Sheet 1 of 2

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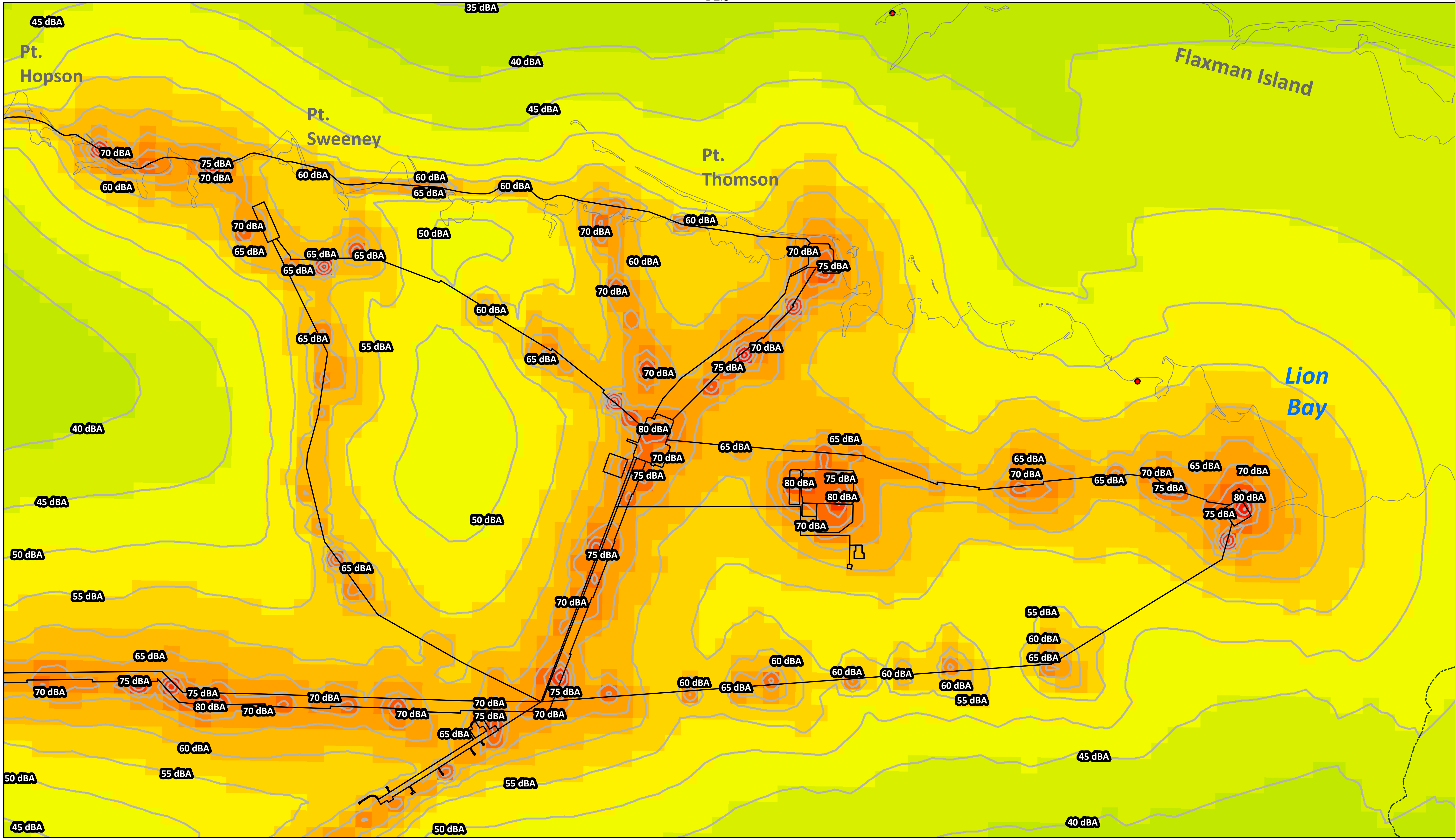

POINT THOMSON PROJECT EIS

Legend

Arctic National Wildlife Refuge
Upland

Proposed Layout - Noise Contour Data

Noise Receptors
Noise Contours (5 dBA)
Alternative D Features

Noise Contours (dBA)

0.1 - 5	25.1 - 30	50.1 - 55	75.1 - 80
5.1 - 10	30.1 - 35	55.1 - 60	80.1 - 85
10.1 - 15	35.1 - 40	60.1 - 65	85.1 - 90
15.1 - 20	40.1 - 45	65.1 - 70	90.1 - 95
20.1 - 25	45.1 - 50	70.1 - 75	95.1 - 100

The data displayed is concept level and has not been engineered.

0 0.5 1 Miles

Figure 54
Alternative D - Construction Winter Noise Contours Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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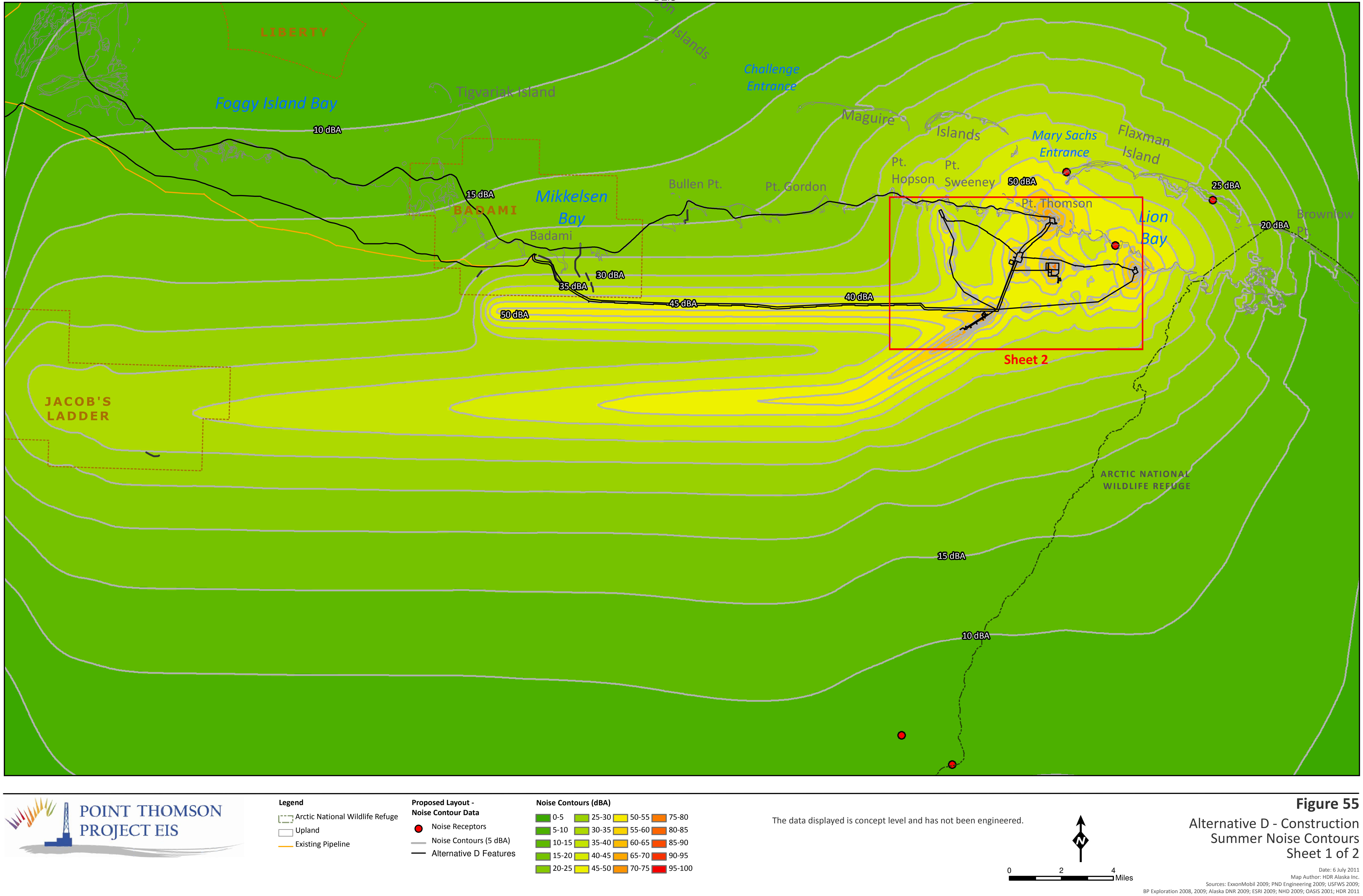

Figure 55
Alternative D - Construction
Summer Noise Contours
Sheet 1 of 2

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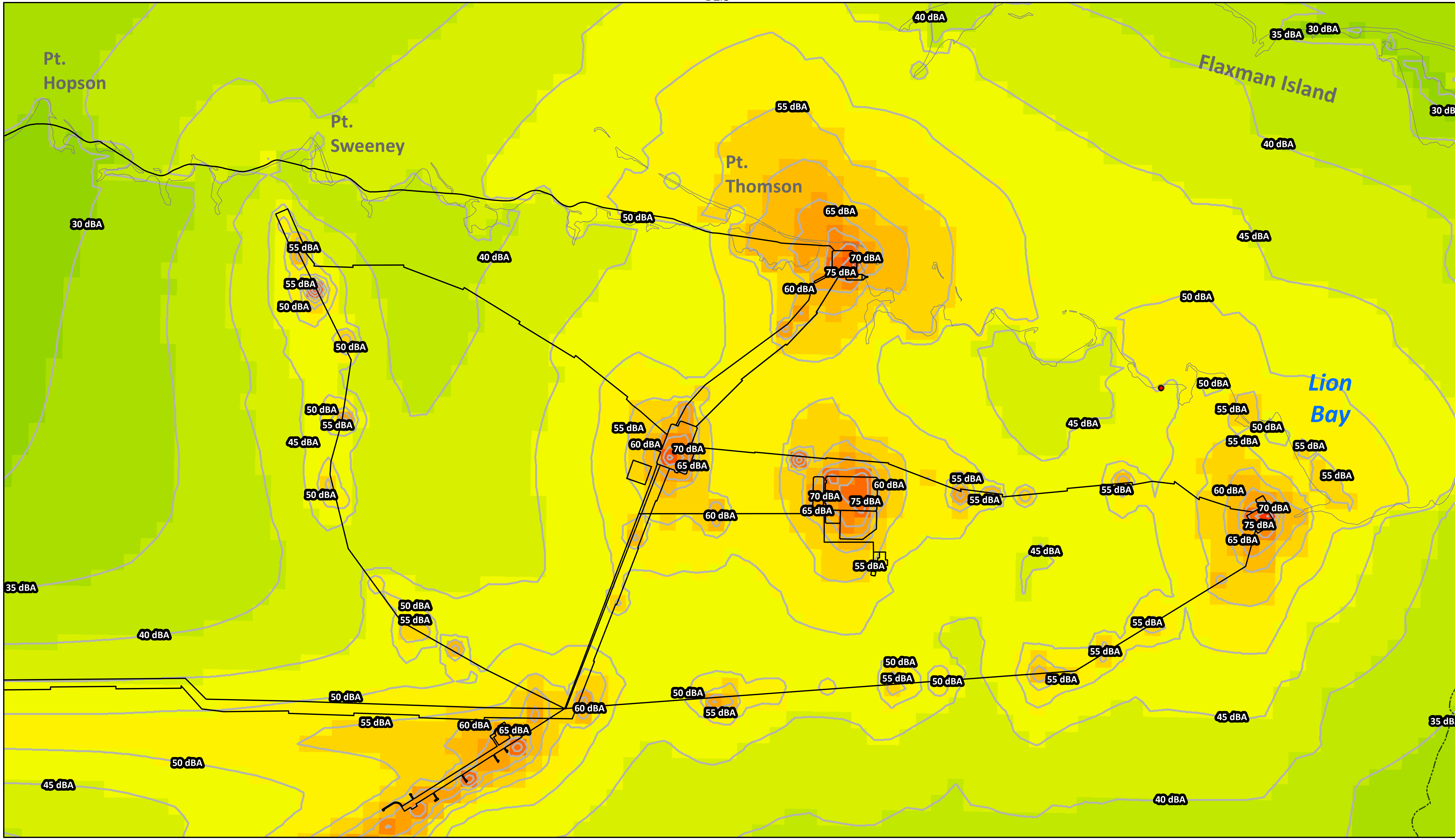

POINT THOMSON PROJECT EIS

Legend

Arctic National Wildlife Refuge

Upland

Proposed Layout - Noise Contour Data

Noise Receptors

Noise Contours (5 dBA)

Alternative D Features

Noise Contours (dBA)

0.1 - 5	25.1 - 30	50.1 - 55	75.1 - 80
5.1 - 10	30.1 - 35	55.1 - 60	80.1 - 85
10.1 - 15	35.1 - 40	60.1 - 65	85.1 - 90
15.1 - 20	40.1 - 45	65.1 - 70	90.1 - 95
20.1 - 25	45.1 - 50	70.1 - 75	95.1 - 100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 56

Alternative D - Construction
Summer Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.3.2 Operations

Operational noise modeling results are expressed in Table 14 and Table 15, and also graphically in Figure 57 through Figure 60. The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. Airplane and helicopter flight path, snow removal (during winter), and noise from activities closer to the proposed pads including the Central Pad are the dominant noise sources from Alternative D.

Noise from operations in areas close to the CPF (within 4 mi), represented by the Sea Coast monitoring location, is predicted to increase between 0 and 3 dBA (Table 14) under this alternative. Generally a 3-dBA increase is considered barely noticeable to the human ear. However, a change in the spectral distribution of noise may result in audible tones or low-frequency hums. Noise from operations in more distant portions of the project area, represented by the other monitoring locations, would not be audible above existing noise levels (Table 14).

Table 14. Alternative D– Increases in Noise Levels above Existing Levels due to Operations

Monitoring location	Existing Noise Level, L_{eq} dBA	Operations Noise Level, L_{eq} dBA[e]	Existing + Operations Noise Level, L_{eq} dBA	Increase Over Existing, dBA[f]
Winter				
Brownlow Spit	35	13	35	0
Canning River West Bank	48	6	48	0
Coastal Plain	32	7	32	0
Mary Sachs Island	37	23	37	0
Sea Coast	35[a]	34	38	3
Flaxman Island	37[b]	14	37	0
Summer				
Brownlow Spit	43[c]	12	43	0
Canning River West Bank	51	9	51	0
Coastal Plain	31	10	31	0
Mary Sachs Island	44[d]	23	44	0
Sea Coast	43	31	43	0
Flaxman Island	44	14	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 miles NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e] The levels in this column are mapped on Figure 57-Figure 60

[f] The magnitude of impact for this alternative was based on the predicted increases in this column.

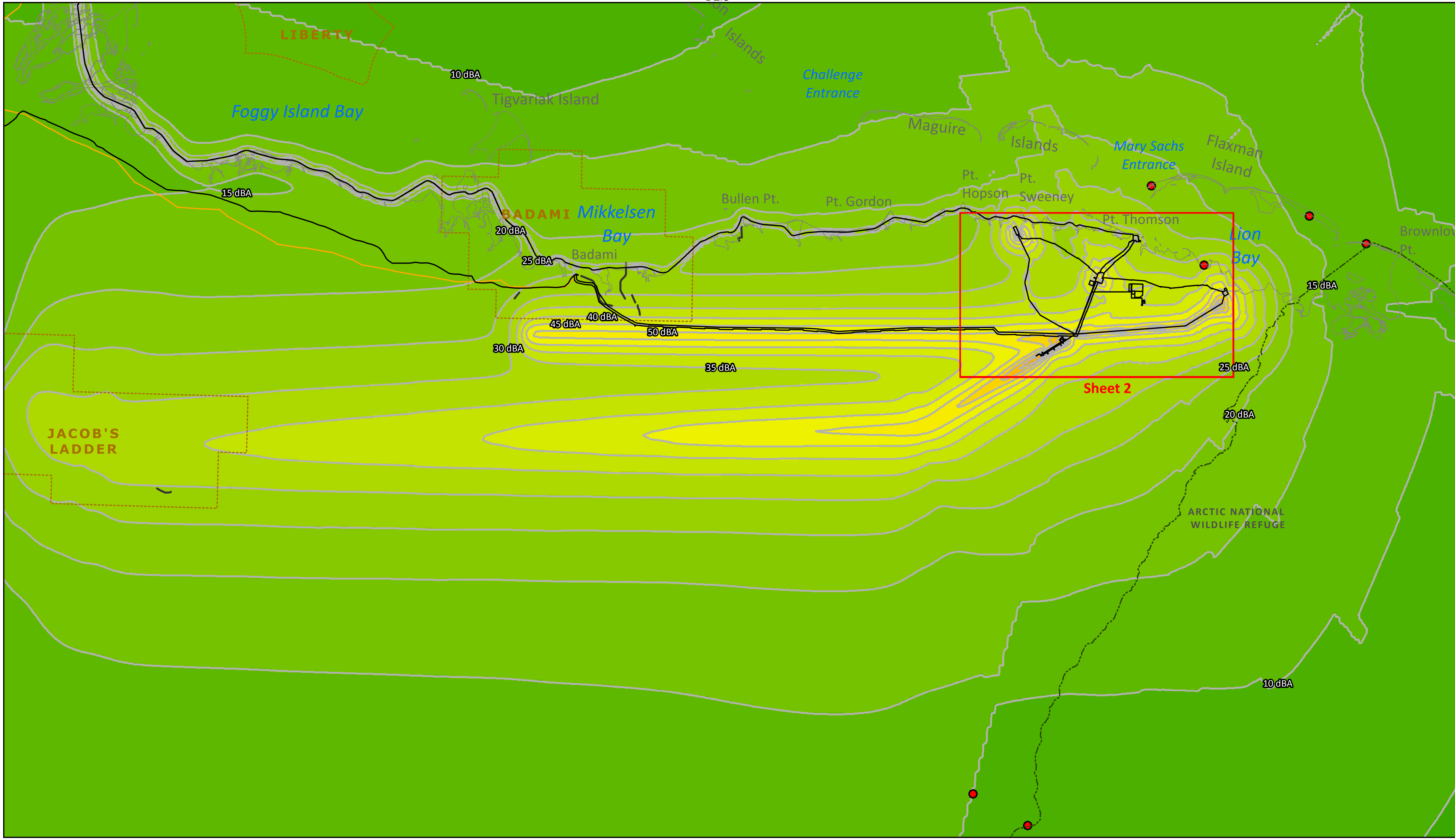
The dominant sources of noise from operations vary depending on season, proximity to the Central Pad, and the presence of other noise. The most common dominant sources at each representative monitoring location would be the CPF (primarily turbines) and aircraft overflight (Table 15). Other activities that may create elevated noise levels seasonally include road maintenance and snow removal.

Noise from the CPF and roadway transportation would occur more frequently or continuously during operations. Activities such as aircraft overflight, road maintenance, and snow removal activities would be intermittent and would dominate the soundscape when in operation. Other intermittent noise sources not included in the operations noise assessment include PA announcements and vehicle backup beepers. These activities would occur occasionally during operations and would increase noise in the immediate vicinity (within 0.5 miles) of the Central Pad.

Table 15. Alternative D – Dominant Noise Sources from Operations

Monitoring location	CPF	Aircraft Overflight	Roadway Transportation	Road Maintenance Activities	Snow Removal Activities	Barge Traffic
Winter						
Brownlow Spit	X	X	X			
Canning River West Bank		X	X		X	
Coastal Plain		X	X		X	
Mary Sachs Island	X	X				
Sea Coast		X	X		X	
Flaxman Island	X	X				
Summer						
Brownlow Spit	X	X				
Canning River West Bank	X	X		X		
Coastal Plain	X	X				
Mary Sachs Island	X	X	X			
Sea Coast		X	X	X		
Flaxman Island	X	X	X			

Analysis results indicate that operational noise associated with Alternative D is expected to be slightly more than operational noise from Alternative C but less than Alternative B at the Sea Coast monitoring sites. The increase may be measureable/modeled, but it is unlikely to be perceivable. At other noise monitoring locations, estimates of operational noise are the same or less than under Alternatives B and C. Visitors to the western-most portions of Arctic Refuge may experience project-related noise when winds are very still. When winds are not still, there is potential that wind-induced noise may mask project-related noise; this is particularly true of winds above 11 mph from any direction. In summer, the acoustically absorptive tundra may also help reduce project-related noise levels at locations inside the Refuge. In winter, denser (colder) air and non-absorptive ground cover may contribute to sound propagation; however, audibility is very hard to predict. In some cases winds from the west may transport noise farther eastward than would otherwise occur. It is very difficult to estimate where, or the extent to which project-related noise will be audible under various wind speeds and directions. However it is likely that project-related noise will be lower in the eastern portions of the study area when the winds blow from the east.



POINT THOMSON PROJECT EIS

Legend
- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data
- Noise Receptors
- Noise Contour (5 dBA)
- Alternative D Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

N

0 2 4 Miles

Figure 57
Alternative D - Operations
Winter Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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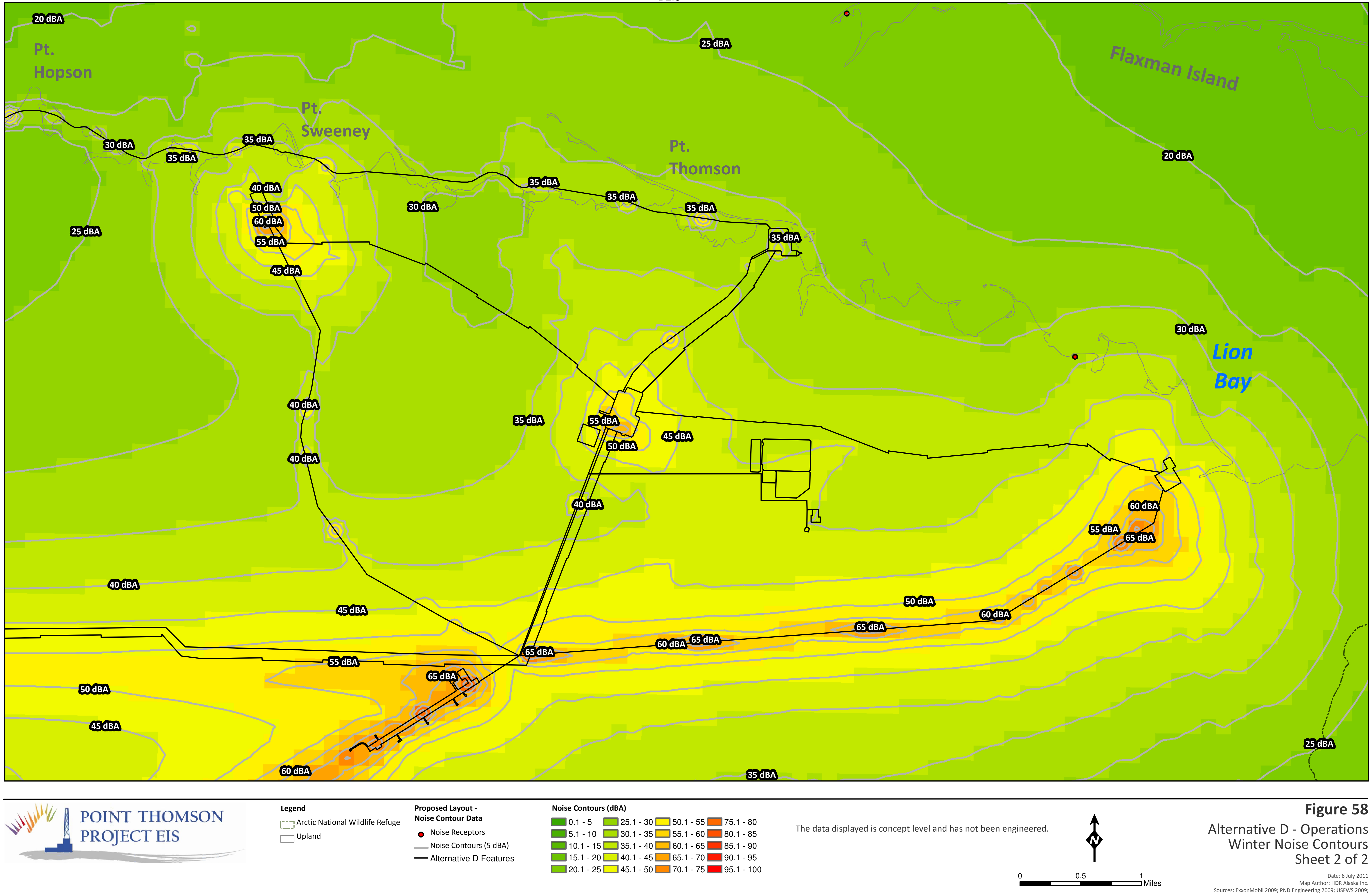

Figure 58
Alternative D - Operations
Winter Noise Contours
Sheet 2 of 2

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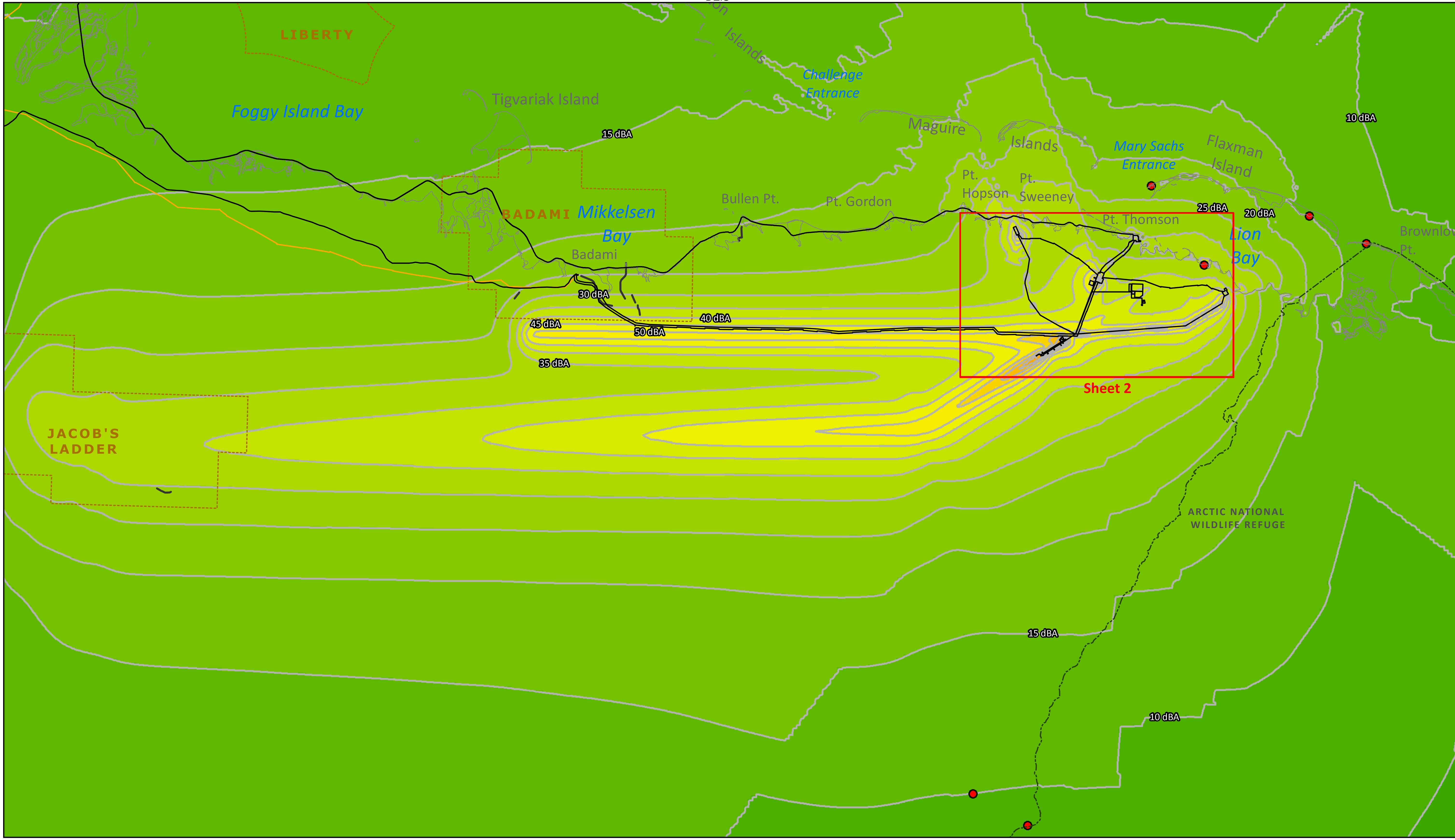

POINT THOMSON PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data

- Noise Receptors
- Noise Contours (5 dBA)
- Alternative D Features

Noise Contours (dBA)

0-5, 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50, 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100

The data displayed is concept level and has not been engineered.

0 2 4 Miles

Figure 59

Alternative D - Operations
Summer Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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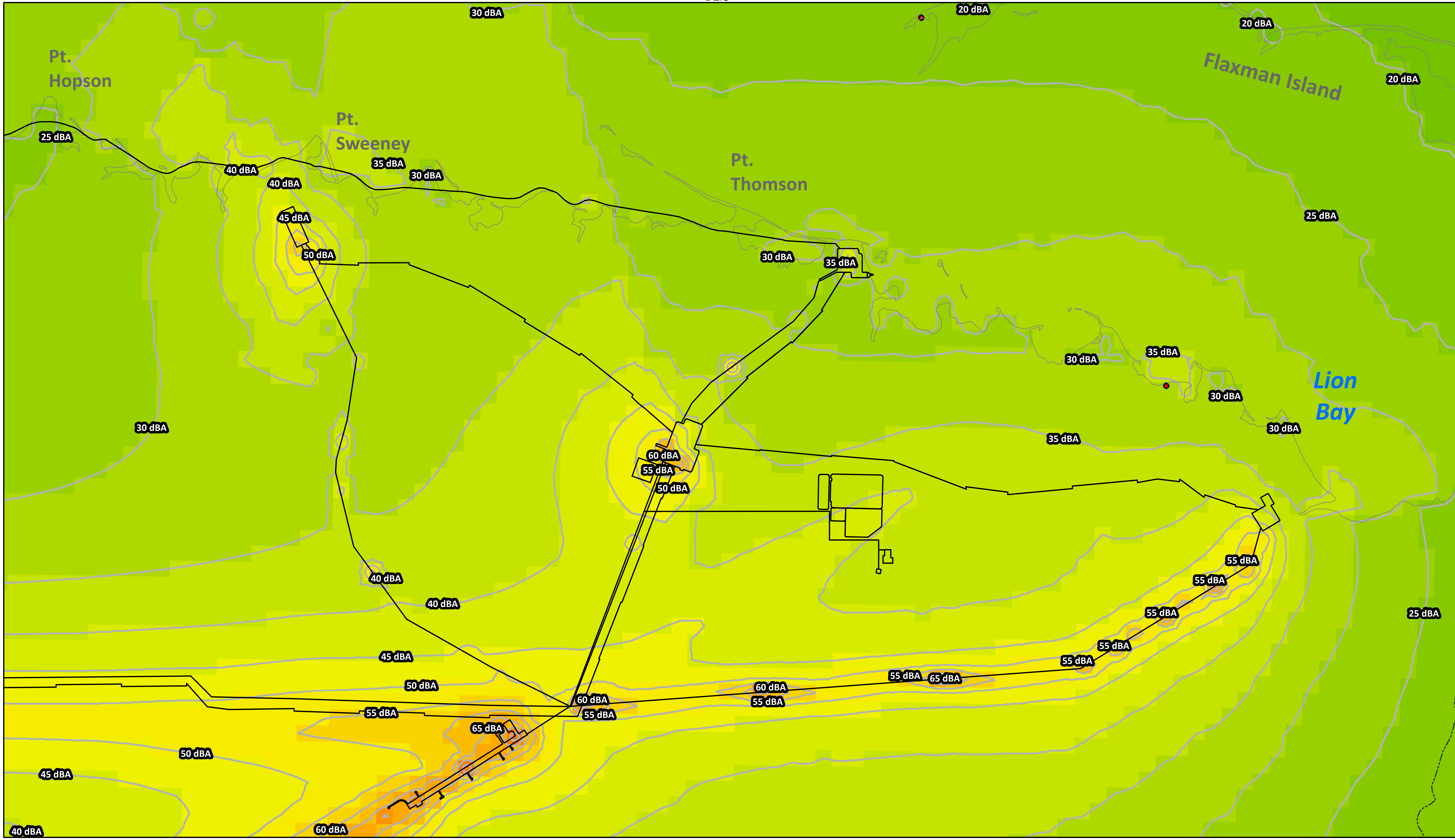

POINT THOMSON PROJECT EIS

Legend

Arctic National Wildlife Refuge

Upland

Proposed Layout - Noise Contour Data

Noise Receptors

Noise Contours (5 dBA)

Alternative D Features

Noise Contours (dBA)

0.1 - 5	25.1 - 30	50.1 - 55	75.1 - 80
5.1 - 10	30.1 - 35	55.1 - 60	80.1 - 85
10.1 - 15	35.1 - 40	60.1 - 65	85.1 - 90
15.1 - 20	40.1 - 45	65.1 - 70	90.1 - 95
20.1 - 25	45.1 - 50	70.1 - 75	95.1 - 100

The data displayed is concept level and has not been engineered.

N

0 0.5 1 Miles

Figure 60

Alternative D - Operations Summer Noise Contours Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.4 ALTERNATIVE E: COASTAL PADS WITH SEASONAL ICE ROADS

The intent of Alternative E is to minimize the development footprint in order to reduce impacts to wetlands and surrounding water resources. This alternative would reduce the amount of gravel fill needed for some of the project components. In particular, the footprint of the East Pad and West Pad would be a combination of ice and gravel (multiyear, multi-season ice pads). During drilling, the gravel pad footprint would be expanded by ice to support other needed facilities. During operations, the ice pad footprint would be removed and only the gravel fill would remain to support the wellheads and required infrastructure. An expanded Central Pad, incorporating both the central well and processing infrastructure, would compensate for the two smaller ice/gravel combination pads. Also, the gravel footprint would be reduced by the use of ice roads as much of the infield road system. This alternative has a gravel road between the air strip and Central Pad.

Noise emissions from these and other activities were assessed in this analysis. . Large noise emissions sources under Alternative E include construction activity associated with infield road and pipelines, aviation and marine transport, power generation at the CPF, and drilling. The turbines used during operations at the CPF are the largest noise source during operations. Operational noise from Alternative E is distinctly different from the other build alternatives due to the extensive reliance upon helicopters for tasks that surface transportation resources facilitate under other build alternatives. While aircraft use under Alternative E is not dramatically different from other build alternatives on an hourly basis, the long-term reliance on aircraft under Alternative E is dramatically different than the other build alternatives.

4.4.1 Construction and Drilling

Construction noise modeling results are expressed in Table 16 and also graphically in Figure 61 through Figure 64. The noise contour figures use color shading to depict how project-related noise is expected to travel throughout the study area. The dominant features of the figures are the noise contours from the airplane and helicopter flight path, noise from barge and other water-based activities (in summer), drilling (in winter), and noise from activities closer to the proposed pads including the Central Pad.

Noise in the project area would increase from 0-22 dBA depending on existing conditions and distance from construction and drilling (Table 16). The largest anticipated increase in noise would occur near the Sea Coast monitoring location during the winter season (22 dBA). This would be perceived as more than a doubling of loudness, resulting in a level between a quiet living room and conversational speech (Table 16). Other areas close to construction sites (within 8 miles) would have noticeable increases in noise levels seasonally, resulting in levels similar to a quiet house (Table 16). These areas are represented by the Brownlow Spit, Mary Sachs Island, and Flaxman Island monitoring locations (Table 16).

Areas further away from construction work areas, represented by the Canning River West Bank and Coastal Plain monitoring locations (>21 miles from CPF), would experience no or a minimal increase over existing conditions (0 to 2 dBA, Table). Existing noise levels during the summer season are generally louder than the winter season due to the influence of running water and increased activity. As a result, estimates of future project-related noise levels at most locations do not indicate an increase over existing noise levels during the summer season (Table 16). Increases of <3 dBA are below the threshold of human perception, although a change in the spectral distribution may result in audible tones or low frequency hums. Intermittent events such as blasting may create increased noise levels and be audible on a short term basis.

Table 16. Alternative E – Increases in Noise above Existing Levels due to Construction and Drilling				
Noise Monitoring Location	Existing Noise Level, L_{eq} dBA	Construction + Drilling Noise Level, L_{eq} dBA[e]	Existing + Construction + Drilling Noise Level, L_{eq} dBA	Increase Over Existing, dBA[f]
Winter				
Brownlow Spit	35	38	40	5
Canning River West Bank	48	29	48	0
Coastal Plain	32	29	34	2
Mary Sachs Island	37	39	41	4
Sea Coast	35[a]	57	57	22
Flaxman Island	37[b]	40	42	5
Summer				
Brownlow Spit	43[c]	21	43	0
Canning River West Bank	51	8	51	0
Coastal Plain	31	10	31	0
Mary Sachs Island	44[d]	47	49	5
Sea Coast	43	47	48	5
Flaxman Island	44	28	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

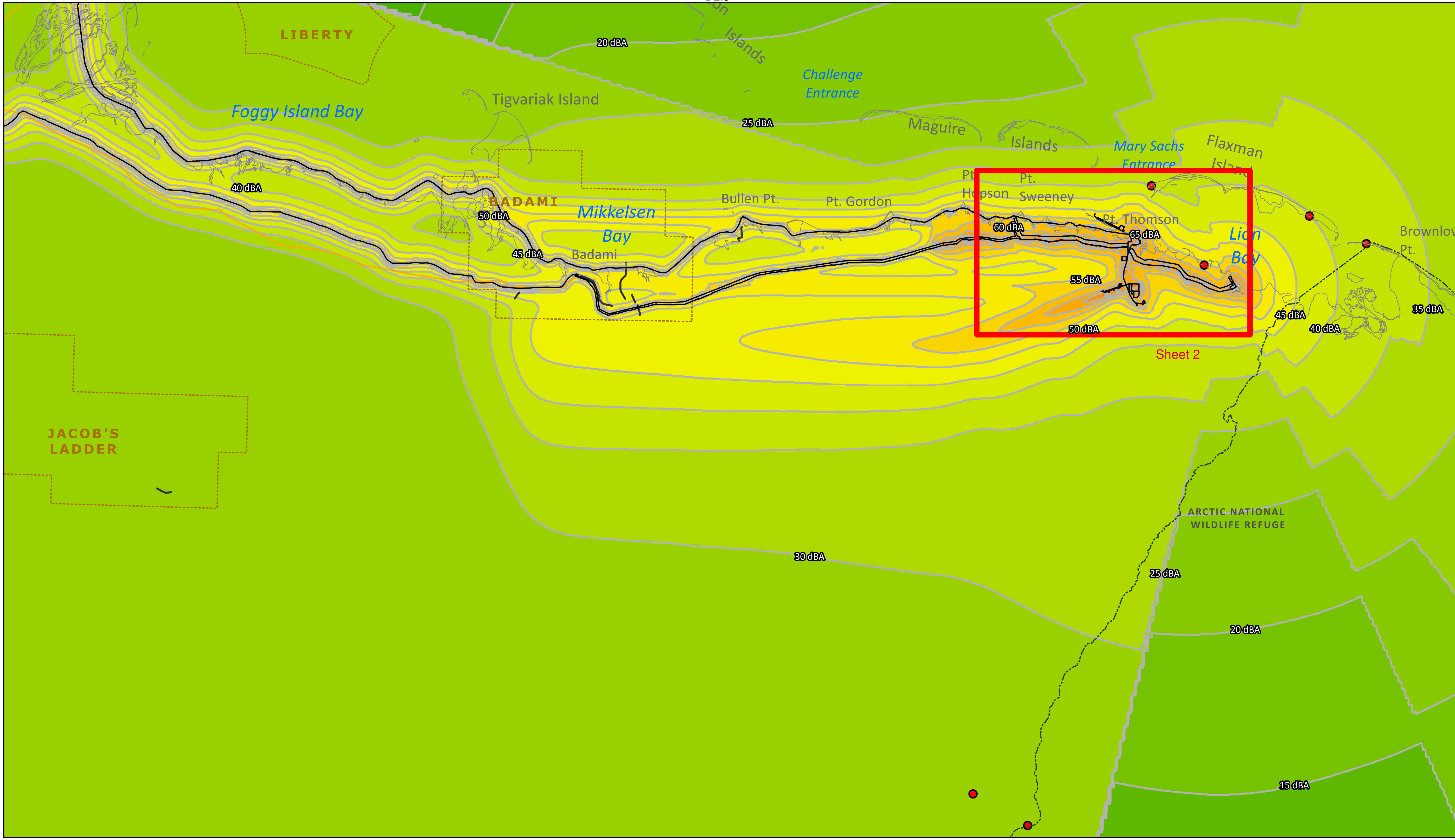
[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 mi NE of the Central Pad)

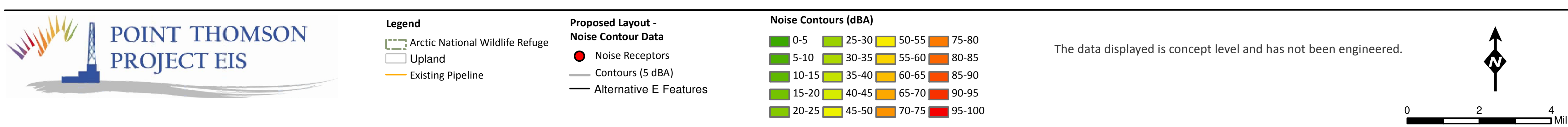
[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e]The levels in this column are mapped on Figure 61 – Figure 64.

[f]The magnitude of impact for this alternative was based on the predicted increases in this column.





The data displayed is concept level and has not been engineered.

Figure 61

Alternative E - Construction Winter Noise Contours Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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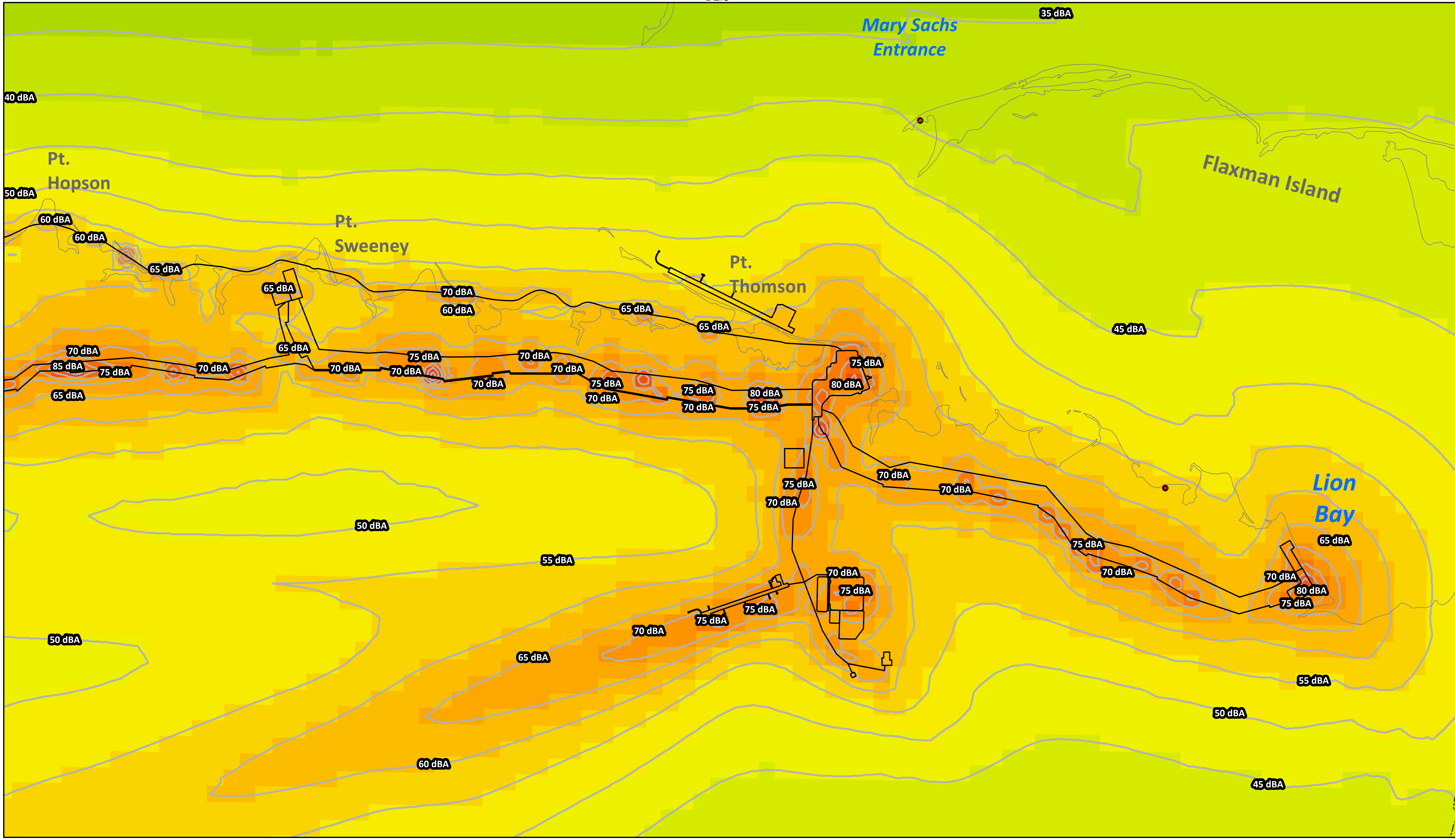

POINT THOMSON
PROJECT EIS

Legend

- Arctic National Wildlife Refuge
- Upland

Proposed Layout - Noise Contour Data

- Noise Receptors
- Noise Contours (5 dBA)
- Alternative E Features

Noise Contours (dBA)

0.1 - 5	25.1 - 30	50.1 - 55	75.1 - 80
5.1 - 10	30.1 - 35	55.1 - 60	80.1 - 85
10.1 - 15	35.1 - 40	60.1 - 65	85.1 - 90
15.1 - 20	40.1 - 45	65.1 - 70	90.1 - 95
20.1 - 25	45.1 - 50	70.1 - 75	95.1 - 100

The data displayed is concept level and has not been engineered.

0 0.5 1 Miles

Figure 62

Alternative E - Construction
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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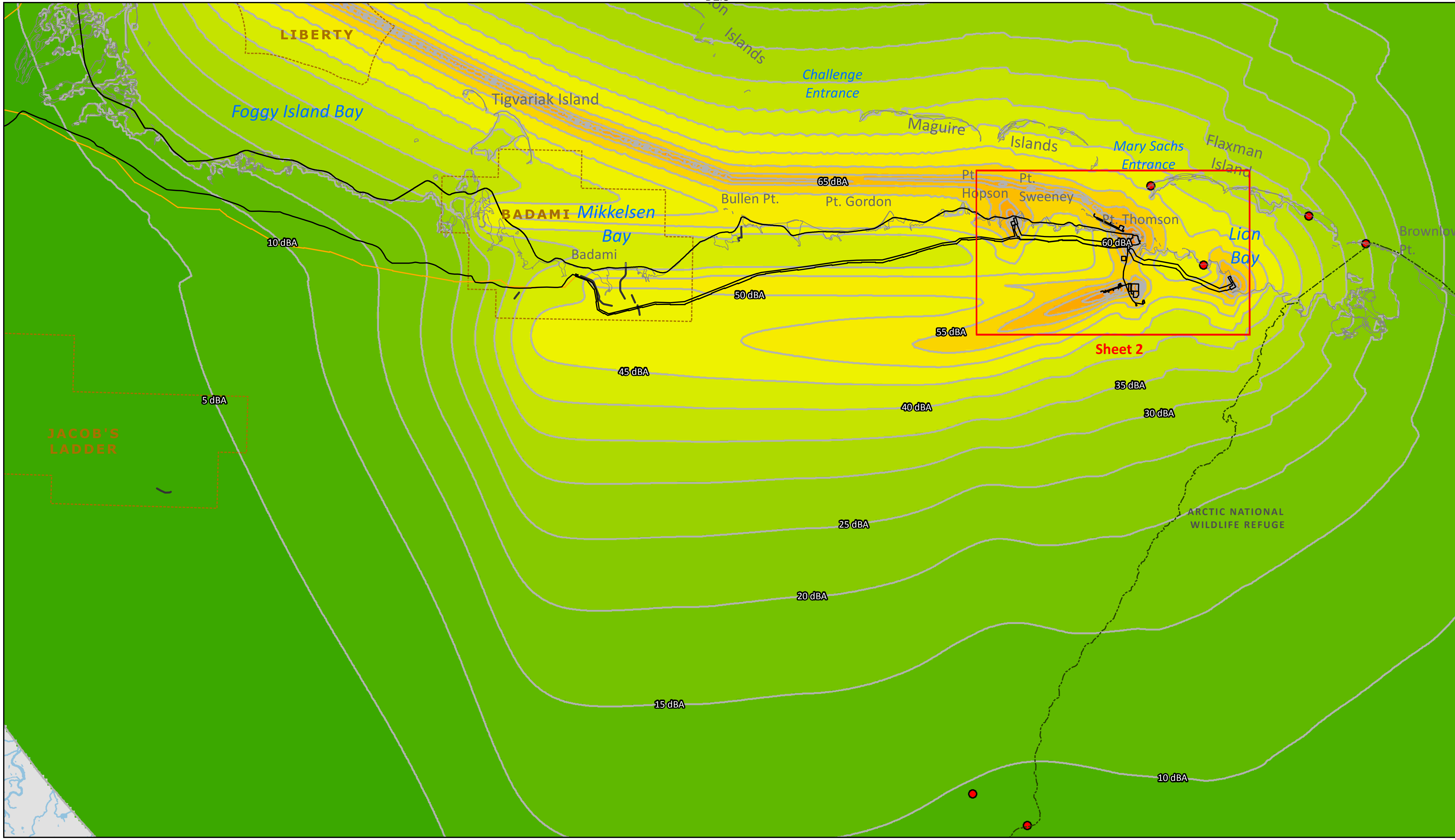

Figure 63

Alternative E - Construction
Summer Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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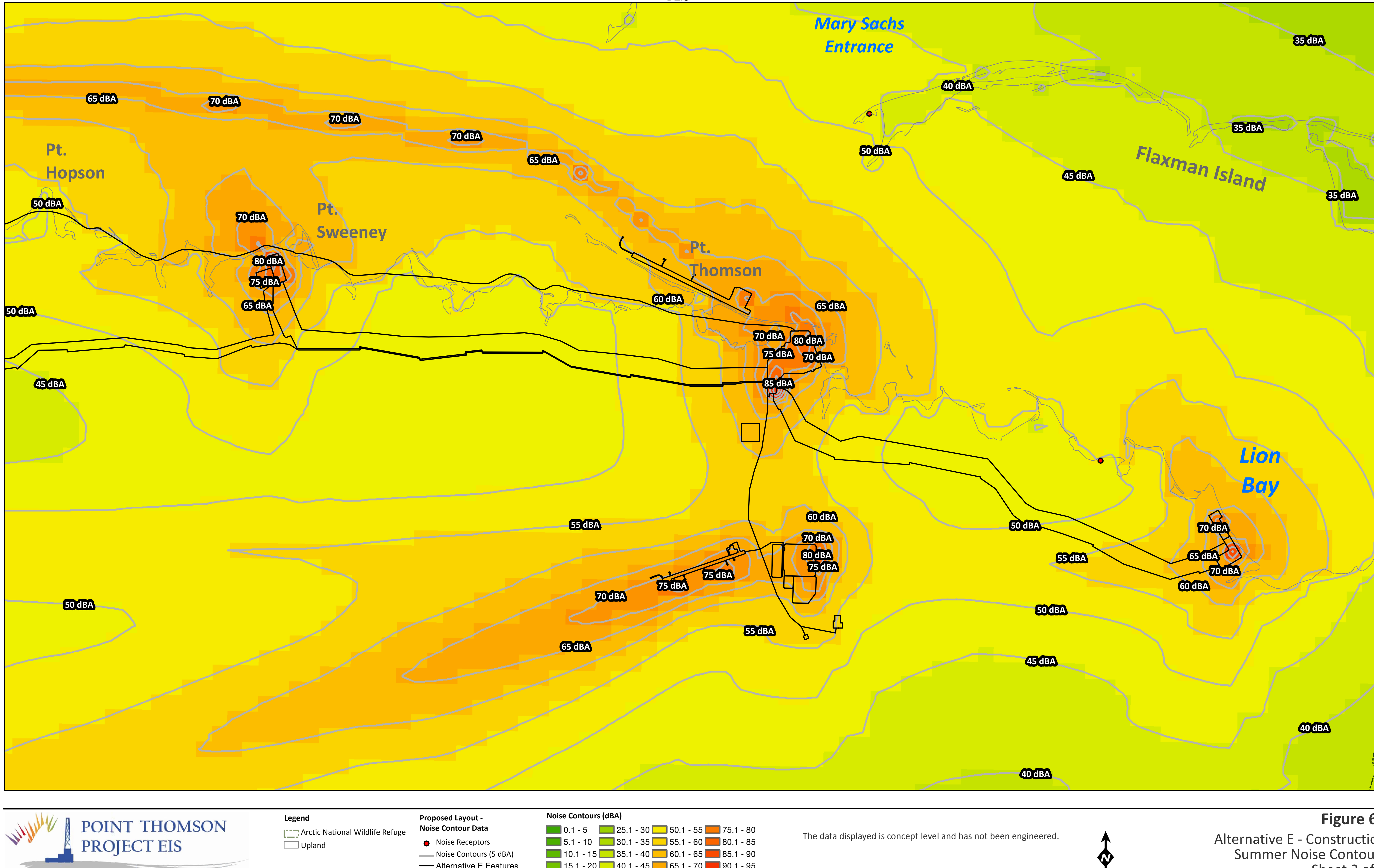

The data displayed is concept level and has not been engineered.

Figure 64
Alternative E - Construction
Summer Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009;
BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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4.4.2 Operations

Operational noise modeling results are expressed in Table 17 and Table 18 and also graphically in Figure 65 through Figure 68. Airplane and helicopter flights, noise from barge and other water-based activities (in summer), snow removal (during winter), and noise from activities closer to the proposed pads including the Central Pad are the dominant noise sources in Alternative E.

Operations associated with Alternative E would increase noise levels in the project area from 0 to 12 dBA depending on distance from the source and environmental conditions (Table 17). Noise levels in areas close to the CPF (e.g. within 3 miles at the Sea Coast site) would increase between 4 and 9 dBA during the occasional snow removal near the East Pad. Generally a 4-dBA increase is considered noticeable to the human ear. The resulting noise level would be less than a typical office. This does not account for the change in the spectral distribution of the noise, which even at <2 dBA can result in audible low-frequency tones and hums. Noise from operations would be lower than existing noise levels, and likely not audible during the summer season and in distant portions of the project area, represented by the Caning River West Bank and Coastal Plain monitoring locations (Table 17).

Table 17. Alternative E – Increases in Noise above Existing Levels due to Operations

Monitoring location	Existing Noise Level, L_{eq} dBA	Operations Noise Level, dBA[e]	Existing + Operations Noise Level, dBA	Increase Over Existing, dBA
Winter				
Brownlow Spit	35	20	35	0
Canning River West Bank	48	8	48	0
Coastal Plain	32	14	32	0
Mary Sachs Island	37	32	38	1
Sea Coast	35[a]	47	47	12
Flaxman Island	37[b]	23	37	0
Summer				
Brownlow Spit	43[c]	21	43	0
Canning River West Bank	51	10	51	0
Coastal Plain	31	11	31	0
Mary Sachs Island	44[d]	35	45	1
Sea Coast	43	45	47	4
Flaxman Island	44	23	44	0

[a] The Sea Coast monitoring location (2.8 miles E of the Central Pad) was not used during initial data collection in 2010, so the existing noise levels were estimated based on a representative monitoring location, Brownlow Spit (8.3 miles E of the Central Pad)

[b] The Flaxman Island monitoring location (6.3 miles NE of the Central Pad) was not used during the winter monitoring season, so the existing noise levels were estimated based on a representative noise monitoring location, Mary Sachs Island (1.7 miles NE of the Central Pad)

[c] The Brownlow Spit monitoring location (8.3 miles E of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Sea Coast (2.8 miles E of the Central Pad)

[d] The Mary Sachs Island monitoring location (1.7 mi NE of the Central Pad) was not used during the summer data collection in 2010, so the existing noise levels were estimated based on a representative noise monitoring location, Flaxman Island (6.3 miles NE of the Central Pad)

[e] The levels in this column are mapped on Figure 65 – Figure 68.

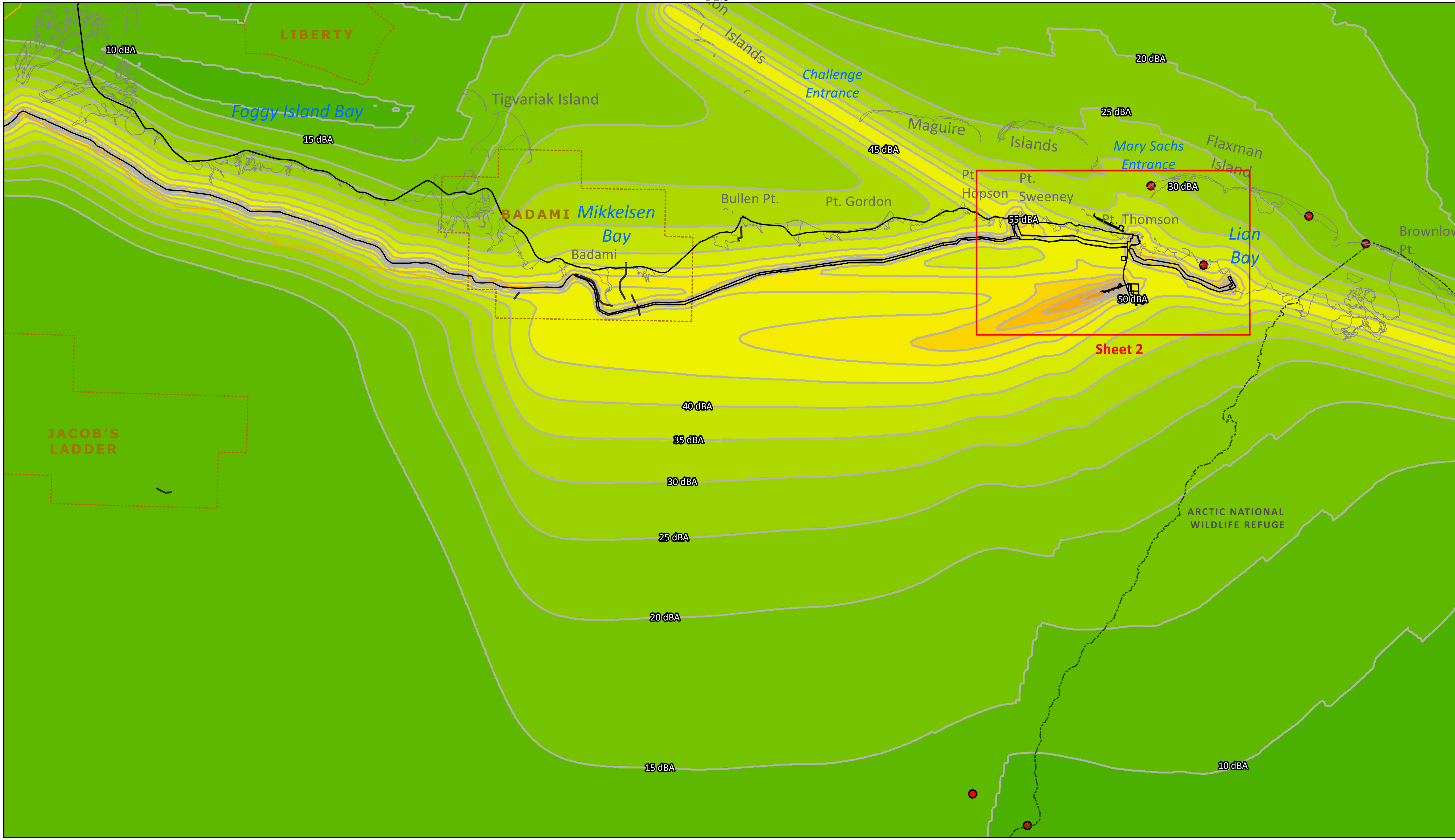
The dominant sources of noise from operations would vary depending on the season, proximity to the Central Pad, and the presence of any other noise. The dominant sources from operations in Alternative E would be from the CPF and aircraft overflight (Table 18). Other activities that may create elevated noise levels seasonally include road maintenance and snow removal (Table 18).

Noise from the CPF and roadway transportation would occur frequently or continuously during operations. Noise from aircraft overflight, road maintenance, and snow removal would be intermittent, but would dominate the soundscape when occurring. Other intermittent noise sources not included in the operations noise assessment include PA announcements and backup beepers. These activities would occur occasionally during operations and would increase noise in the immediate vicinity (within 0.5 mile).

Table 18. Alternative E – Dominant Noise Sources from Operations

Monitoring location	CPF	Aircraft Overflight	Roadway Transportation	Road Maintenance Activities	Snow Removal Activities	Barge Traffic
Winter						
Brownlow Spit	X	X				
Canning River West Bank		X	X		X	
Coastal Plain	X	X	X		X	
Mary Sachs Island	X	X				
Sea Coast		X				
Flaxman Island	X	X				
Summer						
Brownlow Spit		X				
Canning River West Bank	X	X	X	X		
Coastal Plain	X	X	X			
Mary Sachs Island	X	X				X
Sea Coast		X		X		
Flaxman Island		X		X		

Analysis results indicate that operational noise associated with Alternative E is expected to be noticeably more than operational noise from Alternatives B, C, and D at the Sea Coast monitoring sites. The increase will likely be perceivable. This alternative is also expected to produce project-related noise levels at Mary Sachs Island that are commensurate with Alternative B. At other noise monitoring locations, estimates of operational noise are the same as under Alternatives B, C, and D. Visitors to the western-most portions of Arctic Refuge may experience project-related noise when winds are very still. When winds are not still, there is potential that wind-induced noise may mask project-related noise; this is particularly true of winds above 11 mph from any direction. In summer, the acoustically absorptive tundra may also help reduce project-related noise levels at locations inside the Refuge. In winter, denser (colder) air and non-absorptive ground cover may contribute to sound propagation; however, audibility is very hard to predict. In some cases winds from the west may transport noise farther eastward than would otherwise occur. It is very difficult to estimate where, or the extent to which project-related noise will be audible under various wind speeds and directions. However it is likely that project-related noise will be lower in the eastern portions of the study area when the winds blow from the east.



POINT THOMSON PROJECT EIS

Legend
- Arctic National Wildlife Refuge
- Upland
- Existing Pipeline

Proposed Layout - Noise Contour Data
- Noise Receptors
- Noise Contours (5 dBA)
- Alternative E Features

Noise Contours (dBA)

0-5	25-30	50-55	75-80
5-10	30-35	55-60	80-85
10-15	35-40	60-65	85-90
15-20	40-45	65-70	90-95
20-25	45-50	70-75	95-100

The data displayed is concept level and has not been engineered.

0 2 4 Miles

Figure 65

Alternative E - Operations
Winter Noise Contours
Sheet 1 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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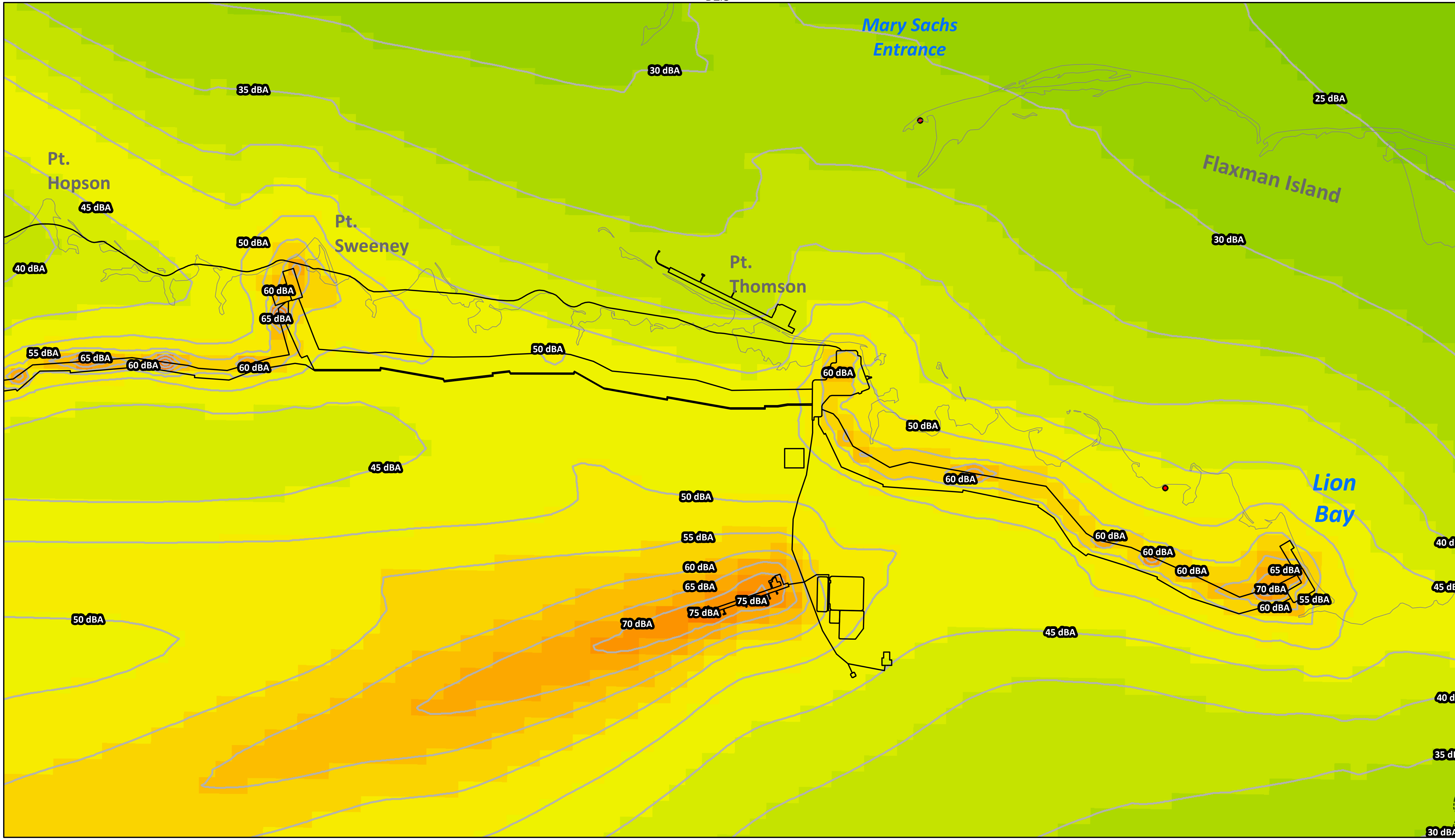

POINT THOMSON PROJECT EIS

Legend

Arctic National Wildlife Refuge
Upland

Proposed Layout - Noise Contour Data

Noise Receptors
Noise Contours (5 dBA)
Alternative E Features

Noise Contours (dBA)

0.1 - 5
5.1 - 10
10.1 - 15
15.1 - 20
20.1 - 25
25.1 - 30
30.1 - 35
35.1 - 40
40.1 - 45
45.1 - 50
50.1 - 55
55.1 - 60
60.1 - 65
65.1 - 70
70.1 - 75
75.1 - 80
80.1 - 85
85.1 - 90
90.1 - 95
95.1 - 100

The data displayed is concept level and has not been engineered.

0 0.5 1 Miles

Figure 66

Alternative E - Operations
Winter Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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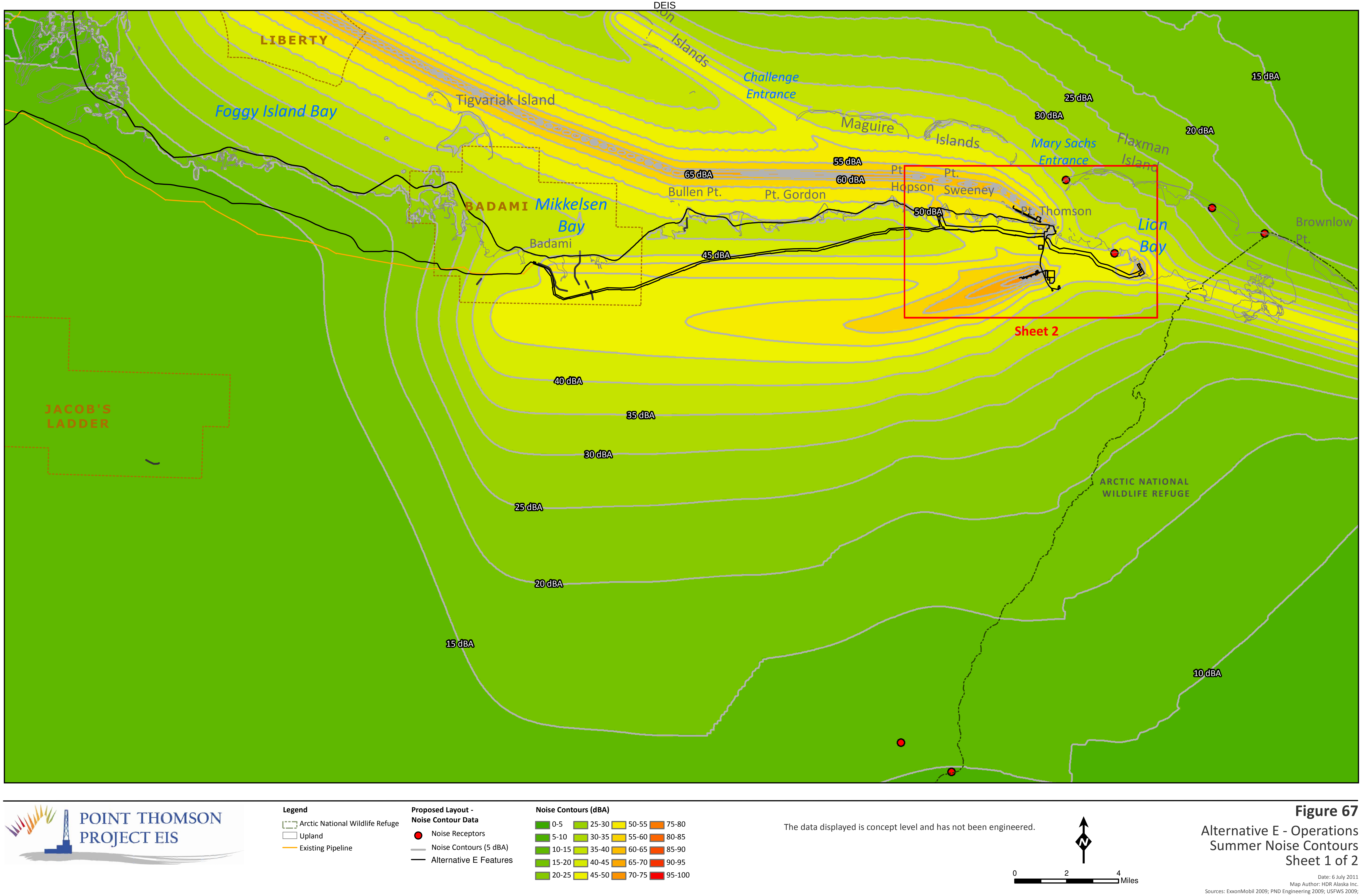

Figure 67

Alternative E - Operations
Summer Noise Contours
Sheet 1 of 2

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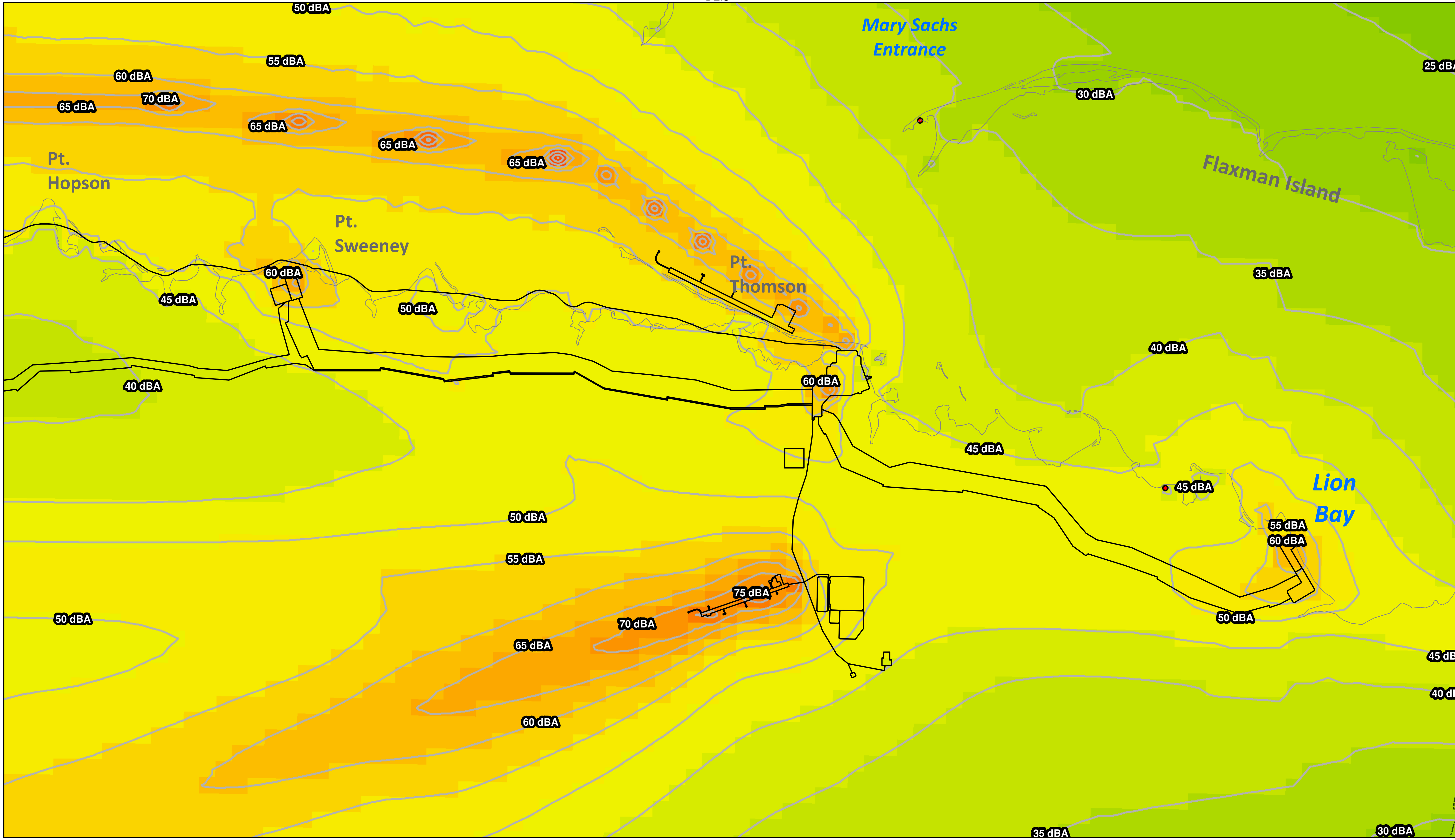

POINT THOMSON PROJECT EIS

Legend
Arctic National Wildlife Refuge
Upland

Proposed Layout - Noise Contour Data
Noise Receptors
Noise Contours (5 dBA)
Alternative E Features

Noise Contours (dBA)
0.1 - 5
5.1 - 10
10.1 - 15
15.1 - 20
20.1 - 25
25.1 - 30
30.1 - 35
35.1 - 40
40.1 - 45
45.1 - 50
50.1 - 55
55.1 - 60
60.1 - 65
65.1 - 70
70.1 - 75
75.1 - 80
80.1 - 85
85.1 - 90
90.1 - 95
95.1 - 100

The data displayed is concept level and has not been engineered.

N
0 0.5 1 Miles

Figure 68
Alternative E - Operations
Summer Noise Contours
Sheet 2 of 2

Date: 6 July 2011
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009; BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2011

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Chapter 5. Potential for Project-related Noise in the Arctic Refuge

At the request of USFWS and with direction from the Corps, HDR prepared additional analyses to assess potential project-related noise levels inside the Arctic Refuge when winds are from the west at speeds of 10, 15, and 20 m/s. The goals of these analyses were to:

1. Assess how winds from the west enhance noise propagation and the extent to which these winds could introduce project-related noises inside the Arctic Refuge;
2. Compare project-related noise levels under these wind conditions with the L_{eq} measured in a representative soundscape;
3. Compare project-related noise levels under these wind conditions with the L_{nat} measured in a representative soundscape, and;
4. Assess the potential increase above the representative L_{eq} and L_{nat} at locations inside the Arctic Refuge.

HDR prepared a series of noise models in Cadna-A to simulate the effects of these wind conditions on project-related noise levels inside the Arctic Refuge. Each model included two rows of modeled receptors (locations where the model calculates project-related noise levels). These receptors started at the western boundary of the Arctic Refuge, were spaced one-half mile apart, and extended eastward for 10 miles inside of the Arctic Refuge, as shown on Figure 69. Receptors 1 through 21 (R1 through R21) commenced at approximately five miles south of the Beaufort seashore receptor. Receptor 22 through 42 commenced at approximately five miles north of the Canning River takeout receptor.

Based on a review of digital aerial photos, HDR determined that the two rows of modeled receptors intersect a region that has a lot of surface water features. Therefore, HDR assigned each modeled receptor to a representative soundscape: either the upland coastal plain or the upland coastal plain near surface water feature. In this manner, HDR also assigned a representative L_{nat} and L_{eq} for each modeled receptor inside the Arctic Refuge based on the receptor's proximity to surface waters. This allowed HDR to compare predicted project-related noise levels with existing noise levels at the modeled receptors inside the Arctic Refuge.

These analyses were performed using both the construction/drilling and operations noise models for each build alternative under consideration in this document, and also using the three different wind speed regimes identified above.

In the figure below, R1-21 refers to the first or northern-most row of modeled receptors; R22-41 refers to the second or southern-most row of receptors. Results for each row are shown in separate graphs for easier interpretation.In that regard, the following graphs convey results of this analysis of potential project-related noise levels at locations up to ten miles inside the western boundary of the Arctic Refuge.

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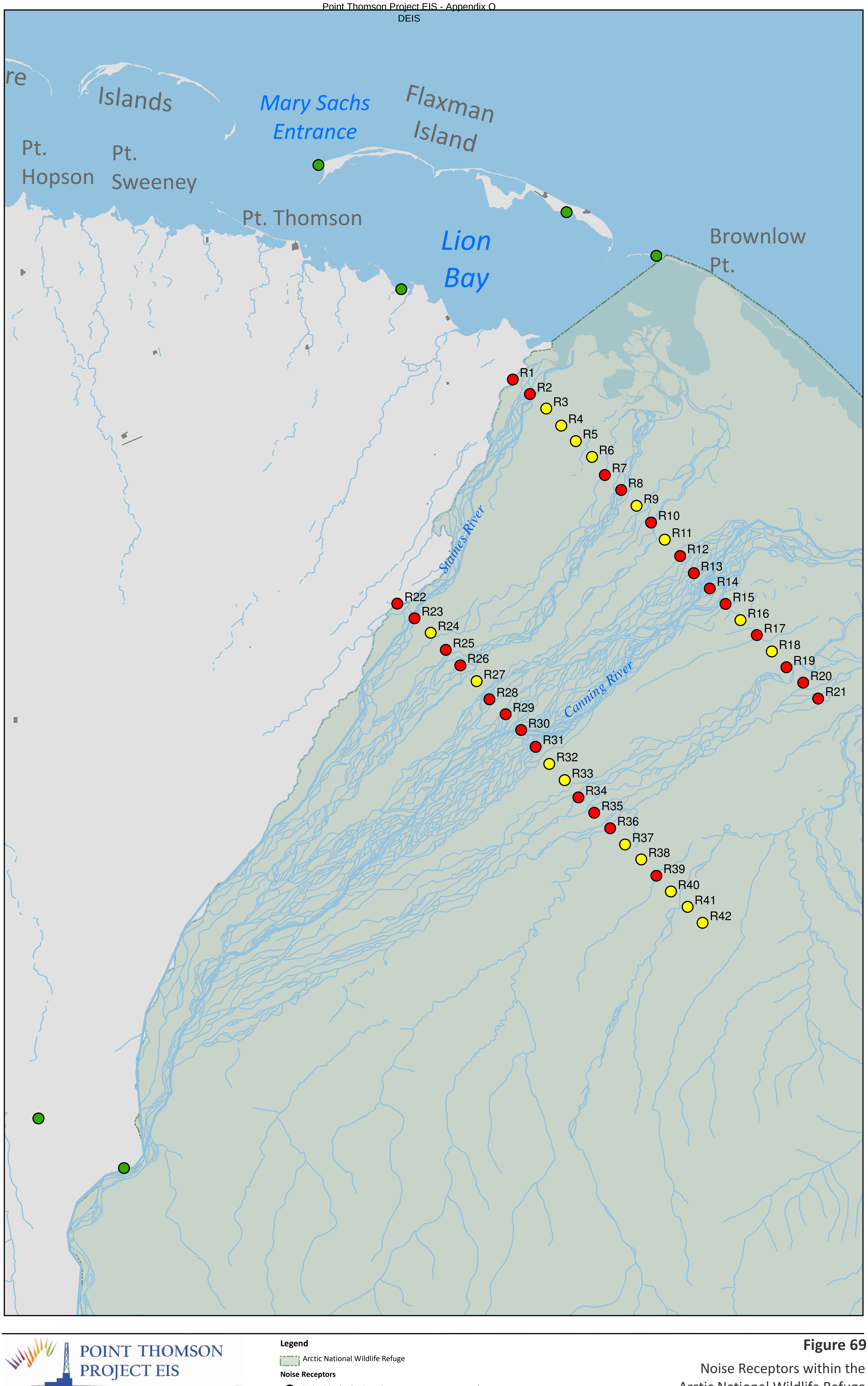

Figure 69

Noise Receptors within the Arctic National Wildlife Refuge

Date: 24 August 2011
Map Author: HDR Alaska Inc.
Source: See References chapter for map source information

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5.1 CONSTRUCTION NOISE ANALYSIS

This section presents the results of the analysis of potential construction noise levels at areas near the western boundary of the Arctic Refuge.

5.1.1 Summertime Construction Noise Levels in the Arctic Refuge

Figure 70 presents analysis results showing the modeled project-related noise levels at receptors inside the Arctic Refuge.

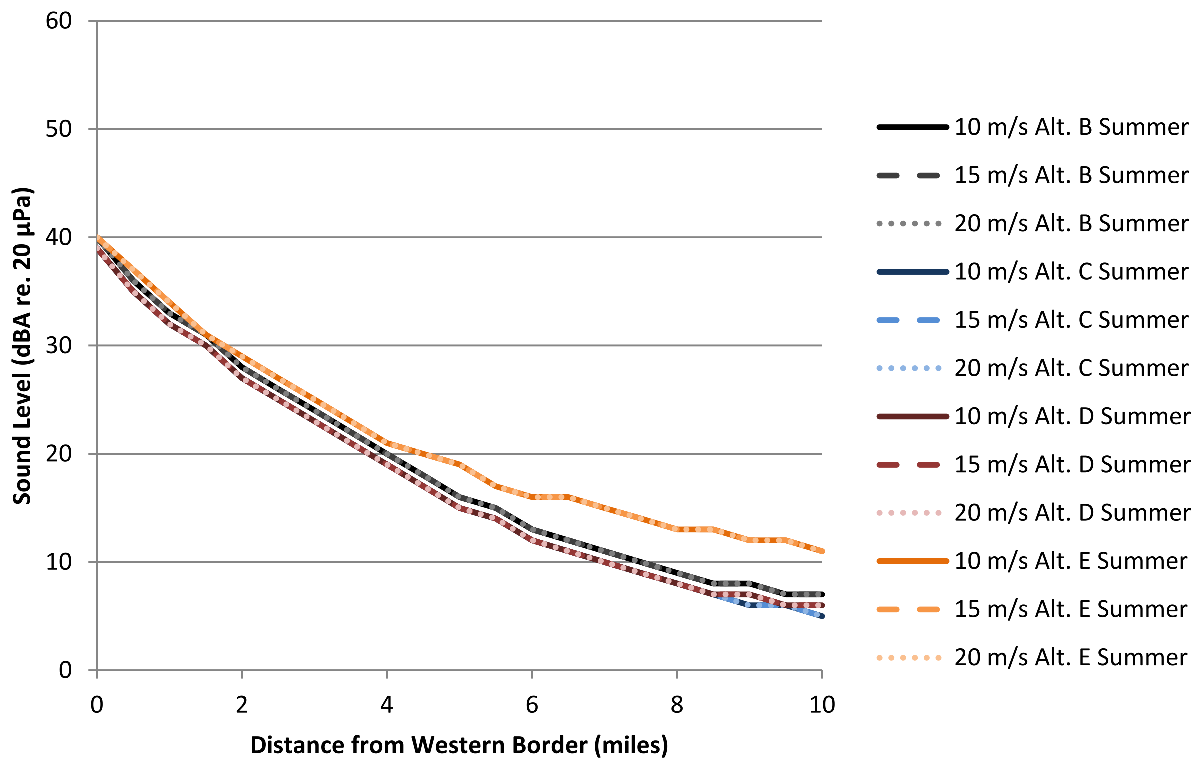

Figure 70. Summer Construction Noise in ANWR – R1 through R21, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off quickly in the summertime, partly due to the acoustically absorptive tundra vegetation.

Figure 71 presents analysis results showing the modeled project-related noise levels at the southern row of receptors inside the Arctic Refuge.

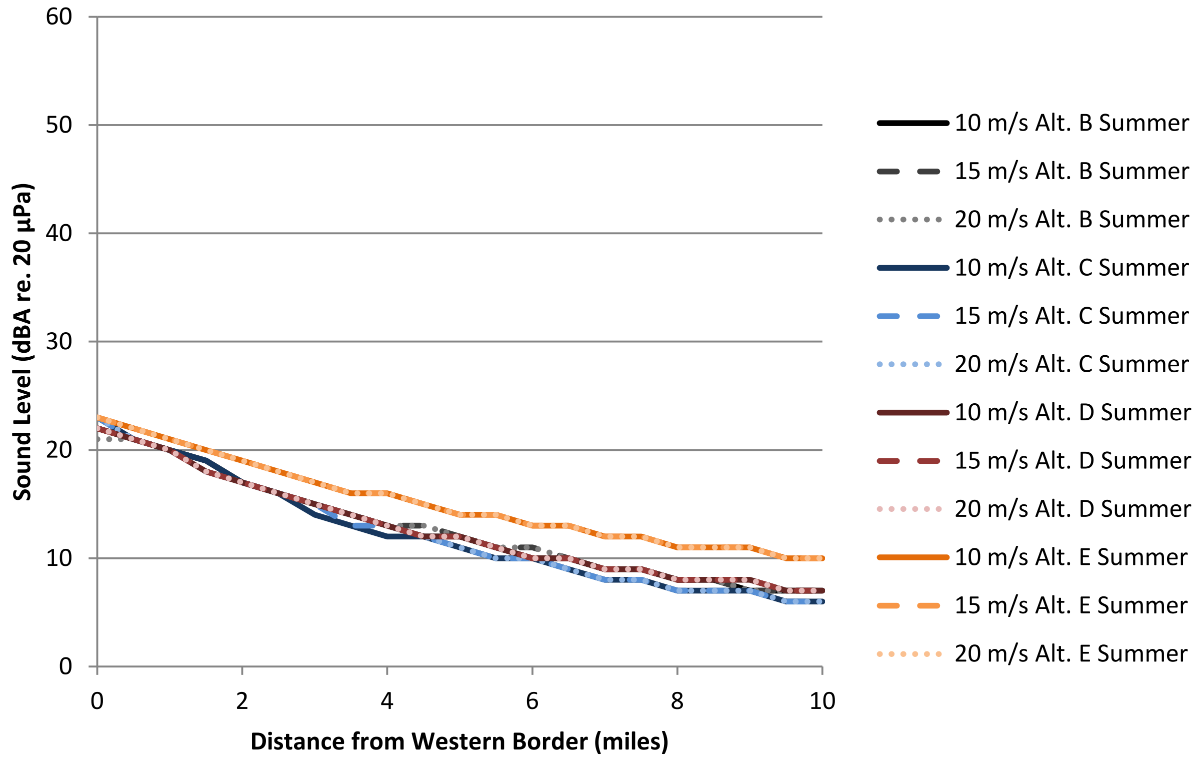

Figure 71. Summer Construction Noise in ANWR – R22 through R42, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off quickly in the summertime, partly due to the acoustically absorptive tundra vegetation.

Figure 72 shows the predicted increase over the L_{nat} at the northern row of receptors inside the Arctic Refuge.

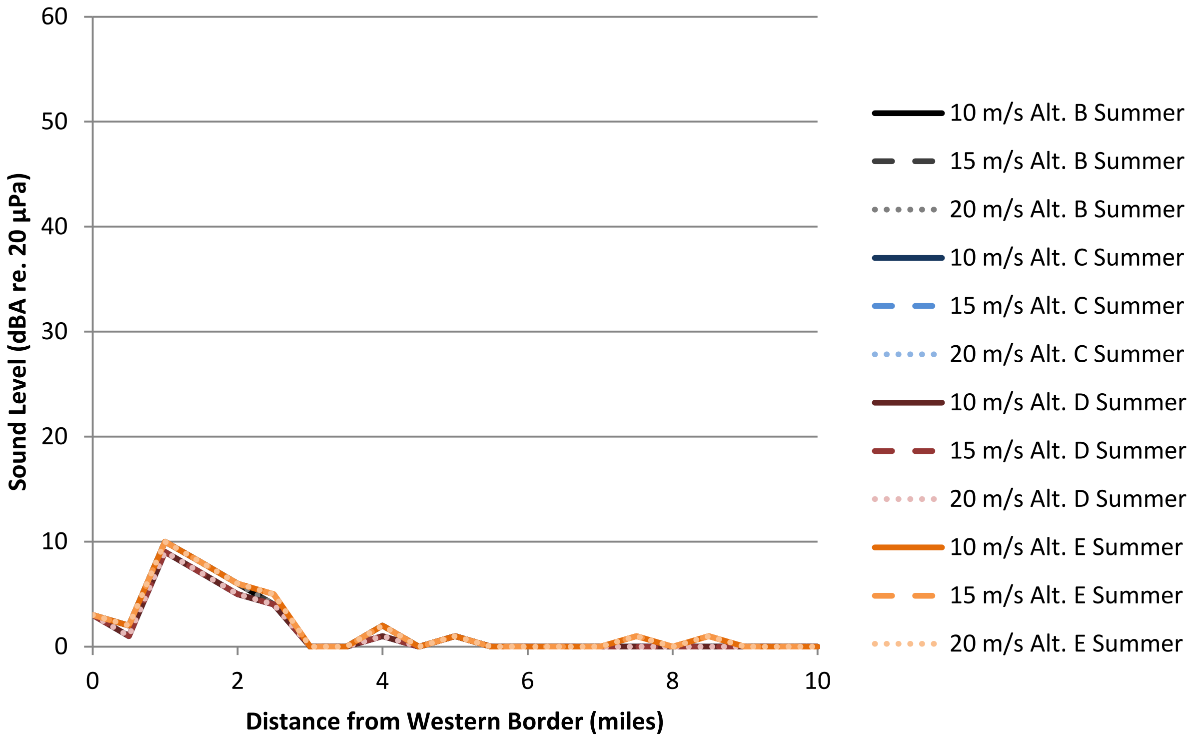

Figure 72. Summer Construction Noise in ANWR – R1 through R21, Increase over L_{nat}

The figure above shows very small predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 73 shows the predicted increase over the L_{nat} at the southern row of receptors inside the Arctic Refuge.

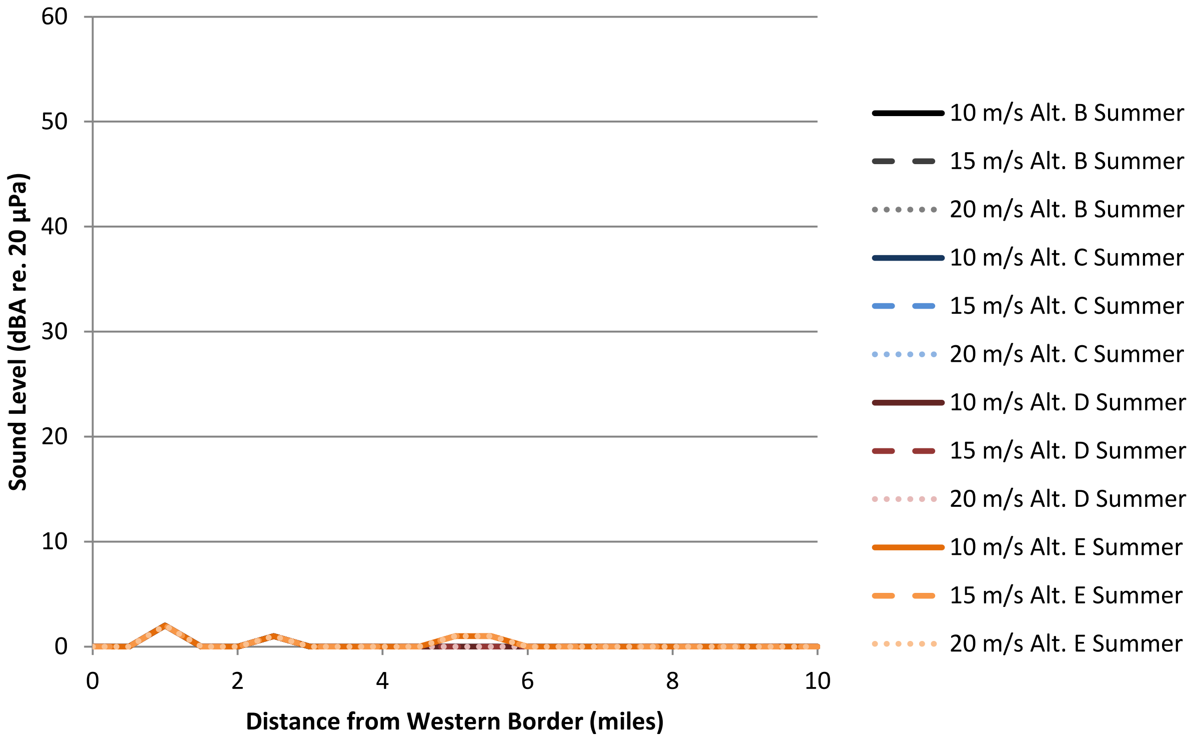

Figure 73. Summer Construction Noise in ANWR – R22 through R42, Increase over L_{nat}

The figure above shows very small predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 74 shows the predicted increase over the L_{eq} at the northern row of receptors inside the Arctic Refuge.

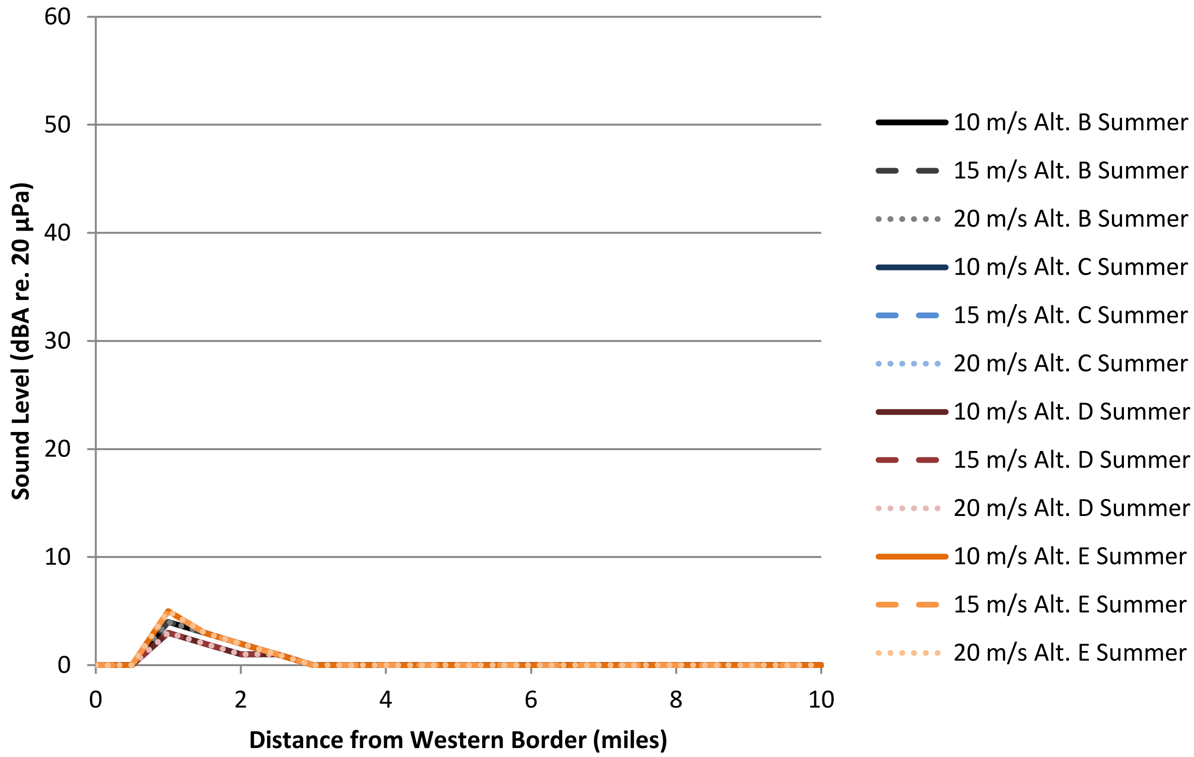

Figure 74. Summer Construction Noise in ANWR – R1 through R21, Increase over L_{eq}

The figure above shows very small predicted increases above the L_{eq}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

The modeled project-related noise did not increase the L_{eq} for R22 through R42 for summer construction; therefore, this graph is omitted.

5.1.2 Winter Construction Noise Levels in the Arctic Refuge

Figure 75 shows the predicted project-related noise levels at the northern row of receptors inside the Arctic Refuge.

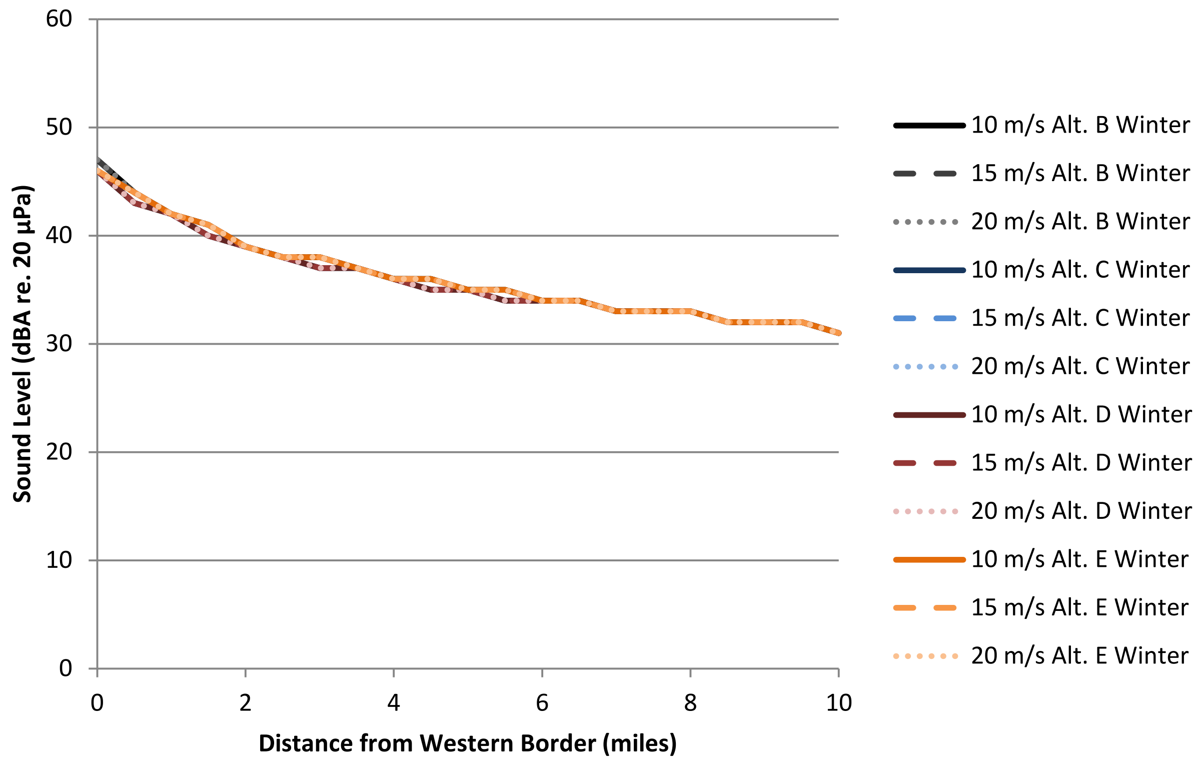

Figure 75. Winter Construction Noise in ANWR – R1 through R21, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off with increasing distance in the wintertime. Project-related noise levels are not predicted to drop off as much as predicted for summertime, because the tundra (normally an acoustically absorptive ground cover) is covered with snow; this reduces its acoustical absorption properties.

Figure 76 shows the predicted project-related noise levels at the southern row of receptors inside the Arctic Refuge.

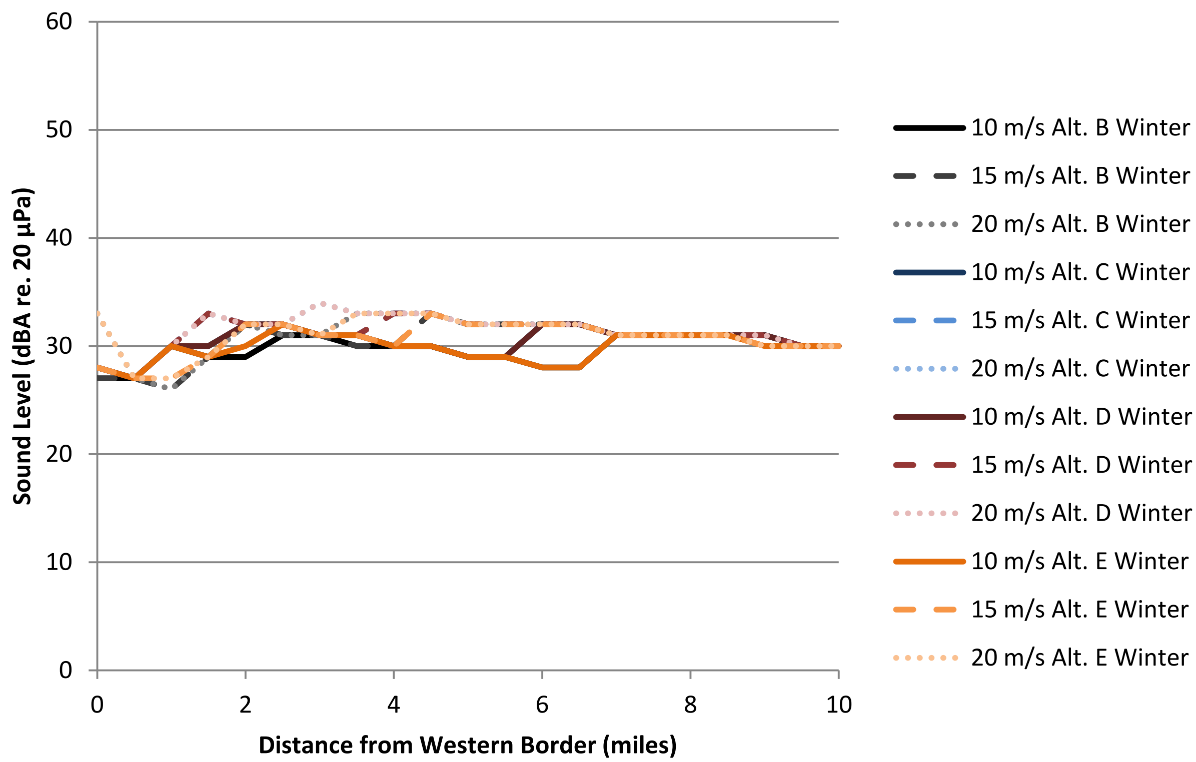

Figure 76. Winter Construction Noise in ANWR – R22 through R42, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off with increasing distance in the wintertime. Project-related noise levels are not predicted to drop off as much as predicted for summertime, because the tundra (normally an acoustically absorptive ground cover) is covered with snow; this reduces its acoustical absorption properties.

Figure 77 shows the predicted project-related increase above the L_{nat} at the northern row of receptors inside the Arctic Refuge.

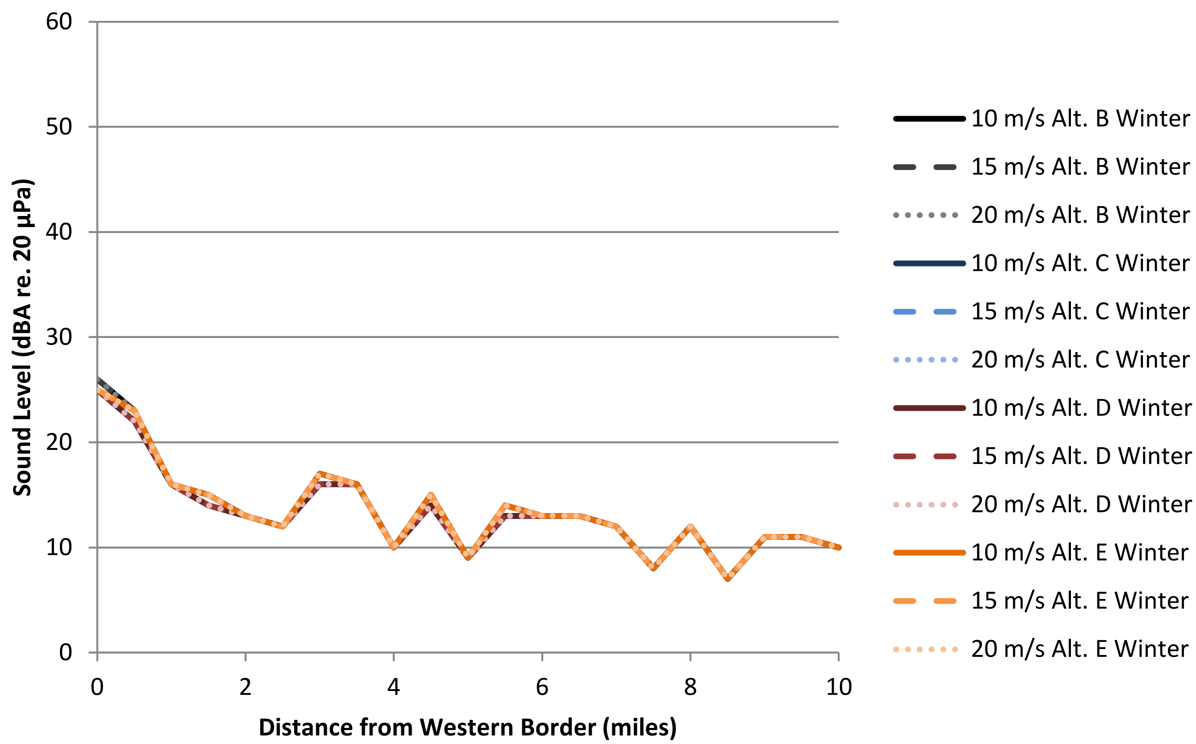

Figure 77. Winter Construction Noise in ANWR – R1 through R21, Increase over L_{nat}

The figure above shows the calculated predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 78 shows the predicted project-related increase above the L_{nat} at the northern row of receptors inside the Arctic Refuge.

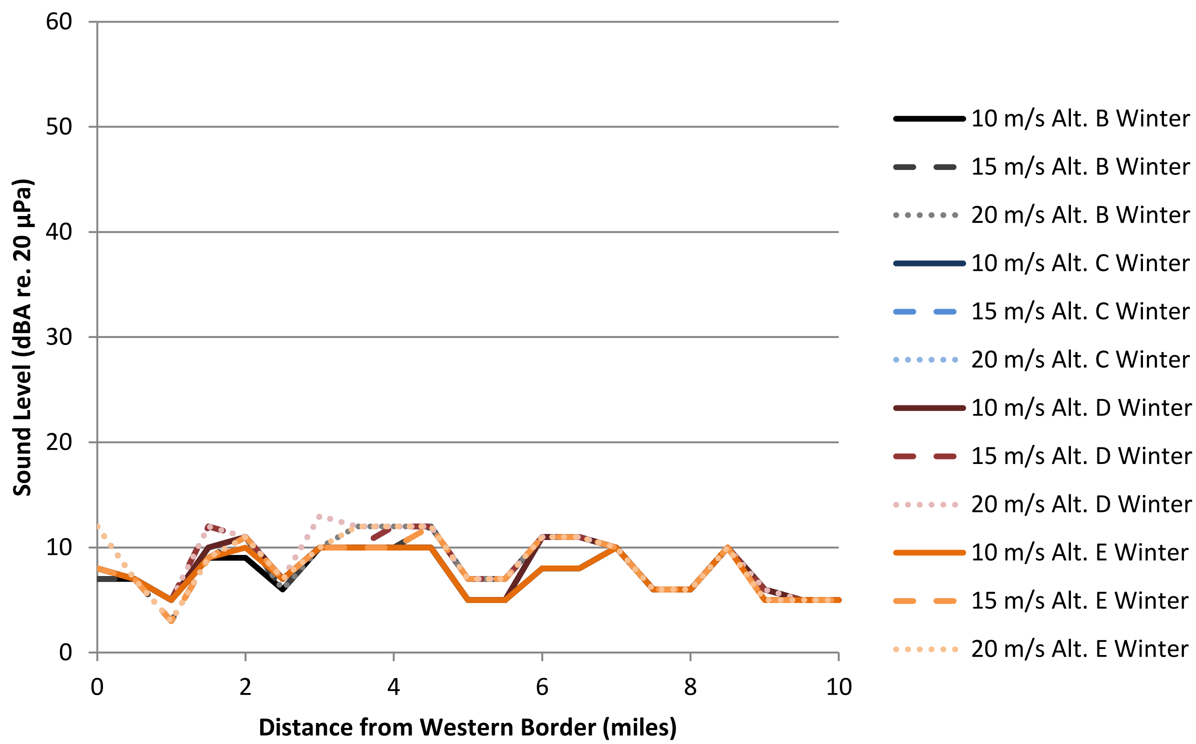

Figure 78. Winter Construction Noise in ANWR – R22 through R42, Increase over L_{nat}

The figure above shows very small predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 79 shows the predicted project-related increase above the L_{eq} at the northern row of receptors inside the Arctic Refuge.

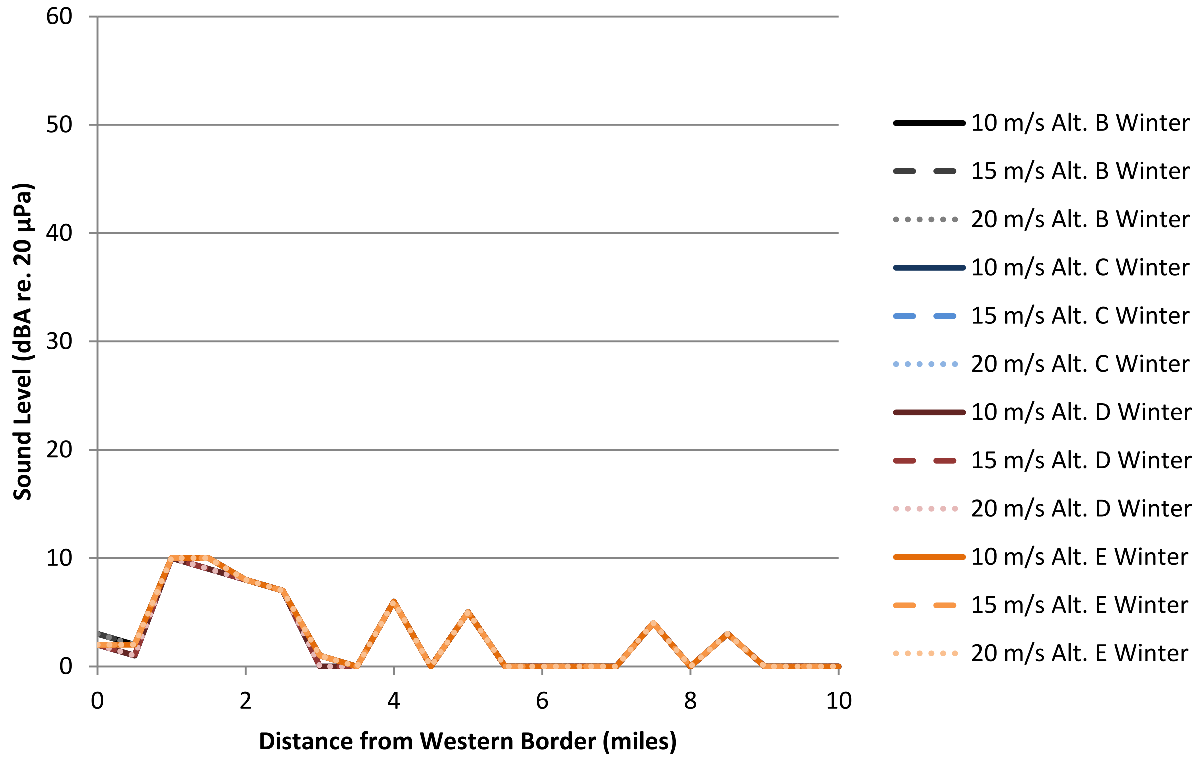

Figure 79. Winter Construction Noise in ANWR – R1 through R21, Increase over L_{eq}

The figure above shows the predicted increases above the L_{eq}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{eq} values based on their proximity to surface waters.

Figure 80 shows the predicted project-related increase above the L_{eq} at the southern row of receptors inside the Arctic Refuge.

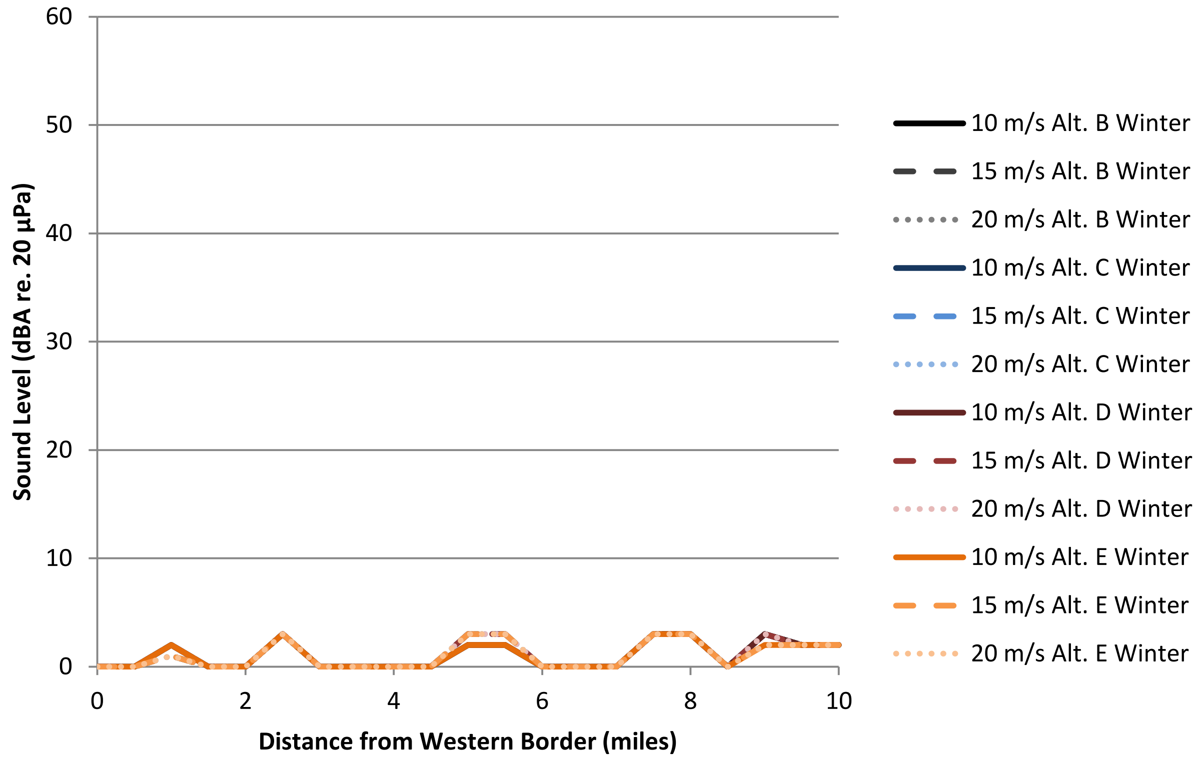

Figure 80. Winter Construction Noise in ANWR – R22 through R42, Increase over L_{eq}

The figure above shows very small predicted increases above the L_{eq}. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{eq} values based on their proximity to surface waters.

5.2 OPERATIONAL NOISE ANALYSIS

This section presents the results of the analysis of potential operational noise levels at areas near the western boundary of the Arctic Refuge.

5.2.1 Summer Operational Noise Levels in the Arctic Refuge

Figure 81 shows the predicted project-related noise levels at the northern row of receptors inside the Arctic Refuge.

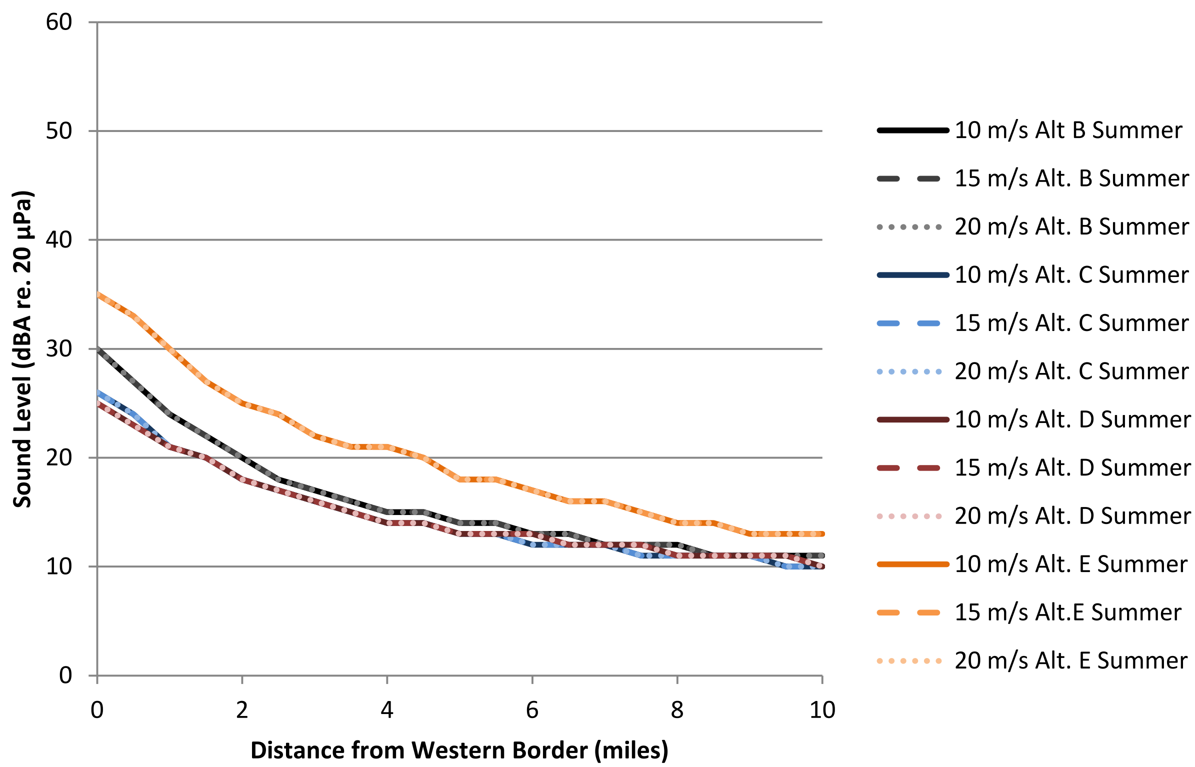

Figure 81. Summer Operation Noise in ANWR – R1 through R22, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off quickly in the summertime, partly due to the acoustically absorptive tundra vegetation.

Figure 82 shows the predicted project-related noise levels at the southern row of receptors inside the Arctic Refuge.

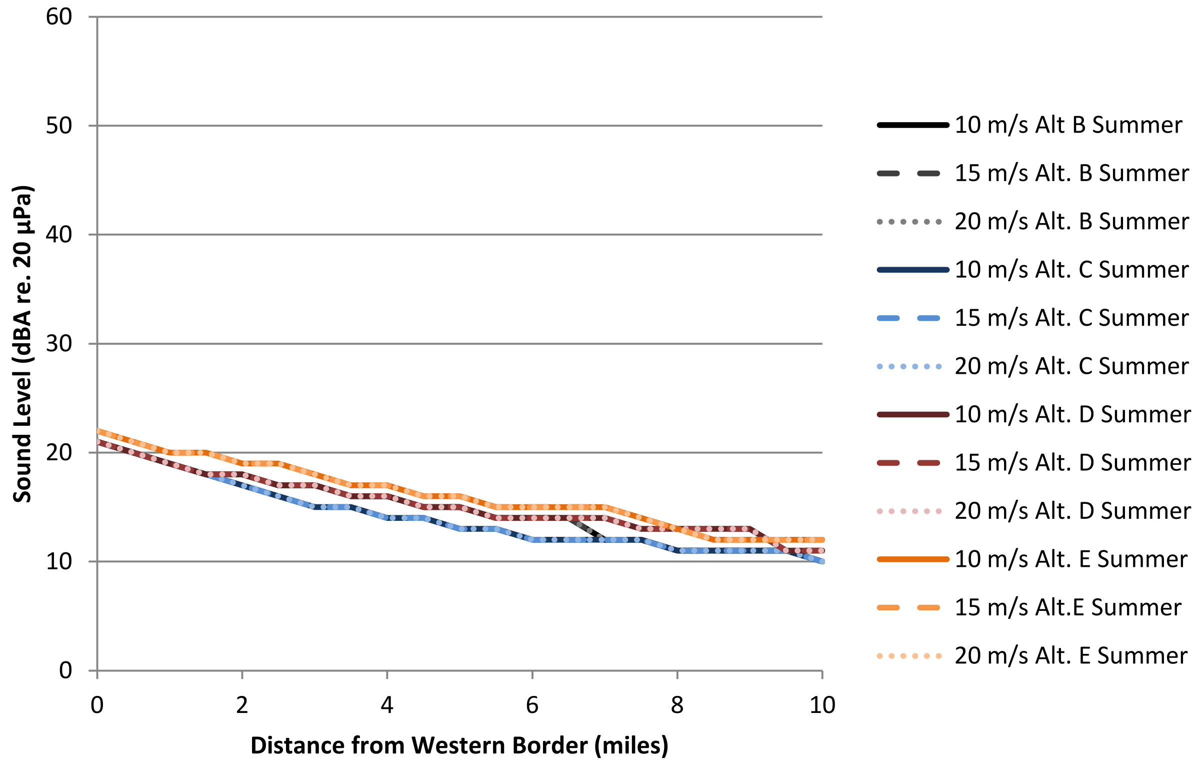

Figure 82. Summer Operation Noise in ANWR – R22 through R42, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off quickly in the summertime, partly due to the acoustically absorptive tundra vegetation.

Figure 83 shows the predicted project-related increase above the L_{nat} at the northern row of receptors inside the Arctic Refuge.

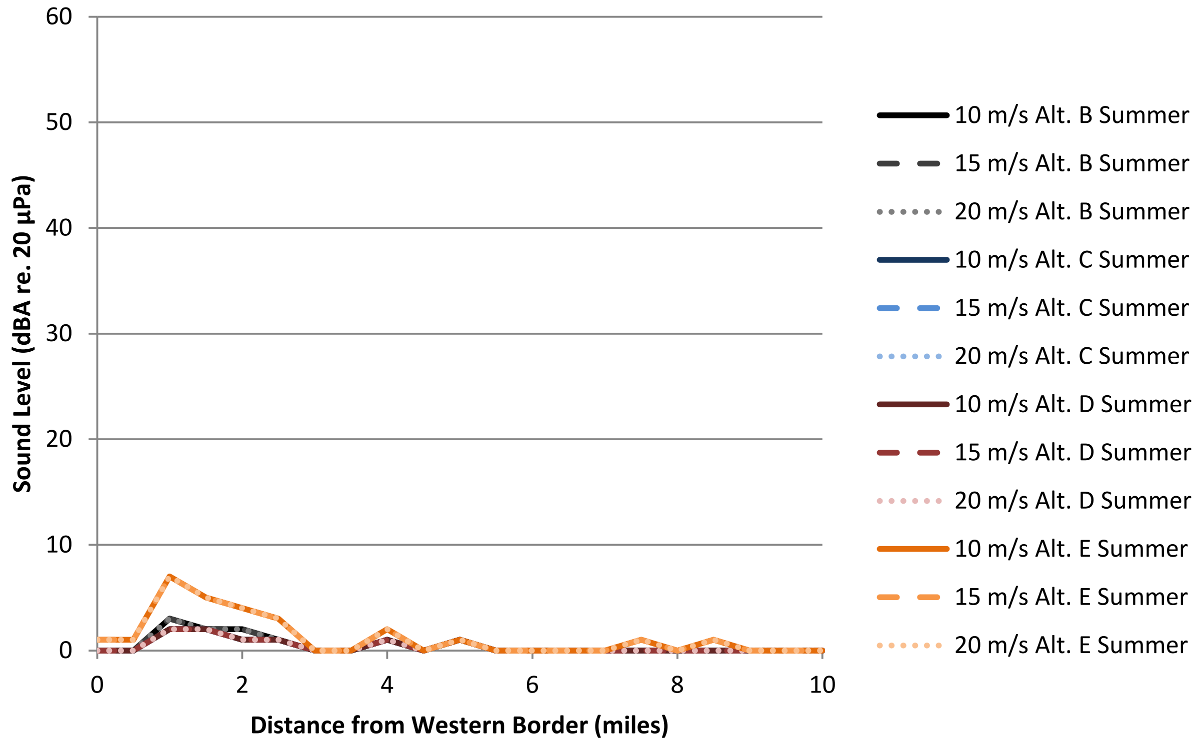

Figure 83. Summer Operation Noise in ANWR – R1 through R22, Increase over L_{nat}

The figure above shows very small predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 84 shows the predicted project-related increase above the L_{nat} at the southern row of receptors inside the Arctic Refuge.

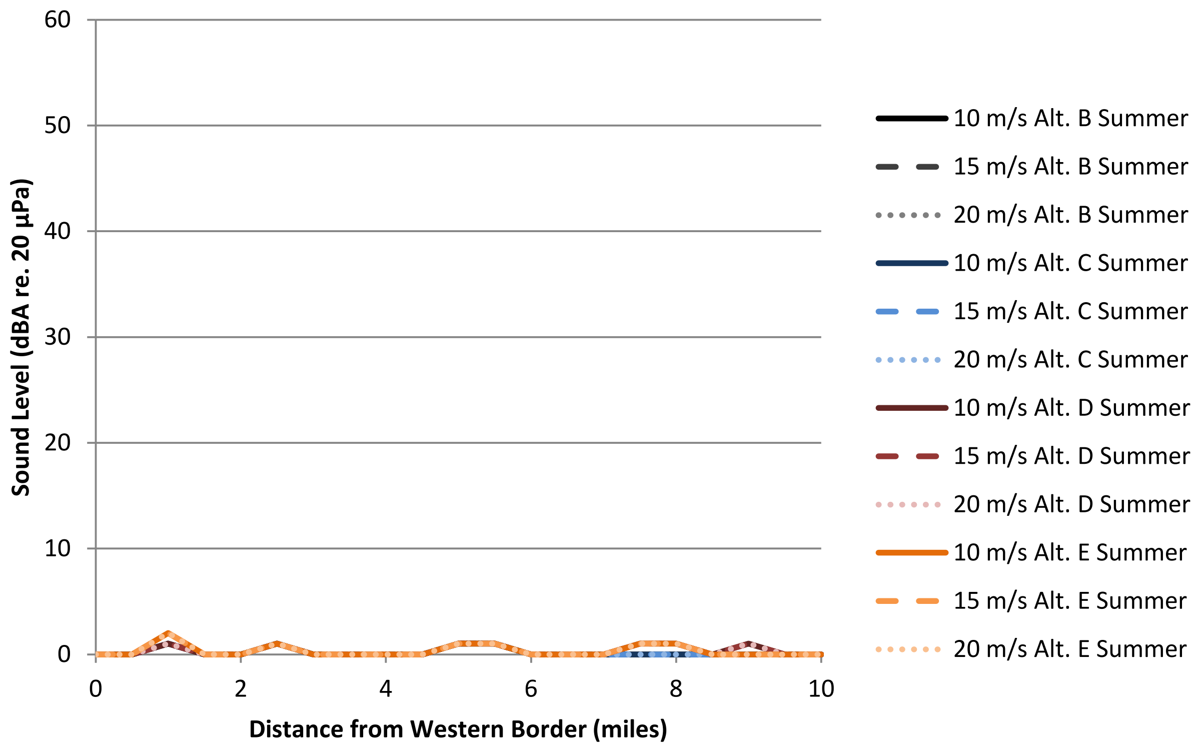

Figure 84. Summer Operation Noise in ANWR – R22 through R42, Increase over L_{nat}

The figure above shows very small predicted increases above the L_{nat}, and that the noise increase decays with increasing distance from Point Thomson. The slight noise increases/fluctuations in the graph above occur because different receptors were assigned different L_{nat} values based on their proximity to surface waters.

Figure 85 shows the predicted project-related increase above the L_{eq} at the northern row of receptors inside the Arctic Refuge.

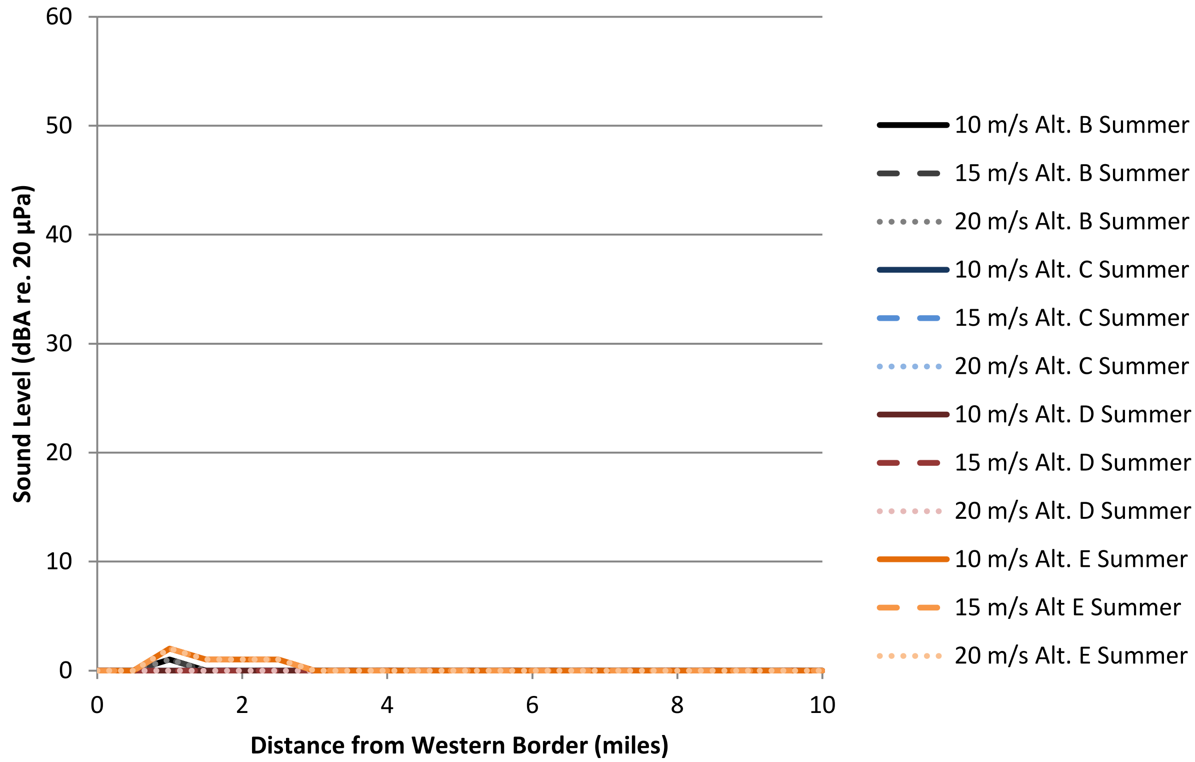

Figure 85. Summer Operation Noise in ANWR – R1 through R21, Increase over L_{eq}

Analysis results in this figure show that project-related noise levels are predicted to increase over the L_{eq}in areas within 0.5 to 2 miles east of the western boundary of the Arctic Refuge.

The modeled project-related noise did not increase the L_{eq} for R22 through R42 for summer operations, therefore this graph is omitted.

5.2.2 Winter Operational Noise Levels in the Arctic Refuge

Figure 86 shows the predicted project-related noise levels at the northern row of receptors inside the Arctic Refuge.

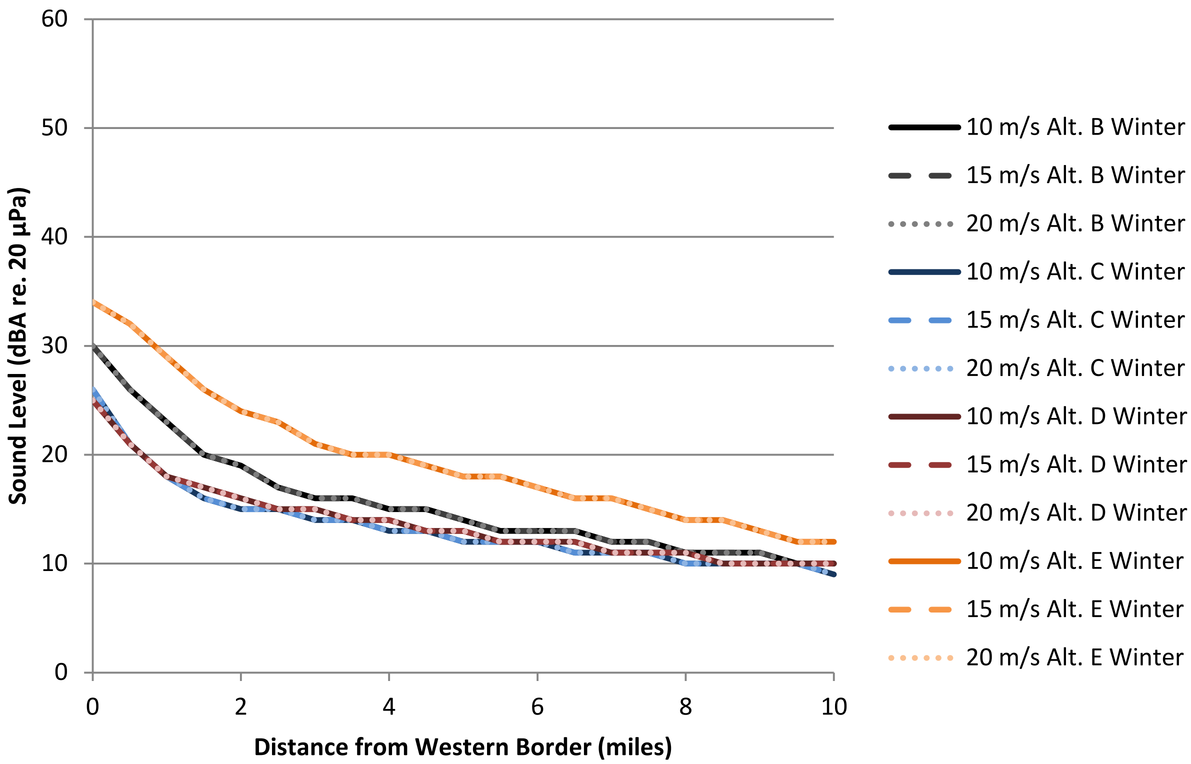

Figure 86. Winter Operation Noise in ANWR – R1 through R21, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off with increasing distance. However, predicted noise levels do not drop off as quickly as predicted in the summertime, partly due to the acoustically absorptive tundra vegetation being covered with snow.

Figure 87 shows the predicted project-related noise levels at the southern row of receptors inside the Arctic Refuge.

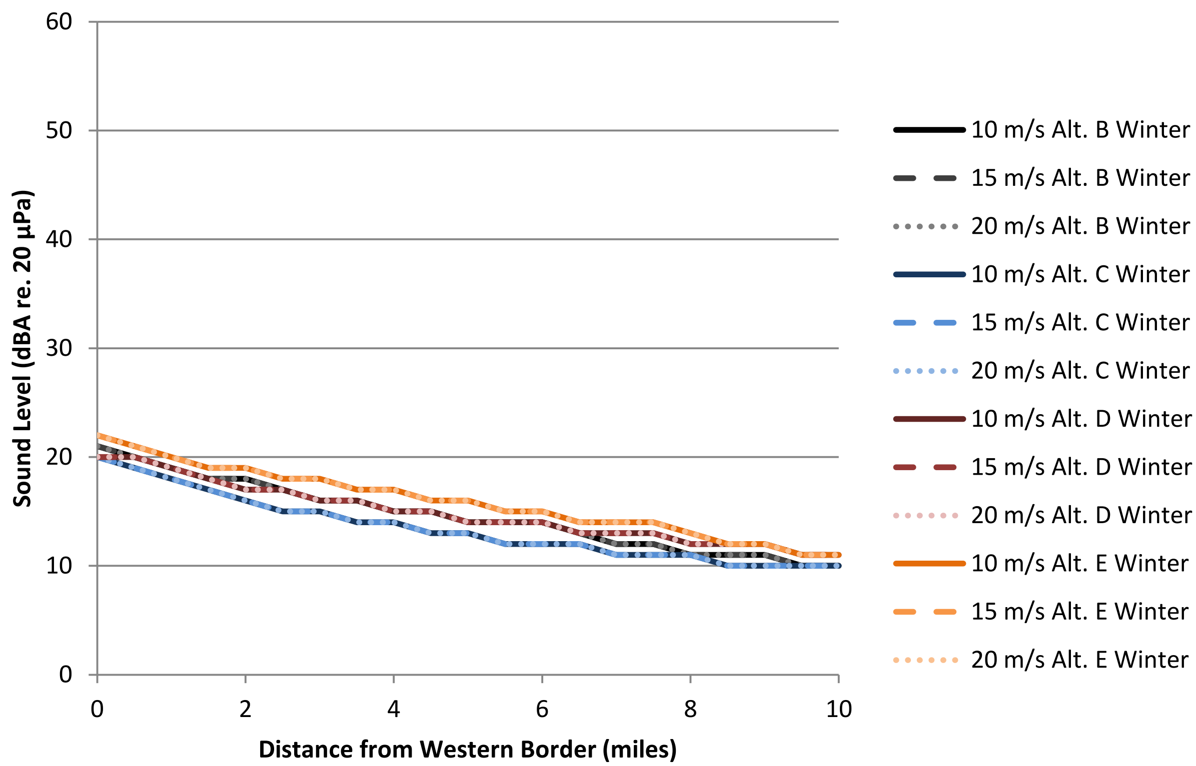

Figure 87. Winter Operation Noise in ANWR – R22 through R42, Modeled Project-Related Noise

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off with increasing distance from the western boundary of the Arctic Refuge.

Figure 88 shows the predicted project-related increase over the L_{nat} at the northern row of receptors inside the Arctic Refuge.

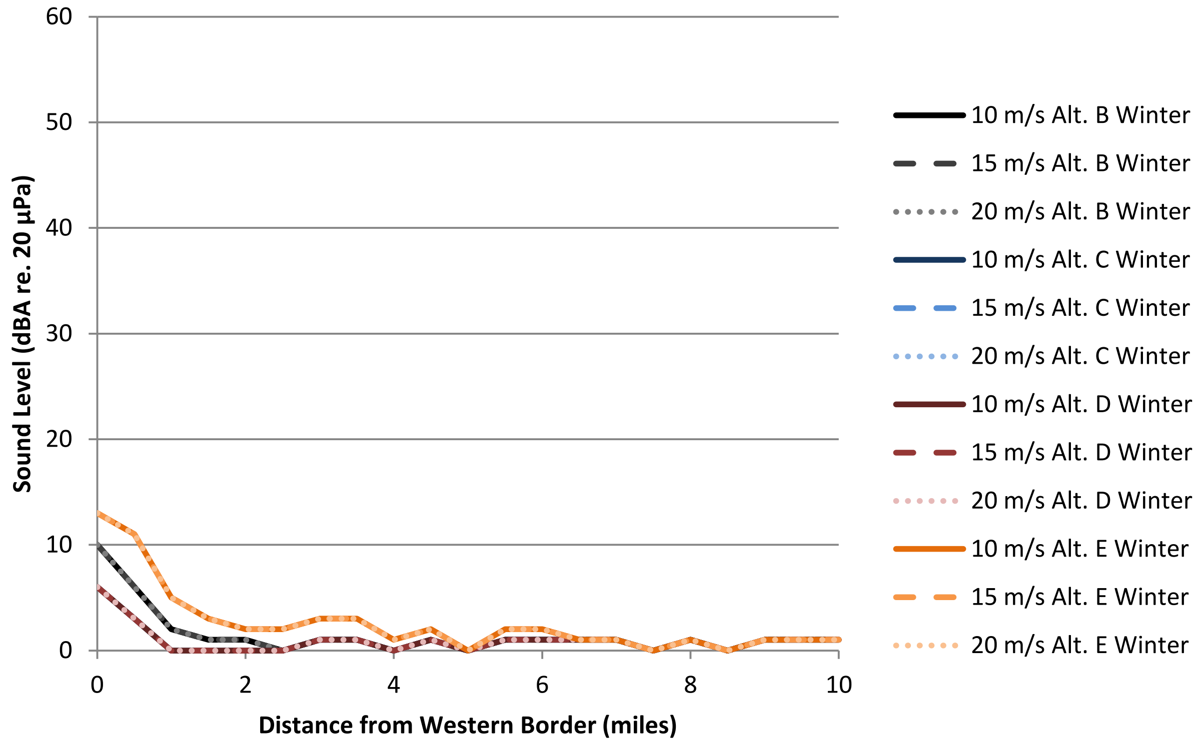

Figure 88. Winter Operation Noise in ANWR – R1 through R21, Increase over L_{nat}

Analysis results in the figure above show that modeled project-related increase above L_{nat} is predicted to drop off to close to the existing L_{nat} at locations inside the Arctic Refuge.

Figure 89 shows the predicted project-related increase over the L_{nat} at the southern row of receptors inside the Arctic Refuge.

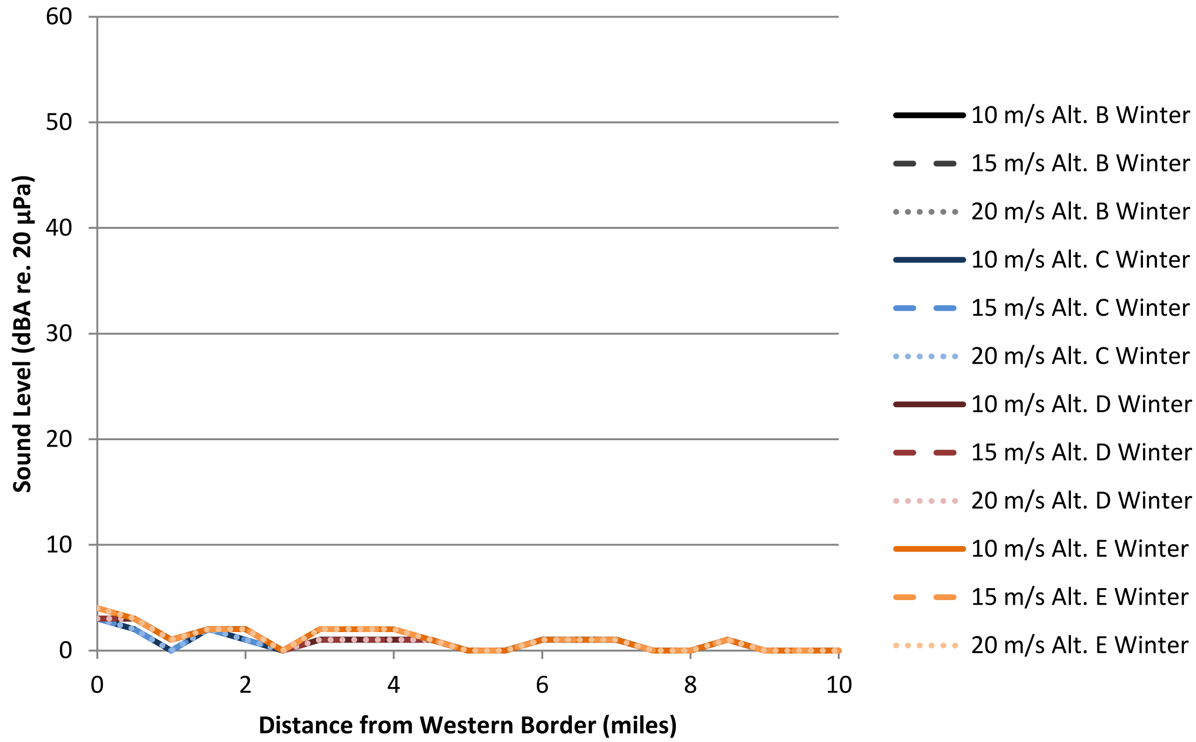

Figure 89. Winter Operation Noise in ANWR – R22 through R42, Increase over L_{nat}

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off to close to the L_{nat} at locations inside the Arctic Refuge.

Figure 90 shows the predicted project-related increase over the L_{eq} at the northern row of receptors inside the Arctic Refuge.

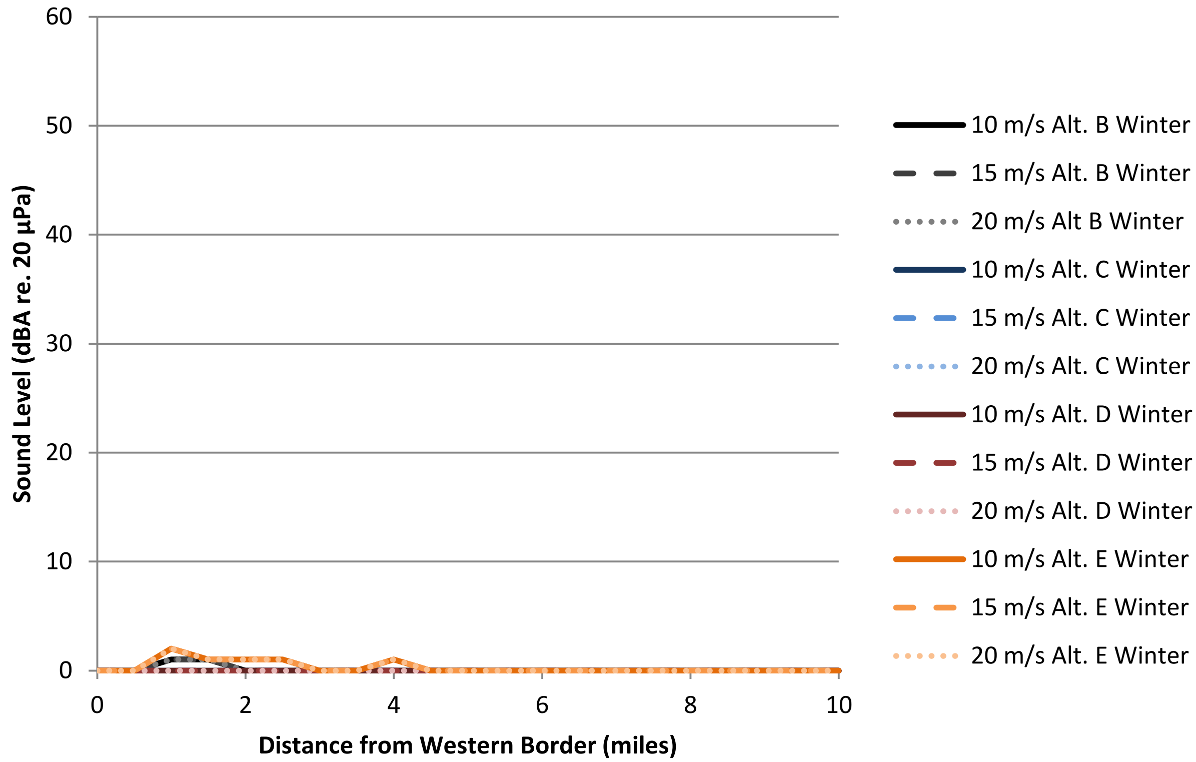

Figure 90. Winter Operation Noise in ANWR – R1 through R21, Increase over L_{eq}

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off to close to the L_{eq} at locations inside the Arctic Refuge.

Figure 91 shows the predicted project-related increase over the L_{eq} at the southern row of receptors inside the Arctic Refuge.

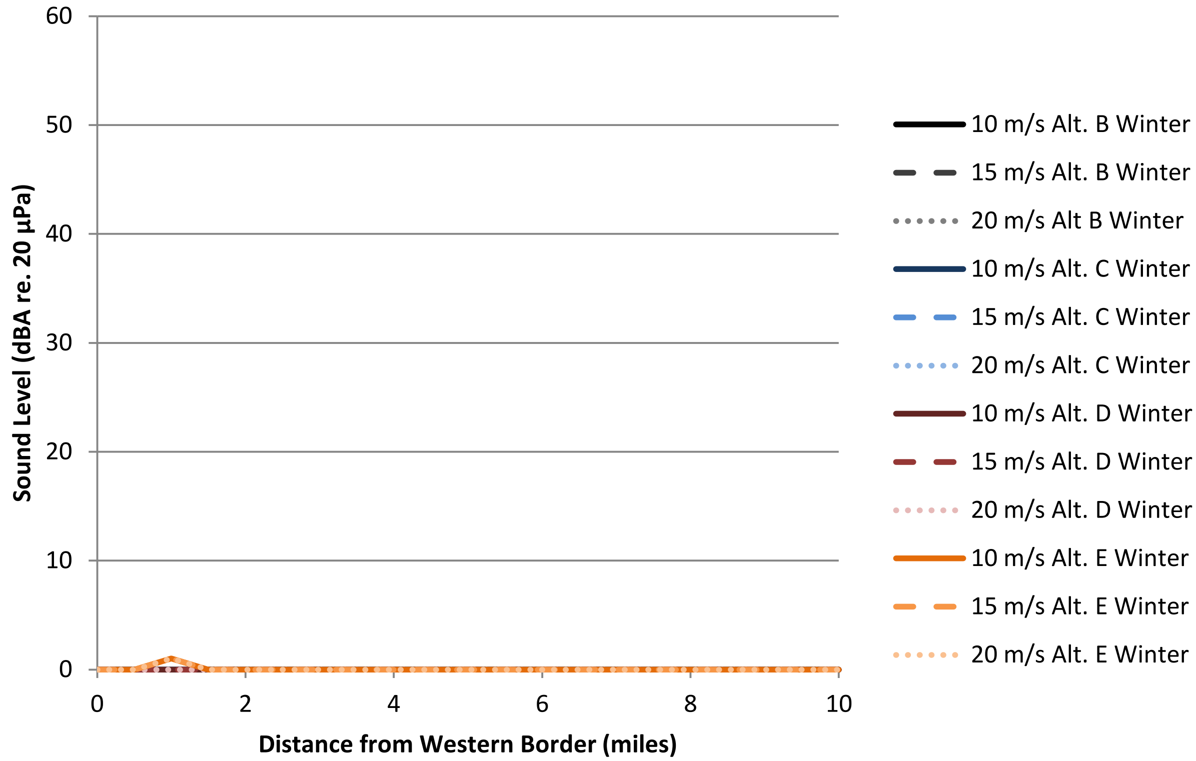

Figure 91. Winter Operation Noise in ANWR – R22 through R42, Increase over L_{eq}

Analysis results in the figure above show that modeled project-related noise levels are predicted to drop off to close to the L_{eq} at locations inside the Arctic Refuge.

Chapter 6. Potential Underwater Noise

Several studies involving underwater noise have been performed in association with the construction and operation of Northstar Island in Prudhoe Bay, Alaska. Information gathered as a part of these studies can help us to understand what underwater noise levels could be expected as a result of the construction and operation of the Point Thomson facility. It is important to note, the data used in the Northstar Island studies does not directly relate to the Point Thomson project area. Water depths ranged from 9-14 meters for the Northstar Island study, whereas much of the area near shore is less than 3 meters deep near the Point Thomson project. Factors such as bottom sediment composition, depth of water, ice depth, etc. affect how far and how loud the sounds of slant drilling and pile driving would travel through the ice during winter at Point Thomson.

6.1 DRILLING SUMMARY

Recordings of sounds underwater were obtained at Northstar Island, an artificial gravel island in the Beaufort Sea near Prudhoe Bay, Alaska. The aim was to document the levels, characteristics, and range dependence of sounds produced by drilling and oil production during the winter, when the island was surrounded by land-fast ice. All recordings were made at stations on the land-fast ice. As opposed to other island activities, drilling produced the highest underwater broadband noise levels. In contrast, drilling did not increase broadband noise levels in air or ice relative to levels during other island activities. Production did not increase broadband levels for any of the sensors. In all media, broadband levels decreased by an approximate 20 dB/tenfold change in distance. Background levels underwater were reached by 9.4 km during drilling and 3-4 km when drilling did not occur. A comparison of the recorded sounds with harbor and ringed seal audiograms showed that Northstar sounds were probably audible to seals, at least intermittently, out to approximately 1.5 km in water and approximately 5 km in air.

Drilling sounds were readily identifiable underwater and drilling resulted in marked increases in noise level for the frequency bands 60-250 Hz and 650-1400 Hz. The higher-frequency peak was still clearly detectable 5 km from the drill rig, but had fallen to background values by the 9.4 km station. The results in Table 19 show that underwater broadband levels were notably higher during drilling. Table 19 is a summary of the main results: highest broadband value recorded and distance (in m) at which it was recorded; broadband value at 1000 m from the source; “background” (i.e. lowest) value and distance at which this background value was reached; center frequency of the main peaks in the one-third-octave and narrow band data; spreading loss terms, when available. Underlined frequencies are the most important ones (Blackwell, Greene Jr. and Richardson 2004).

Previous studies of underwater (i.e. under –ice) noise from winter drilling on icebound gravel islands and ice pads have indicated that drilling noise is clearly detectable at close ranges, but is generally confined to low frequencies and has low received levels.

Table 19. Summary of Underwater Drilling Sound Results					
Underwater sound (in dB re: 1 µPa)[a]	Broadband Noise Levels			Center frequency of peaks(s)	Spreading loss term (dB/tenfold change in distance)
	Highest level recorded (distance)	Lowest level at 1000 m	"Background" level (closest distance with that level)[b]		
No drilling, no production (N)	98 (500 m)	83		7, 40	
No drilling, production	102 (220 m)	91	76 (3-4 km)	7, 20, 50, 125	22.0
Drilling, no production (N)	116 (250 m)	92	77 (4-6 km)		
Drilling, no production (E)	124 (1000 m)	124	80 (5 km)		
Drilling and production	104 (220 m)	99	76 (5-9.4 km)	7, 50, 125, 1 k	21.5

Source: Greene, Blackwell and McLennan 2008

[a] Bandwidth 5-10 000 Hz for underwater sound (unweighted)

[b] Note only drilling affected underwater levels of broadband sound

6.2 PILE-DRIVING SUMMARY

Underwater sounds were recorded from sea-ice near an artificial gravel island during its initial construction in the Beaufort Sea near Prudhoe Bay, Alaska. Recordings were made in February-May 2000 when construction began at Northstar Island. Activities recorded included ice auguring, pumping sea water to flood the ice and build an ice road, a bulldozer plowing snow, a Ditchwitch cutting ice, trucks hauling gravel over an ice road to the island site, a backhoe trenching the sea bottom for a pipeline, and both vibratory and impact sheet pile driving.

Vibratory sheet pile driving produced the strongest extended duration sounds, with broadband underwater levels of 143 dB re 1 µPa at 100 m. Most of the sound energy was in a tone close to 24 Hz. Distances to background underwater noise levels (approximately 3 km) were somewhat smaller that expected because of the larger than expected spreading loss term (39.1 dB/decade). Table 20 shows a summary of the levels of sounds and vibrations from vibration sheet piling, for three parameters: (1) Broadband levels at 100m. (2) The center frequency of the strongest one-third octave band for each sound source, as determined from the closest recording. (3) The distance from the source at which the level in the strongest one-third octave band was equal to the media level of the background sound in the same one-third octave band (Greene, Blackwell and McLennan 2008).

Table 20. Summary of Underwater Sound from Vibratory Sheet Pile Driving			
	Hydrophone (10 – 10,000 Hz)		
Sound Source	Broadband @ 100 m (dB re 1 µPa)	Center of Strongest 1/3 OB (Hz)	Distance to 0 dB S/N in 1/3 OB (m)
Vibr. sheet	142.9	25	2930

Source: Greene, Blackwell and McLennan 2008

Distances to background levels will vary greatly from time to time, given the wide variability in ambient levels.

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Appendix A:

Wind Roses

The noise monitoring stations collected wind data along with noise data. A wind sensor provided both wind speed and wind direction data. These data are useful to noise level measurements. It is primarily useful to determine when the noise measurement is likely to be influenced by wind/microphone interference, where the turbulence around the microphone and windscreen begins to generate measurable noise. This is traditionally 5 m/s but can vary depending upon the windscreen construction.

Wind data are also useful to inform where there may be acoustic "shadow zones" created by the wind. Typically, an acoustic shadow zone is found upwind of a noise source. In the shadow zone, the noise from the source will be refracted upward through the atmosphere, away from the listener. Noise levels upwind from the source on a windy day may be lower than on a day with a quiescent atmosphere. The converse is also true, where noise levels downwind of the source on a windy day may be increased due to downward refraction when compared to a day with a quiescent atmosphere and no atmospheric refraction due to wind. This is only one of several atmospheric sound-propagation effects, so by itself it can only give some qualitative illumination on the likely sound propagation from the noise source to the listener.

Wind data from each monitoring location was reduced from 1-second wind speed and direction to a hourly average of the wind speed and direction on a vector basis (the wind direction was weighted by the corresponding wind speed in the average). These data were then converted to a standard hourly meteorological data format and processed by specialty software to produce wind-roses. The results are below in **Figures A-1** through **A-7**.

Continuous, one-second wind speed and wind direction measurement data was collected using on-site wind sensors. Wind speed data collected onsite was entered into a database and later used to identify hours contaminated with high winds. Hours containing winds speeds greater than 5 m/s for more than 25 percent of the hour were considered invalid and excluded from the analysis. Contaminated data was not included in the calculation of acoustical metrics or audio review.

The wind roses do not show the percent of time which met this criterion. The data shown by the wind roses is for a broader description of the wind in these environments.

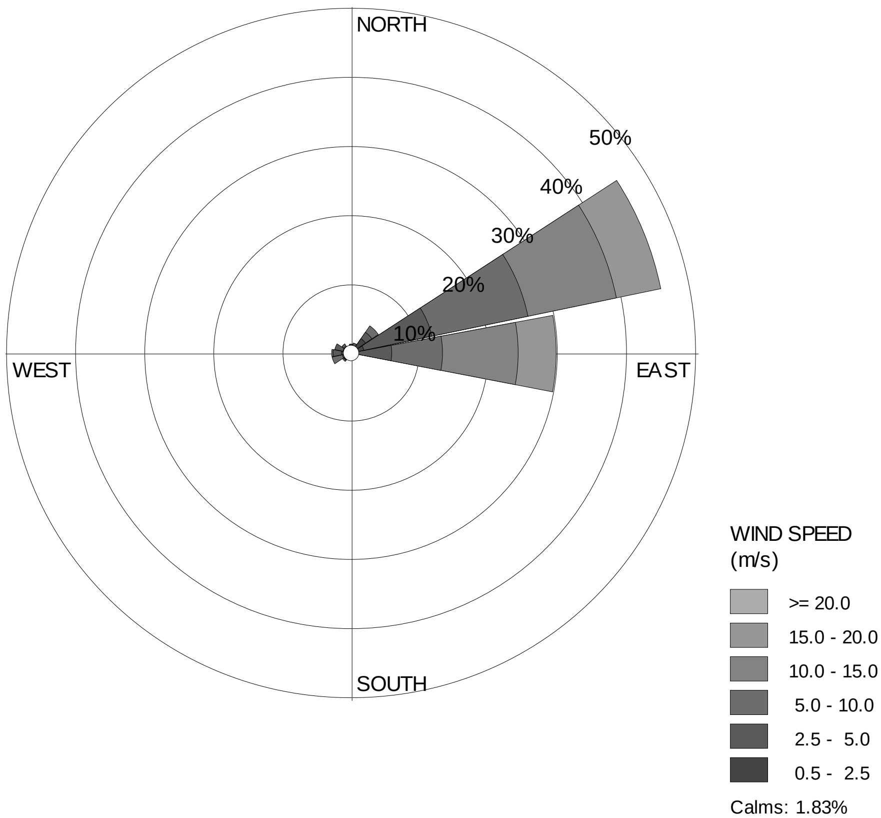


Figure A-1

Wind Rose, Canning River
from Winter Noise Monitoring Station (S1L1)

Figure A-1 shows the wind rose gathered from the winter noise monitoring station at the Canning River. This location is intended to represent existing ambient noise conditions at inland locations near surface water. The rose shows a dominant wind direction. The wind is from the East (E) and the East-by-Northeast (ENE) directions for a combined 76% of the hours. The hourly average wind speed exceeds 10 m/s for 36% of the hours, and does not exceed 20 m/s.

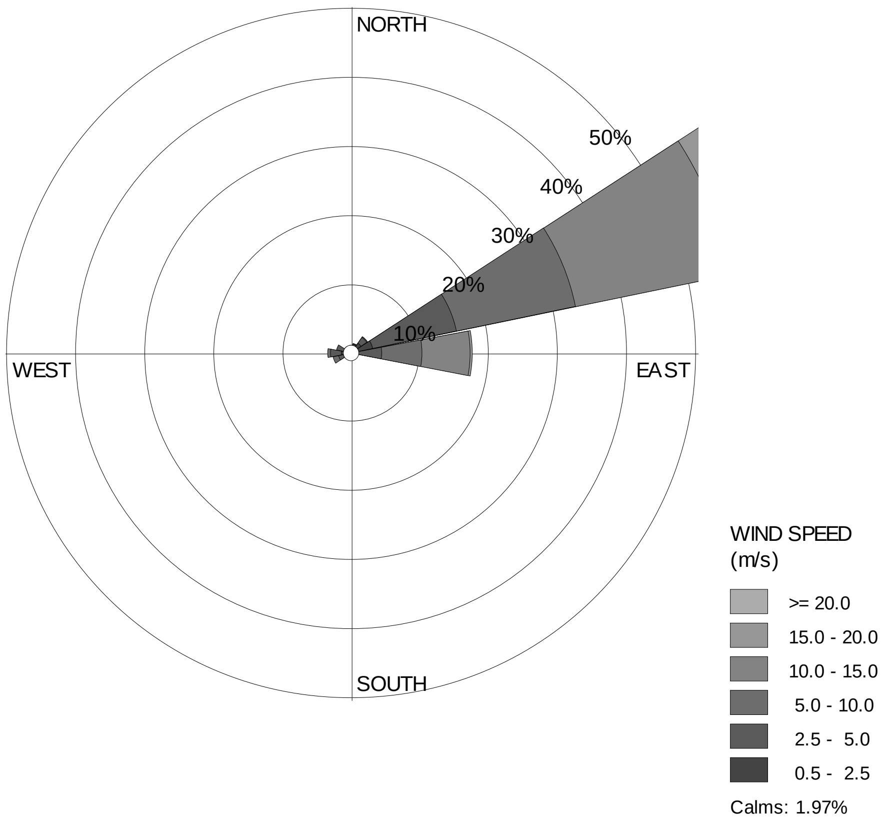


Figure A-2

Wind Rose, Coastal Plains
from Winter Noise Monitoring Station (S1L2)

Figure A-2 shows the wind rose gathered from the winter noise monitoring station at the Coastal Plains site. This location is intended to represent existing ambient noise conditions at upland coastal plains locations. The outermost gridline is 50% so the scale matches the other winter wind roses. However, winds from the East-by-Northeast (ENE) direction occur more frequently and fall outside of the wind rose extents. The outermost value is wind speeds less than 20 m/s for 60% of the hours. The rose shows a dominant wind direction. The wind is from the East (E) and the East-by-Northeast (ENE) directions for a combined 78% of the hours. The hourly average wind speed exceeds 10 m/s for 35% of the hours, and does not exceed 20 m/s.

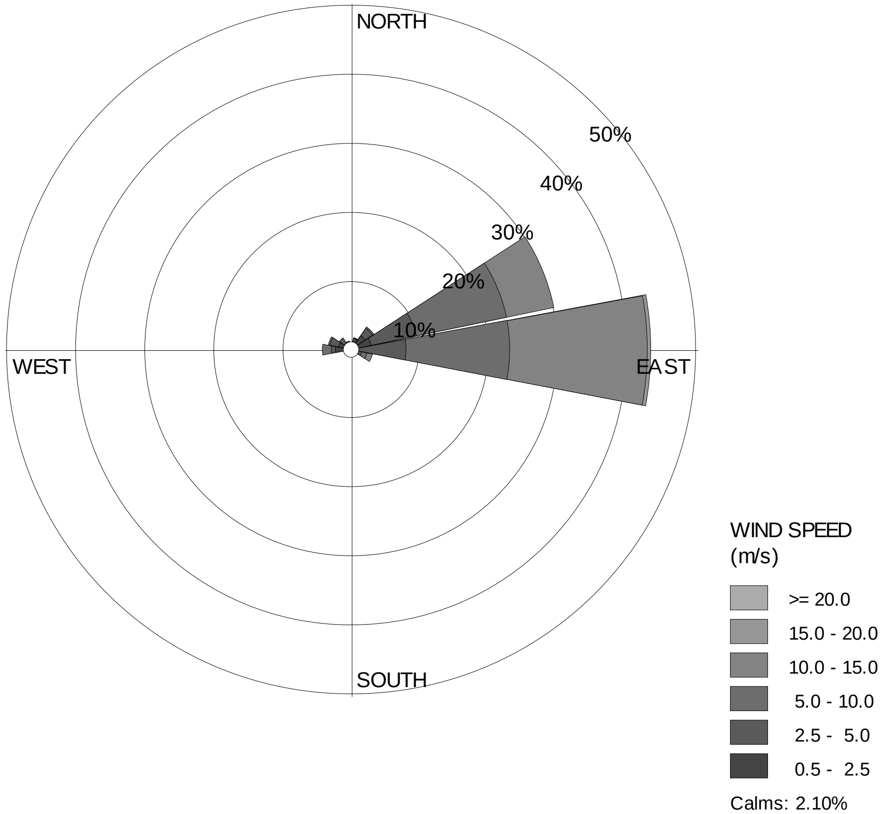


Figure A-3

Wind Rose, Mary Sachs Island
from Winter Noise Monitoring Station (S1L3)

Figure A-3 shows the wind rose gathered from the winter noise monitoring station at Mary Sachs Island. This location is intended to represent existing ambient noise conditions at island locations. The rose shows a dominant wind direction. The wind is from the East (E) and the East-by-Northeast (ENE) directions for a combined 73% of the hours. The hourly average wind speed exceeds 10 m/s for 28% of the hours, and only nominally exceeds 15 m/s less than 1% of the hours.

Detailed wind data are not available for the winter noise monitoring station at Brownlow Spit. The wind data that were collected are not able to be reduced in the same manner as the other sites.

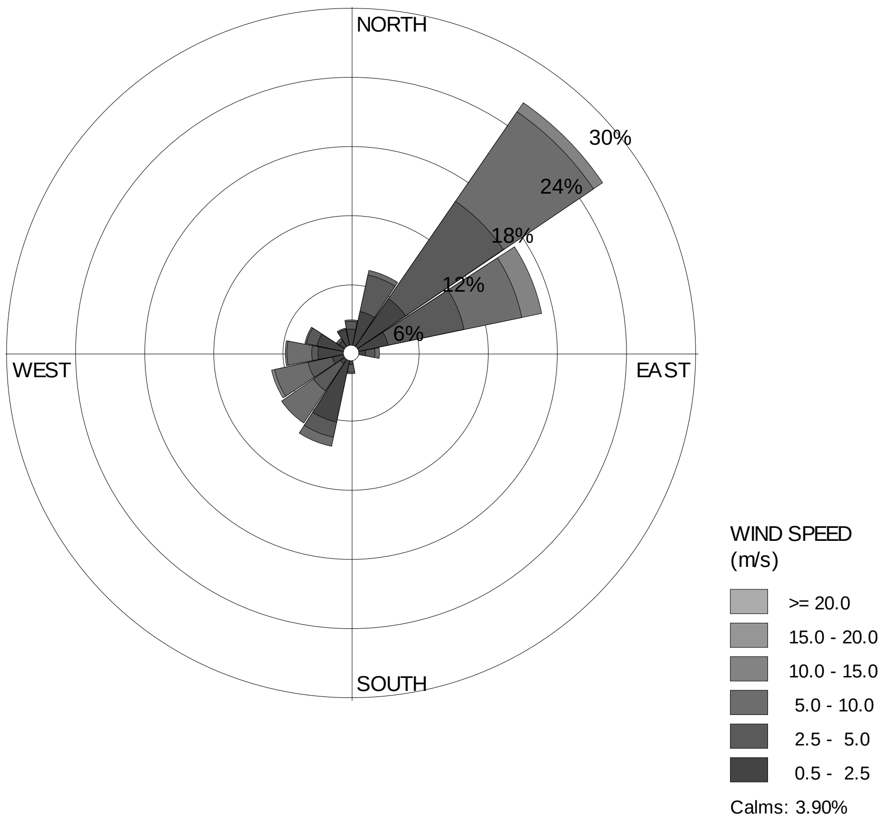


Figure A-4

Wind Rose, Canning River
from Summer Noise Monitoring Station (S2L1)

Figure A-4 shows the wind rose gathered from the summer noise monitoring station at the Canning River. This location is intended to represent existing ambient noise conditions at inland locations near surface water. The rose shows a dominant wind direction. The wind is from the Northeast (NE) and the East-by-Northeast (ENE) directions for a combined 43% of the hours. The hourly average wind speed exceeds 10 m/s for 3% of the hours, and does not exceed 15 m/s.

Figure A-5

Wind Rose, Coastal Plains
from Winter Noise Monitoring Station (S2L2)

Figure A-5 shows the wind rose gathered from the winter noise monitoring station at the Coastal Plains site. This location is intended to represent existing ambient noise conditions at upland coastal plains locations. The rose shows a dominant wind direction. The wind is from the Northeast (NE) and the North-by-Northeast (NNE) directions for a combined 45% of the hours. The hourly average wind speed does not exceed 10 m/s at this location.

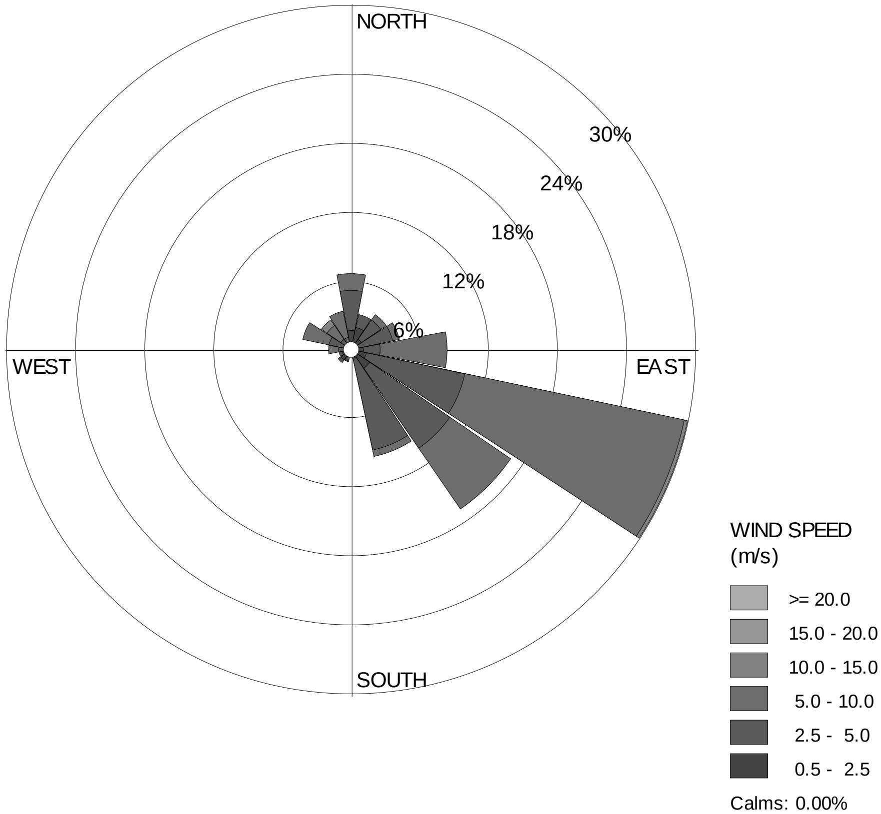


Figure A-6

Wind Rose, Sea Coast
from Winter Noise Monitoring Station (S2L3)

Figure A-6 shows the wind rose gathered from the winter noise monitoring station at the Sea Coast site. This location is intended to represent existing ambient noise conditions at coastal locations. The rose shows a dominant wind direction. The wind is from the Southeast (SE) and the East-by-Southeast (ESE) directions for a combined 47% of the hours. The hourly average wind speed only nominally exceeds 10 m/s less than 1% of the hours.

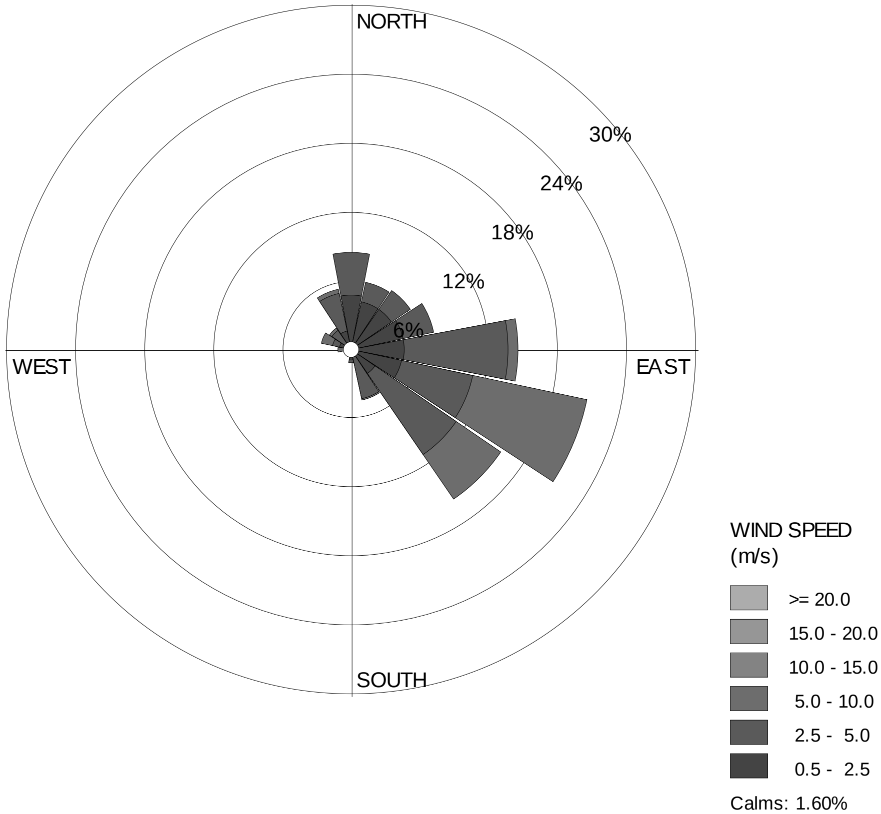


Figure A-7

Wind Rose, Flaxman Island
from Winter Noise Monitoring Station (S2L4)

Figure A-7 shows the wind rose gathered from the winter noise monitoring station at Flaxman Island. This location is intended to represent existing ambient noise conditions at island locations. The rose shows a dominant wind direction, although not as definitive as the other measurements. The wind is from the East-by-Southeast (ESE) direction for 21% of the hours, but winds from the East (E), East-by-Southeast (ESE) and Southeast (SE) directions occur a combined 78% of the hours. The hourly average wind speed does not exceed 10 m/s at this location.

Overall, there are similarities in results between the measurements. Wind speeds are similar at all four sites but differ between the winter monitoring period and the summer monitoring period. Wind directions are similar between the winter and summer monitoring periods, but differ between the sites near the coast and sites further inland.

The winds in the winter measurements reached much higher levels than the summer measurements. The hourly average wind speed exceeded 10 m/s for 33% of all the hours of wind data collected during the winter noise monitoring, and did not exceed 20 m/s in any hour. During the summer noise monitoring, the hourly average wind speed only nominally exceeded 10 m/s less than 1% of all the hours.

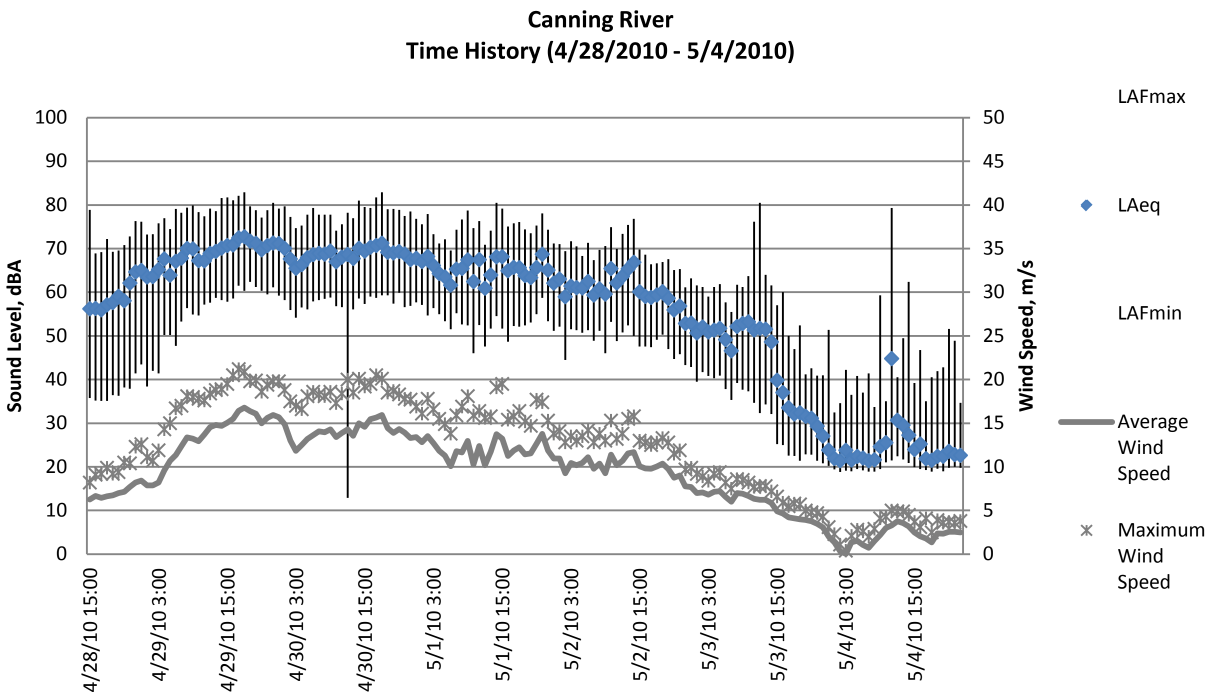
The dominant wind directions were similar across the winter and summer monitoring periods for the Coastal Plains and Canning River sites. The hourly average wind direction in these four measurements combined was 32% of the hours from the East-by-Northeast (ENE). For 61% of the hours the wind direction spanned from the Northeast (NE) to the East (E), including East-by-Northeast (ENE) direction.

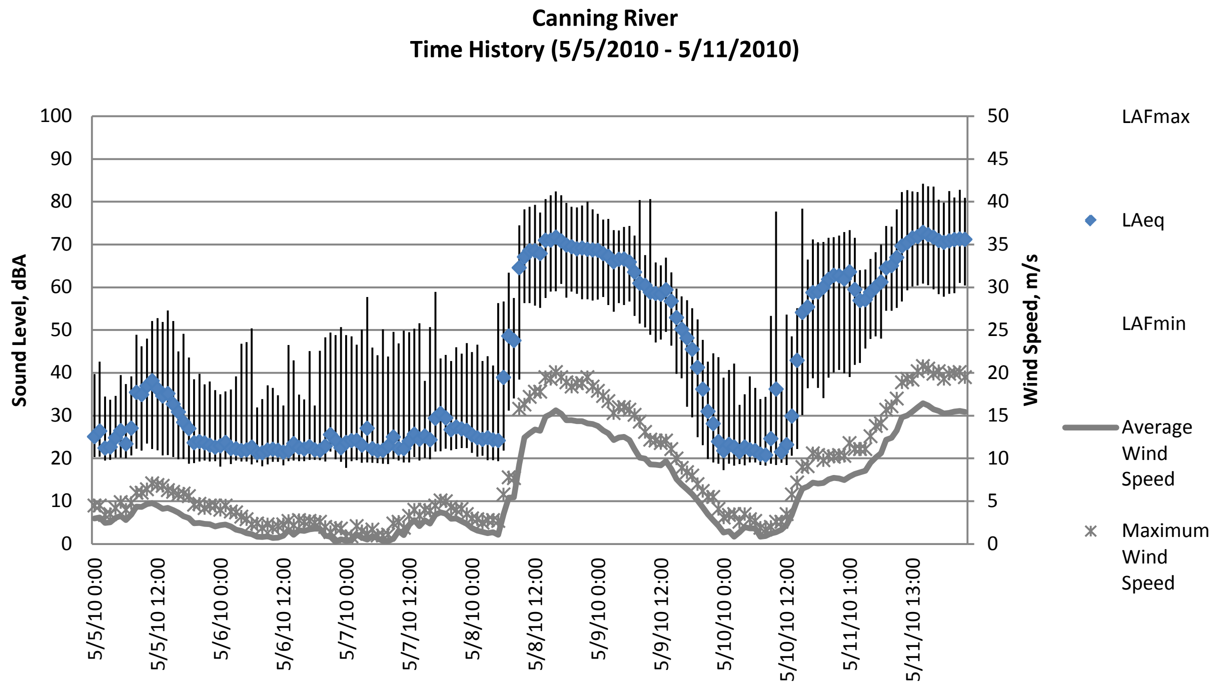
Likewise, dominant wind directions were similar across the winter and summer monitoring periods for the coastal and island sites. The similarity between the summertime Sea Coast and Flaxman Island sites is stronger than the similarity of the winter Mary Sachs Island site to either of the other coastal summer sites. The hourly average wind direction in these three measurements combined was 22% of the hours from the East (E). For 54% of the hours the wind direction spanned from the East-by-Northeast (ENE) Northeast (NE) to the East-by-Southeast (ESE), including the East (E).

Appendix B:

Time Histories of Wind and Sound Measurements

The following series of graphs presents the time histories of measured sound levels and wind speeds at each monitoring location. Each graph represents one week of raw measurement data (the data was not filtered for high wind speeds). In general, the graphs show good correlation between measured wind speeds and noise levels. These graphs are presented for informational purposes only; they do not represent the subset of the data that was used in the analyses discussed earlier in this document.




Canning River
Time History (5/5/2010 - 5/11/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/5/10 0:00
5/5/10 12:00
5/6/10 0:00
5/6/10 12:00
5/7/10 0:00
5/7/10 12:00
5/8/10 0:00
5/8/10 12:00
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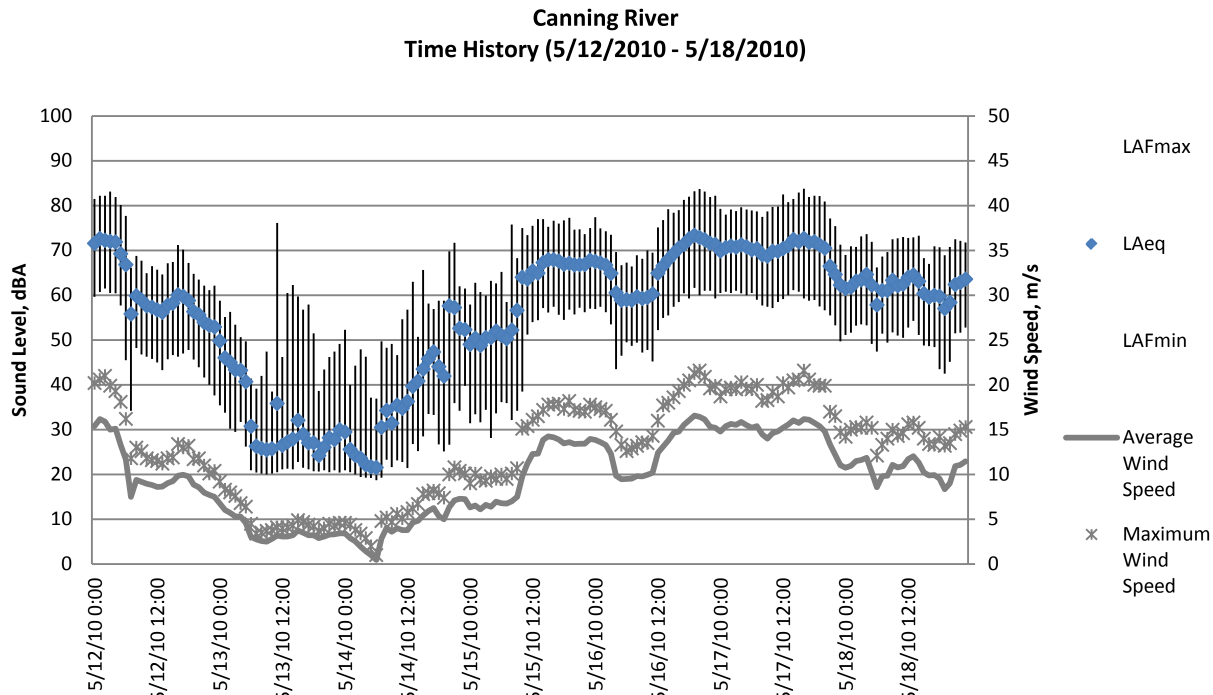
5/11/10 13:00


Canning River
Time History (5/12/2010 - 5/18/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/12/10 0:00
5/12/10 12:00
5/13/10 0:00
5/13/10 12:00
5/14/10 0:00
5/14/10 12:00
5/15/10 0:00
5/15/10 12:00
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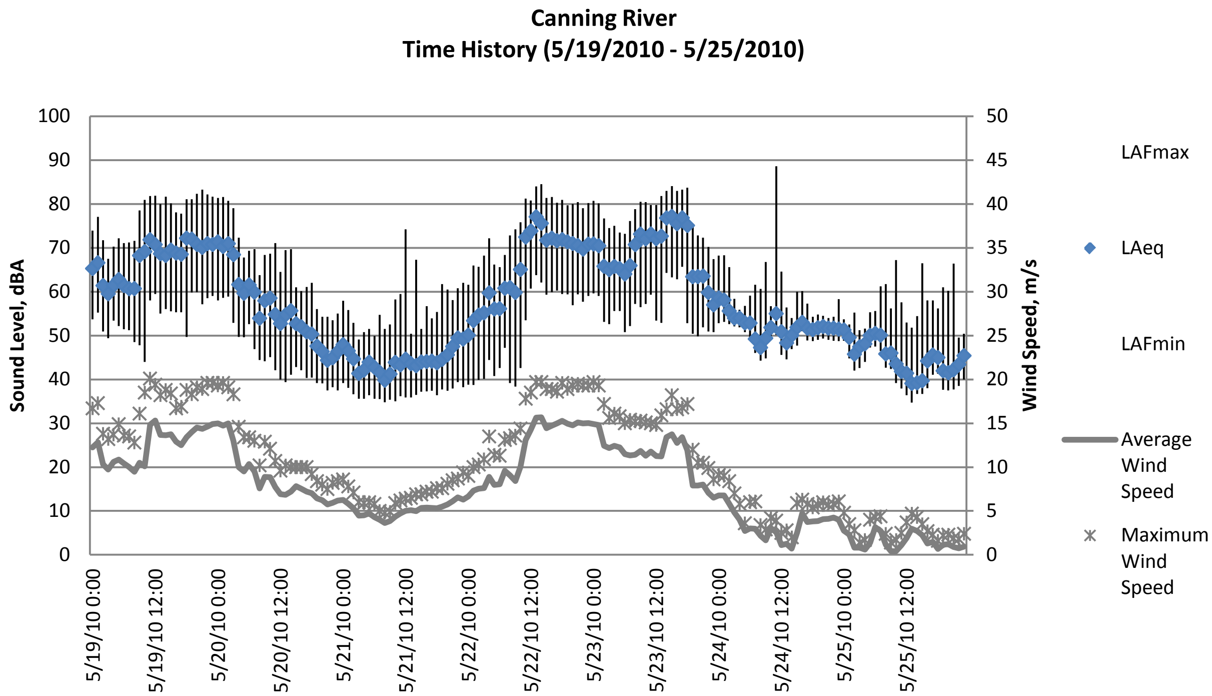
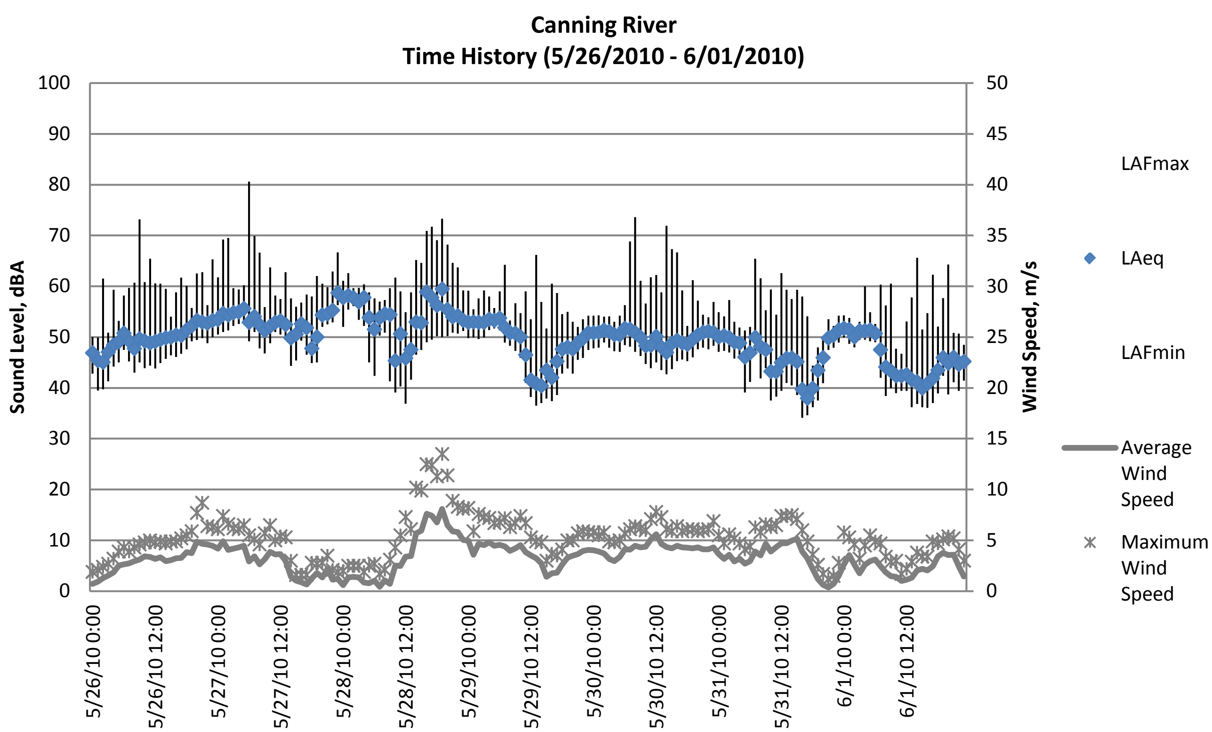
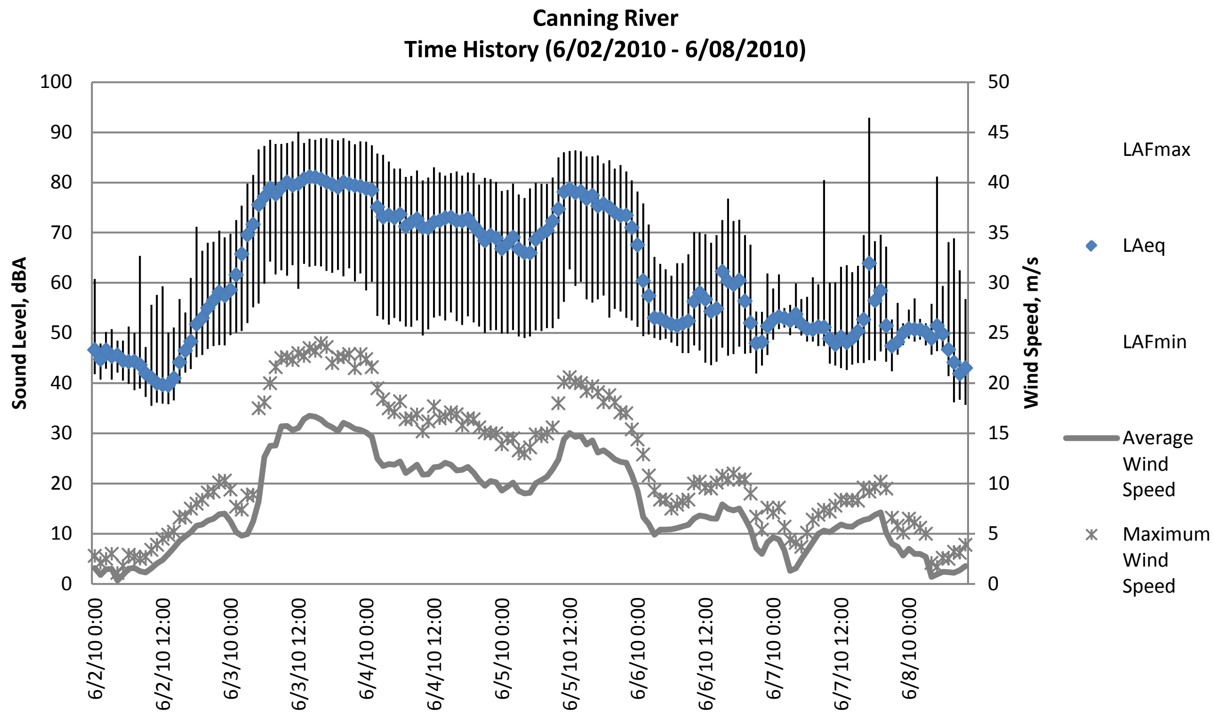
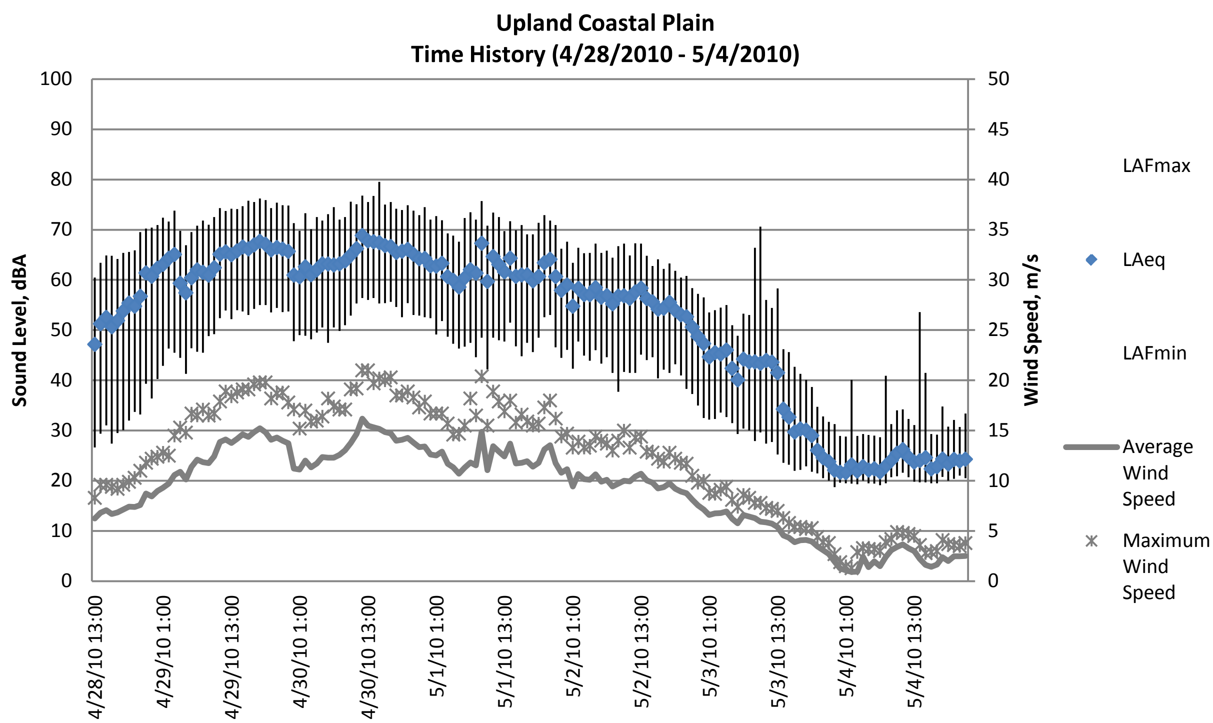
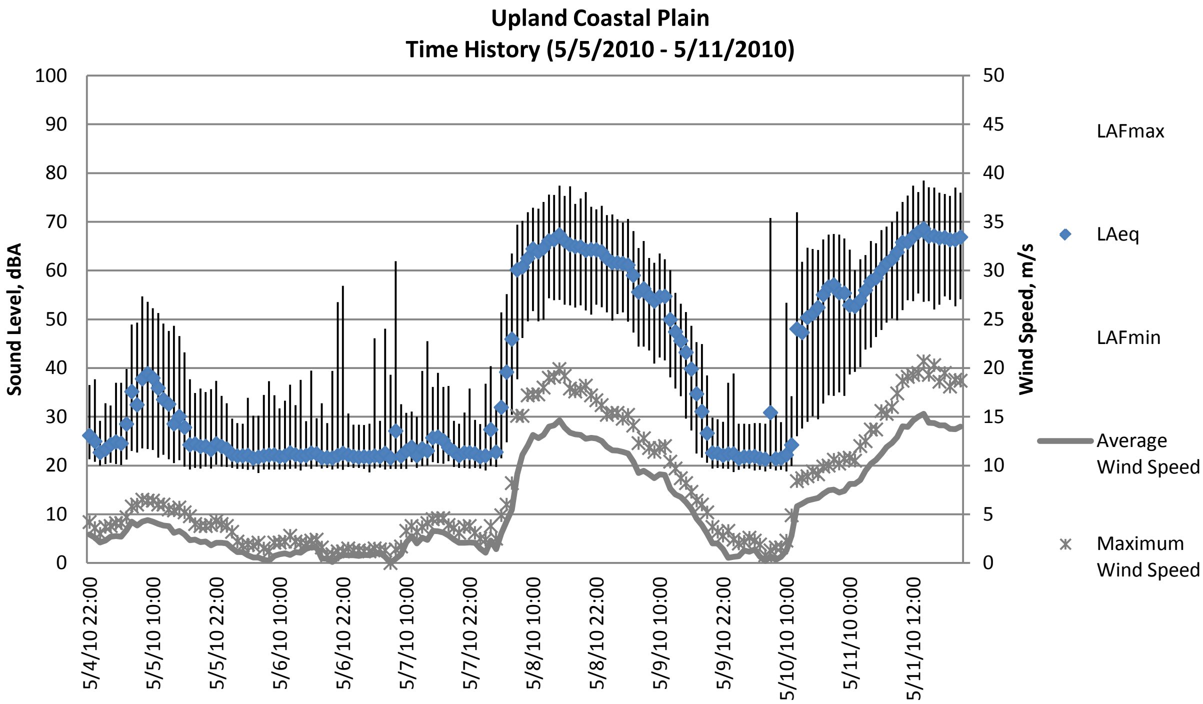
5/18/10 12:00


Canning River
Time History (5/19/2010 - 5/25/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
5/19/10 0:00
5/19/10 12:00
5/20/10 0:00
5/20/10 12:00
5/21/10 0:00
5/21/10 12:00
5/22/10 0:00
5/22/10 12:00
5/23/10 0:00
5/23/10 12:00
5/24/10 0:00
5/24/10 12:00
5/25/10 0:00
5/25/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Canning River
Time History (5/26/2010 - 6/01/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
5/26/10 0:00
5/26/10 12:00
5/27/10 0:00
5/27/10 12:00
5/28/10 0:00
5/28/10 12:00
5/29/10 0:00
5/29/10 12:00
5/30/10 0:00
5/30/10 12:00
5/31/10 0:00
5/31/10 12:00
6/1/10 0:00
6/1/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Canning River
Time History (6/02/2010 - 6/08/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
6/2/10 0:00
6/2/10 12:00
6/3/10 0:00
6/3/10 12:00
6/4/10 0:00
6/4/10 12:00
6/5/10 0:00
6/5/10 12:00
6/6/10 0:00
6/6/10 12:00
6/7/10 0:00
6/7/10 12:00
6/8/10 0:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Upland Coastal Plain
Time History (4/28/2010 - 5/4/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
4/28/10 13:00
4/29/10 1:00
4/29/10 13:00
4/30/10 1:00
4/30/10 13:00
5/1/10 1:00
5/1/10 13:00
5/2/10 1:00
5/2/10 13:00
5/3/10 1:00
5/3/10 13:00
5/4/10 1:00
5/4/10 13:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Upland Coastal Plain
Time History (5/5/2010 - 5/11/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/4/10 22:00
5/5/10 10:00
5/5/10 22:00
5/6/10 10:00
5/6/10 22:00
5/7/10 10:00
5/7/10 22:00
5/8/10 10:00
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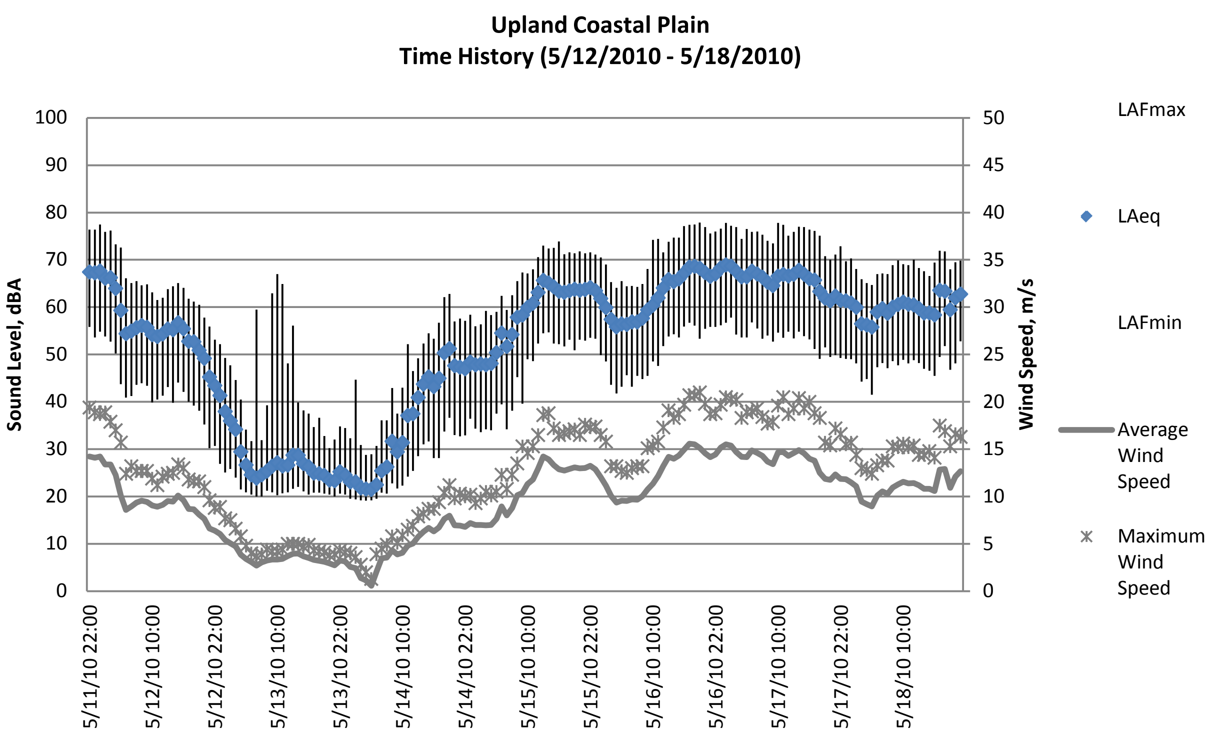
5/11/10 12:00


Upland Coastal Plain
Time History (5/12/2010 - 5/18/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/11/10 22:00
5/12/10 10:00
5/12/10 22:00
5/13/10 10:00
5/13/10 22:00
5/14/10 10:00
5/14/10 22:00
5/15/10 10:00
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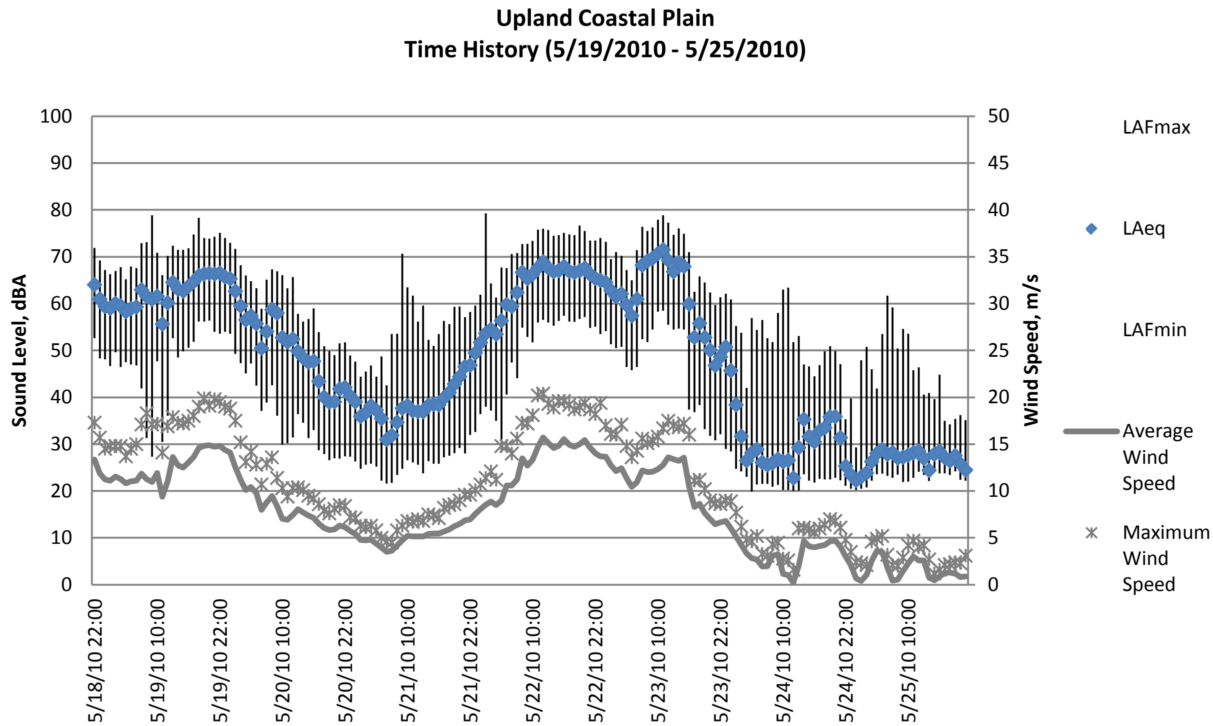
5/18/10 10:00


Upland Coastal Plain
Time History (5/19/2010 - 5/25/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
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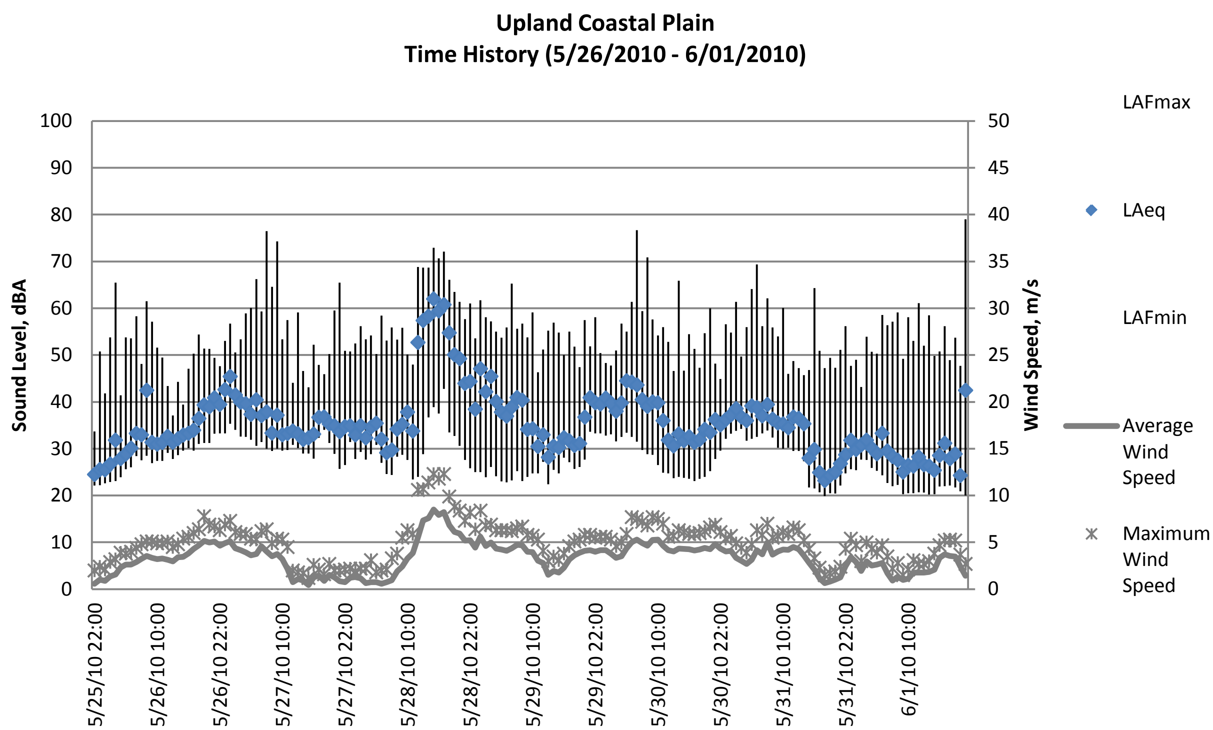
5/18/10 22:00
5/19/10 10:00
5/19/10 22:00
5/20/10 10:00
5/20/10 22:00
5/21/10 10:00
5/21/10 22:00
5/22/10 10:00
5/22/10 22:00
5/23/10 10:00
5/23/10 22:00
5/24/10 10:00
5/24/10 22:00
5/25/10 10:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Upland Coastal Plain
Time History (5/26/2010 - 6/01/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
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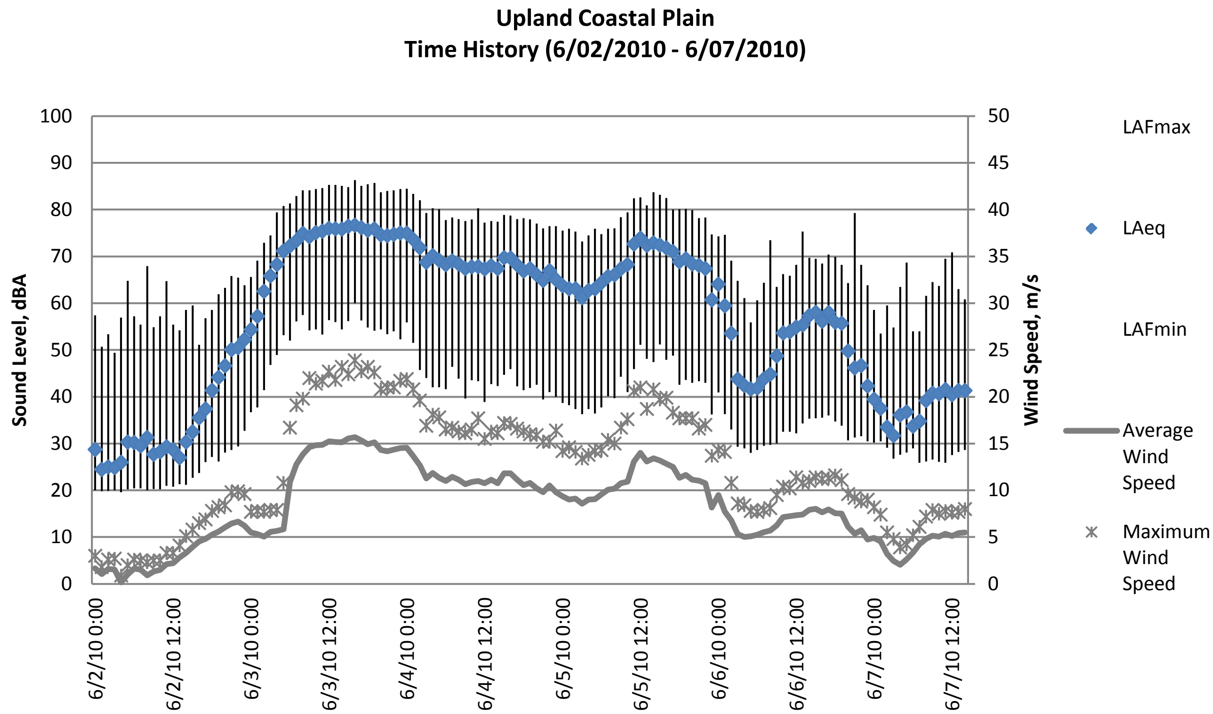
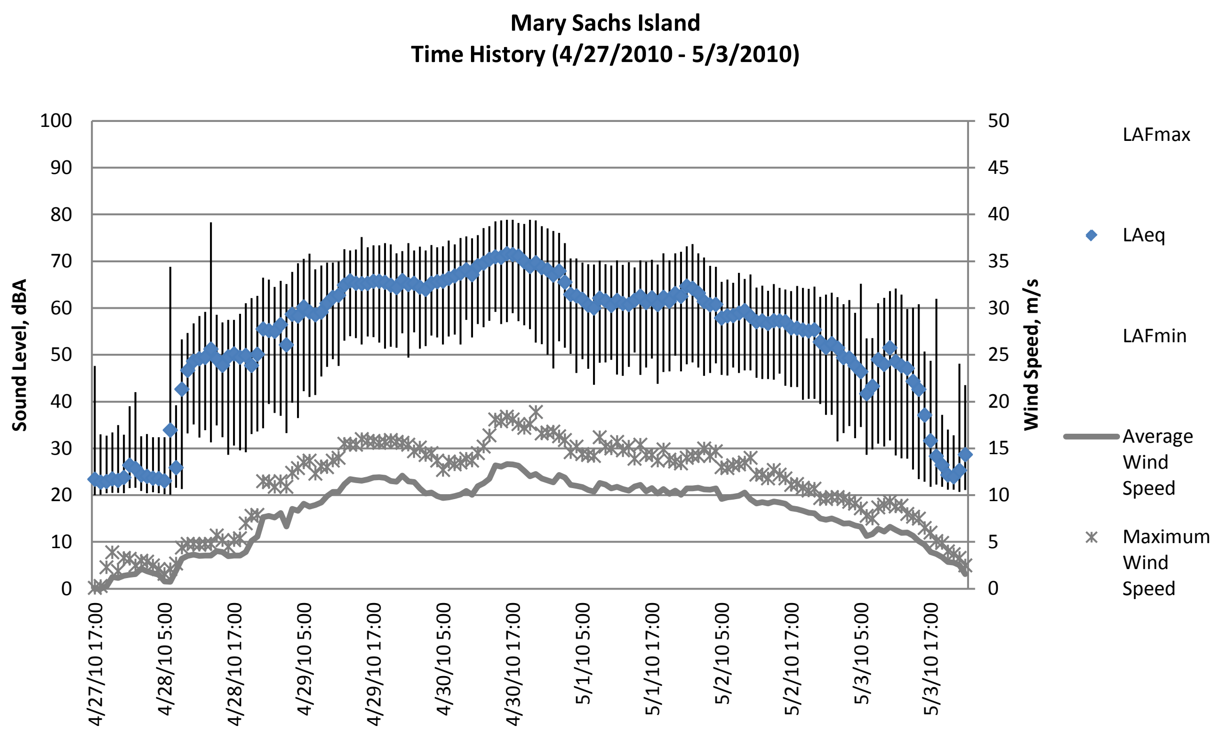
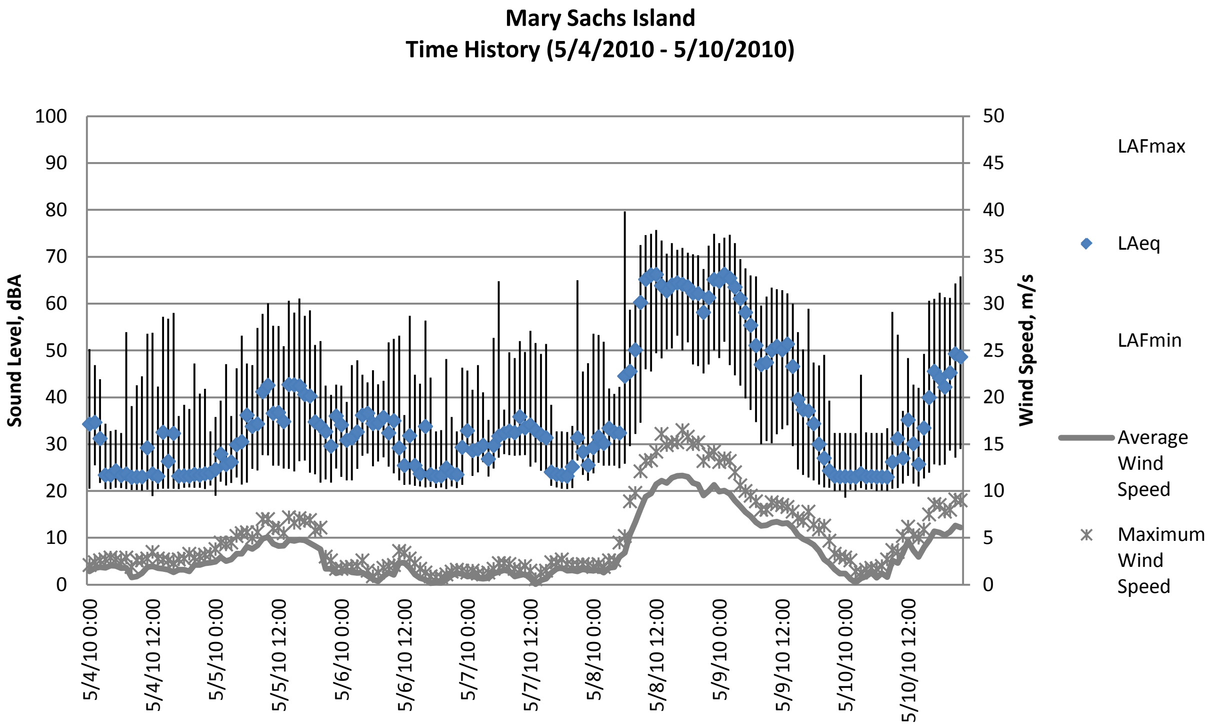
5
0
5/25/10 22:00
5/26/10 10:00
5/26/10 22:00
5/27/10 10:00
5/27/10 22:00
5/28/10 10:00
5/28/10 22:00
5/29/10 10:00
5/29/10 22:00
5/30/10 10:00
5/30/10 22:00
5/31/10 10:00
5/31/10 22:00
6/1/10 10:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Upland Coastal Plain
Time History (6/02/2010 - 6/07/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
6/2/10 0:00
6/2/10 12:00
6/3/10 0:00
6/3/10 12:00
6/4/10 0:00
6/4/10 12:00
6/5/10 0:00
6/5/10 12:00
6/6/10 0:00
6/6/10 12:00
6/7/10 0:00
6/7/10 12:00


Mary Sachs Island
Time History (4/27/2010 - 5/3/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
4/27/10 17:00
4/28/10 5:00
4/28/10 17:00
4/29/10 5:00
4/29/10 17:00
4/30/10 5:00
4/30/10 17:00
5/1/10 5:00
5/1/10 17:00
5/2/10 5:00
5/2/10 17:00
5/3/10 5:00
5/3/10 17:00


Mary Sachs Island
Time History (5/4/2010 - 5/10/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
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40
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0
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25
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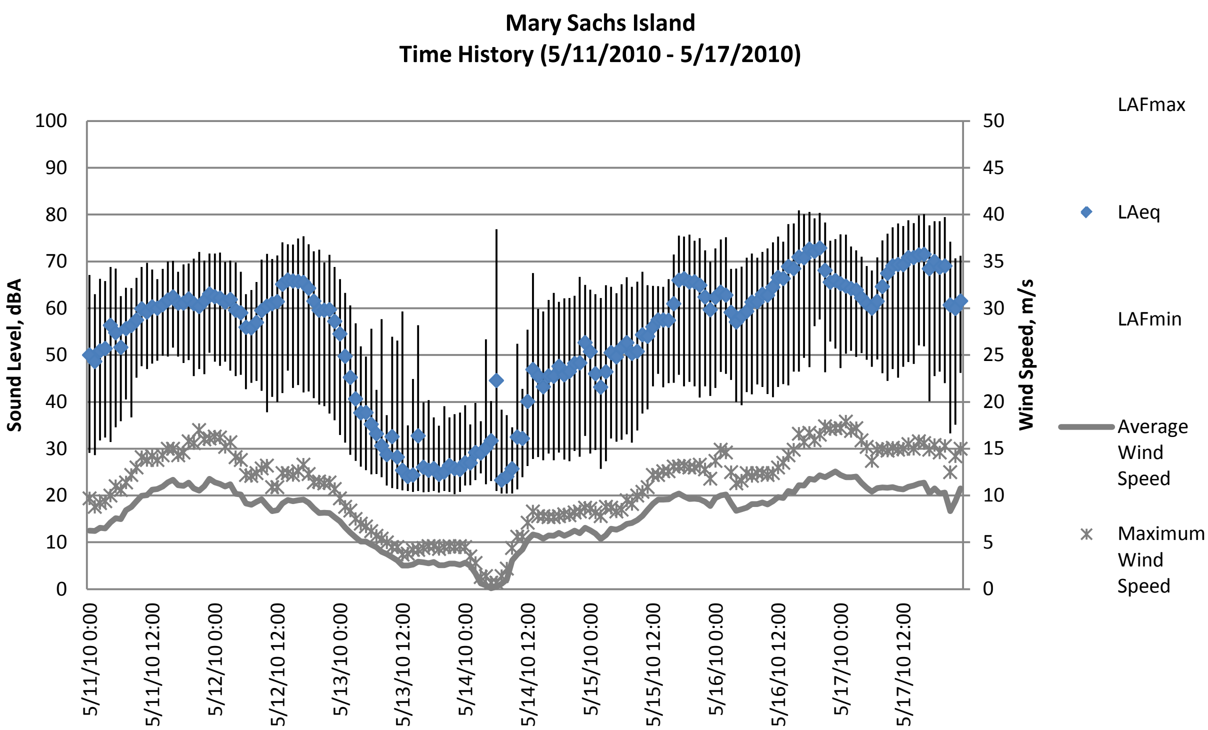
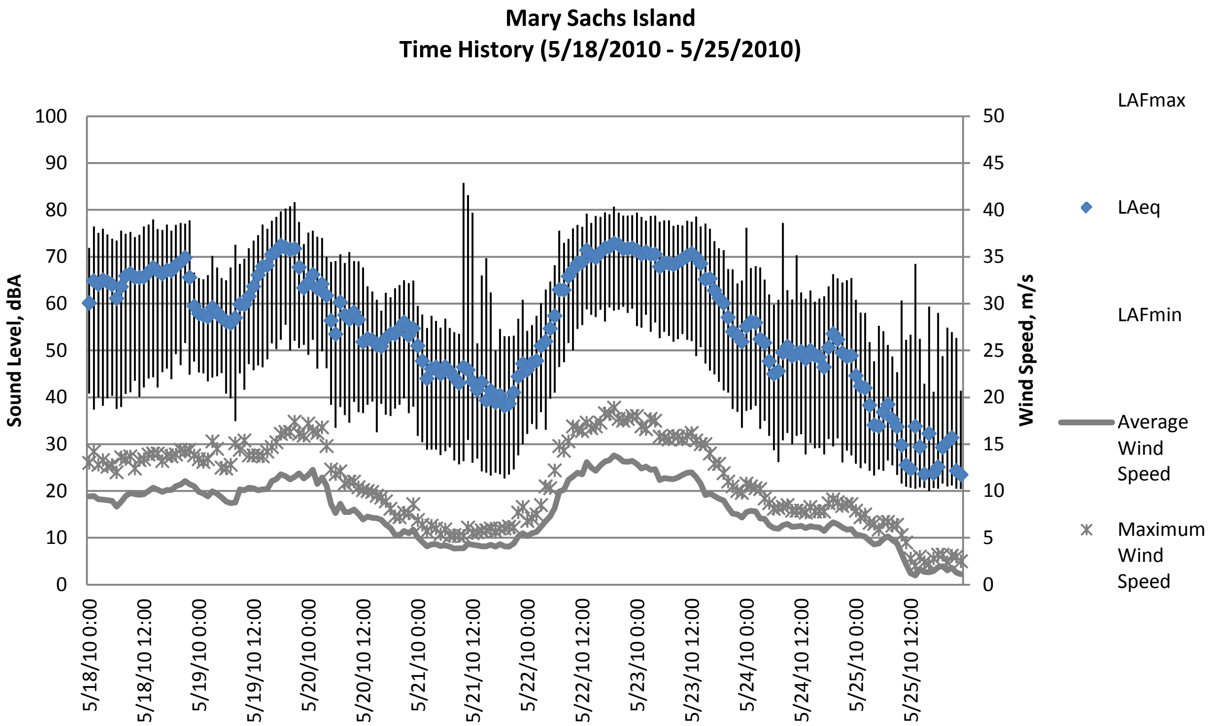
5/4/10 0:00
5/4/10 12:00
5/5/10 0:00
5/5/10 12:00
5/6/10 0:00
5/6/10 12:00
5/7/10 0:00
5/7/10 12:00
5/8/10 0:00
5/8/10 12:00
5/9/10 0:00
5/9/10 12:00
5/10/10 0:00
5/10/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Mary Sachs Island
Time History (5/11/2010 - 5/17/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
5/11/10 0:00
5/11/10 12:00
5/12/10 0:00
5/12/10 12:00
5/13/10 0:00
5/13/10 12:00
5/14/10 0:00
5/14/10 12:00
5/15/10 0:00
5/15/10 12:00
5/16/10 0:00
5/16/10 12:00
5/17/10 0:00
5/17/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Mary Sachs Island
Time History (5/18/2010 - 5/25/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
5/18/10 0:00
5/18/10 12:00
5/19/10 0:00
5/19/10 12:00
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5/24/10 0:00
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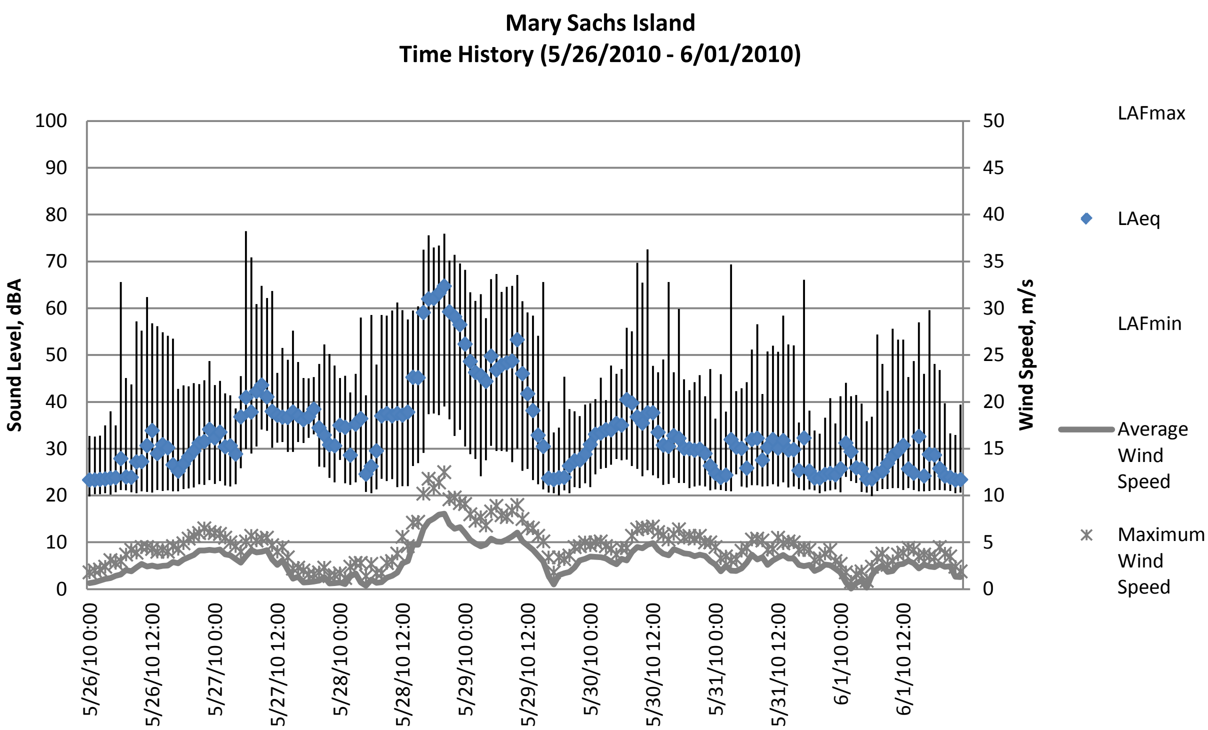
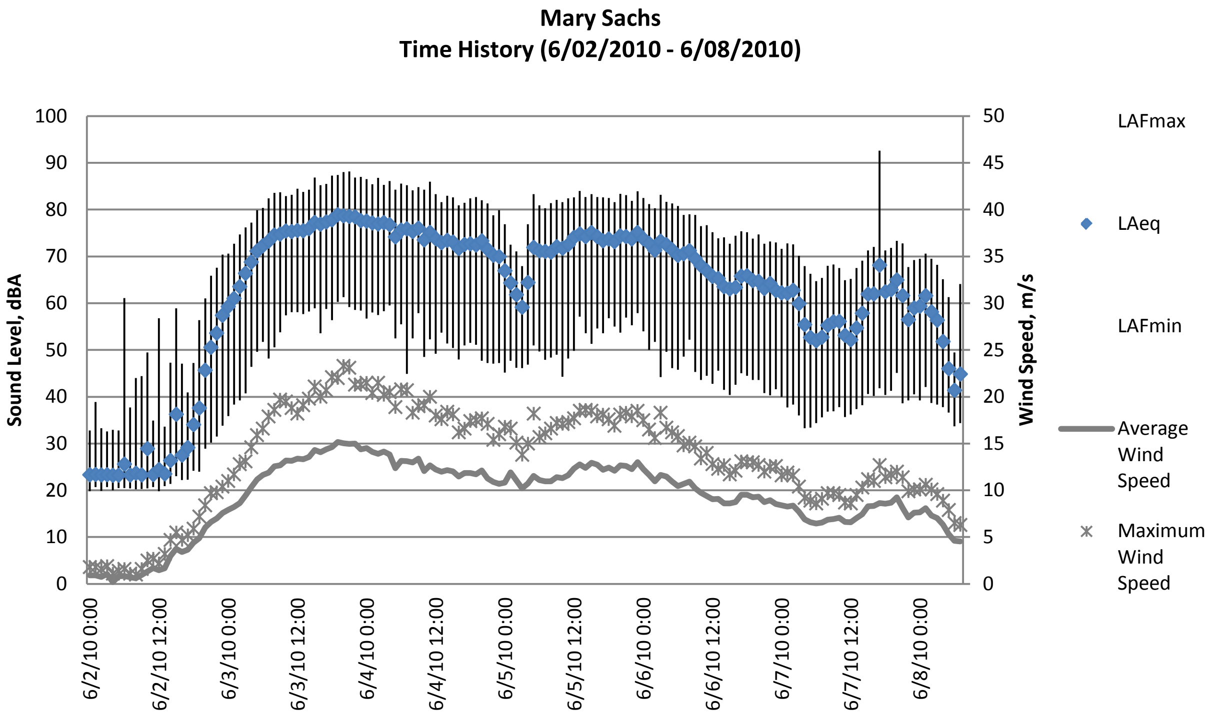
5/25/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Mary Sachs Island
Time History (5/26/2010 - 6/01/2010)
Sound Level, dBA
Wind Speed, m/s
100
90
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
5/26/10 0:00
5/26/10 12:00
5/27/10 0:00
5/27/10 12:00
5/28/10 0:00
5/28/10 12:00
5/29/10 0:00
5/29/10 12:00
5/30/10 0:00
5/30/10 12:00
5/31/10 0:00
5/31/10 12:00
6/1/10 0:00
6/1/10 12:00
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed


Mary Sachs
Time History (6/02/2010 - 6/08/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
6/2/10 0:00
6/2/10 12:00
6/3/10 0:00
6/3/10 12:00
6/4/10 0:00
6/4/10 12:00
6/5/10 0:00
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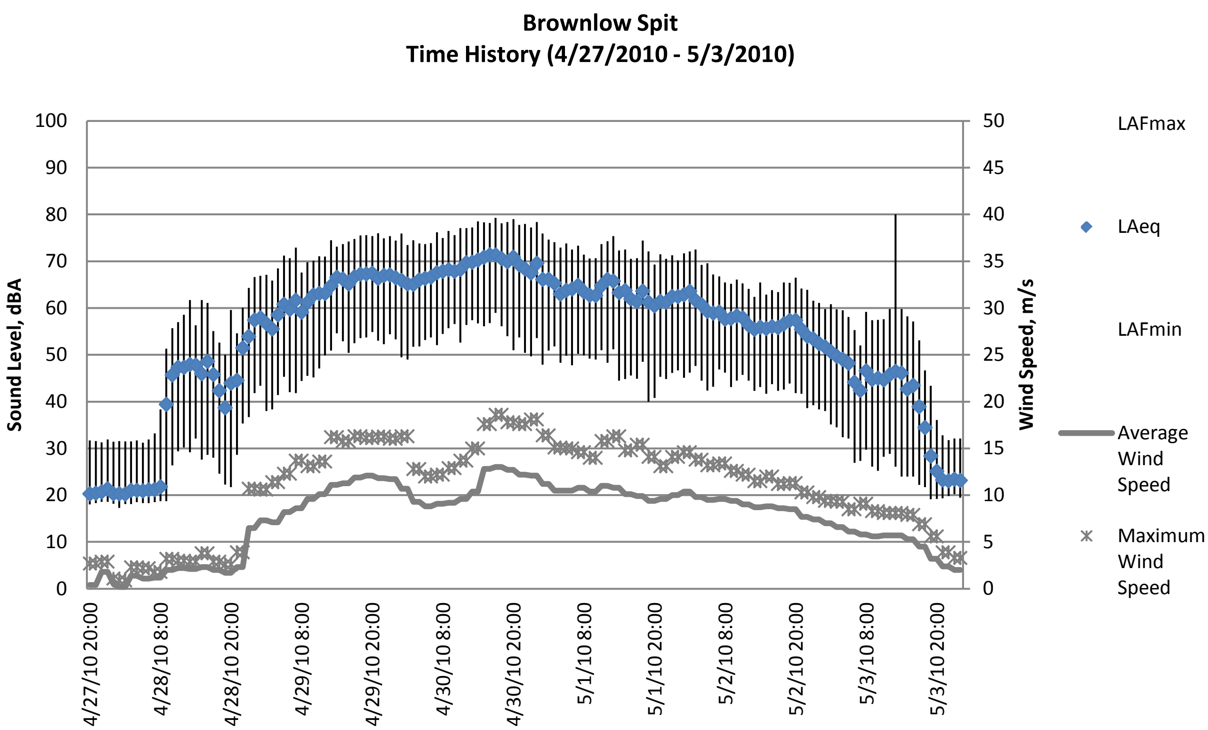
6/8/10 0:00


Brownlow Spit
Time History (4/27/2010 - 5/3/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
4/27/10 20:00
4/28/10 8:00
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4/29/10 8:00
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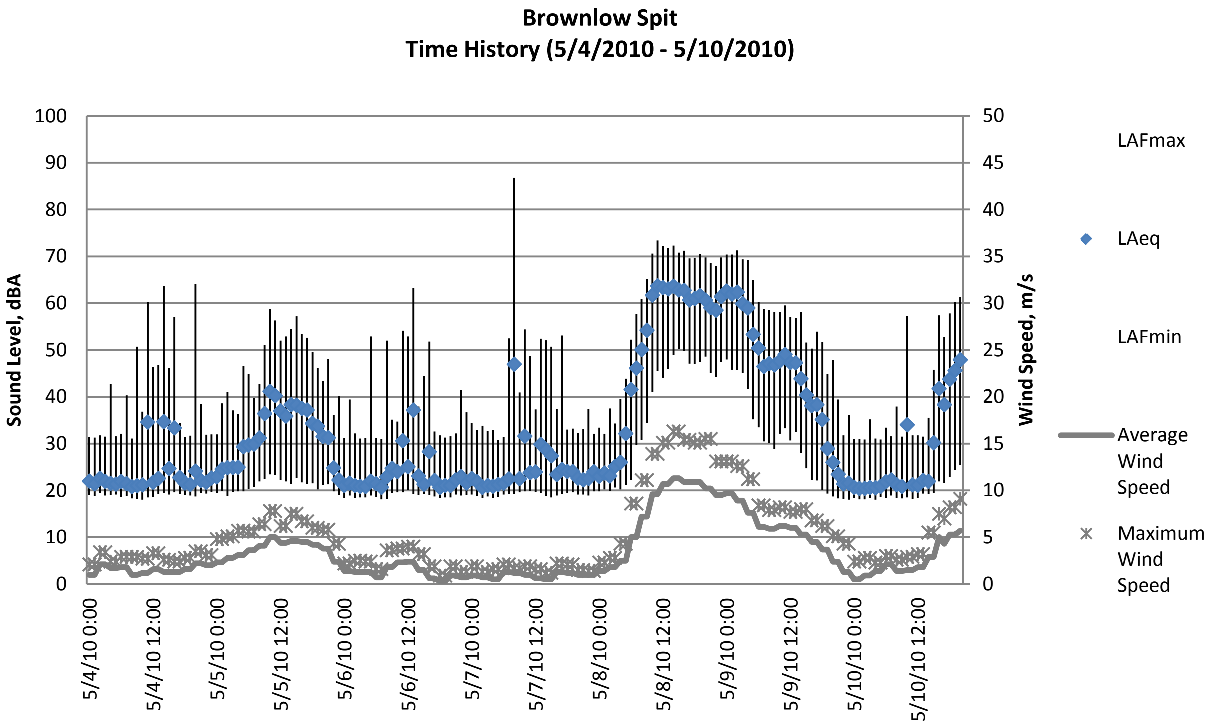
5/3/10 20:00


Brownlow Spit
Time History (5/4/2010 - 5/10/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/4/10 0:00
5/4/10 12:00
5/5/10 0:00
5/5/10 12:00
5/6/10 0:00
5/6/10 12:00
5/7/10 0:00
5/7/10 12:00
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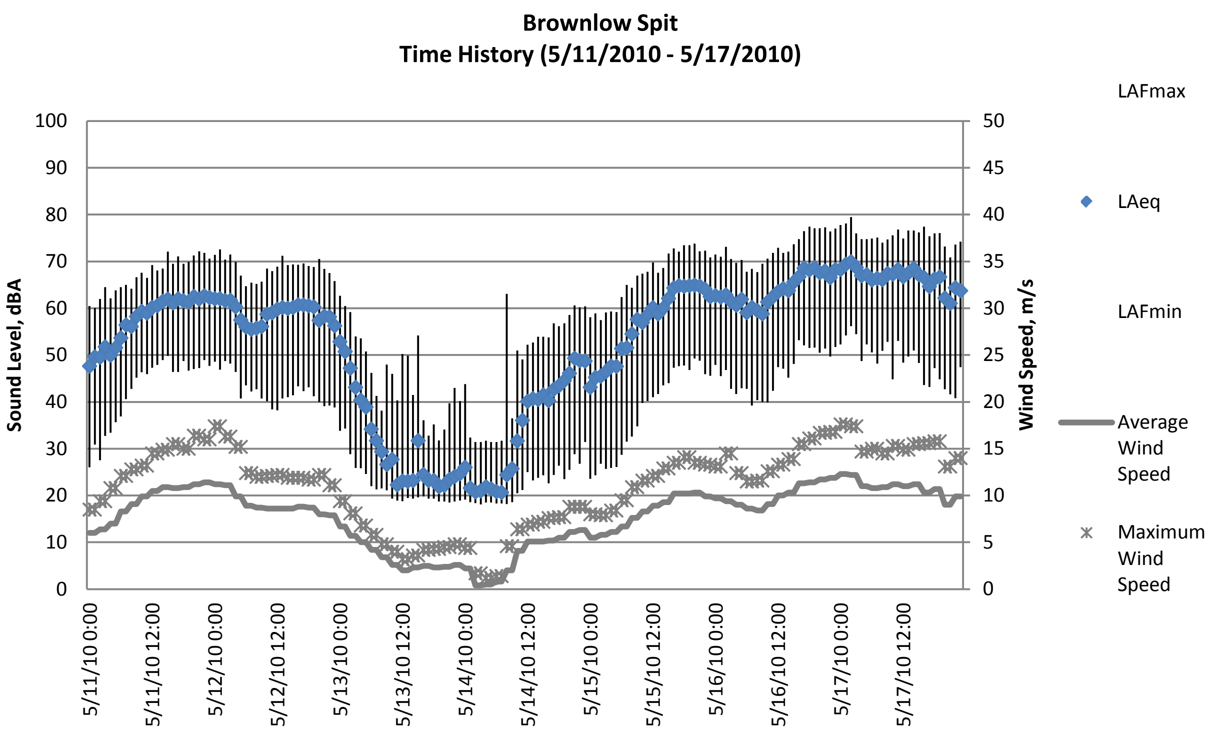
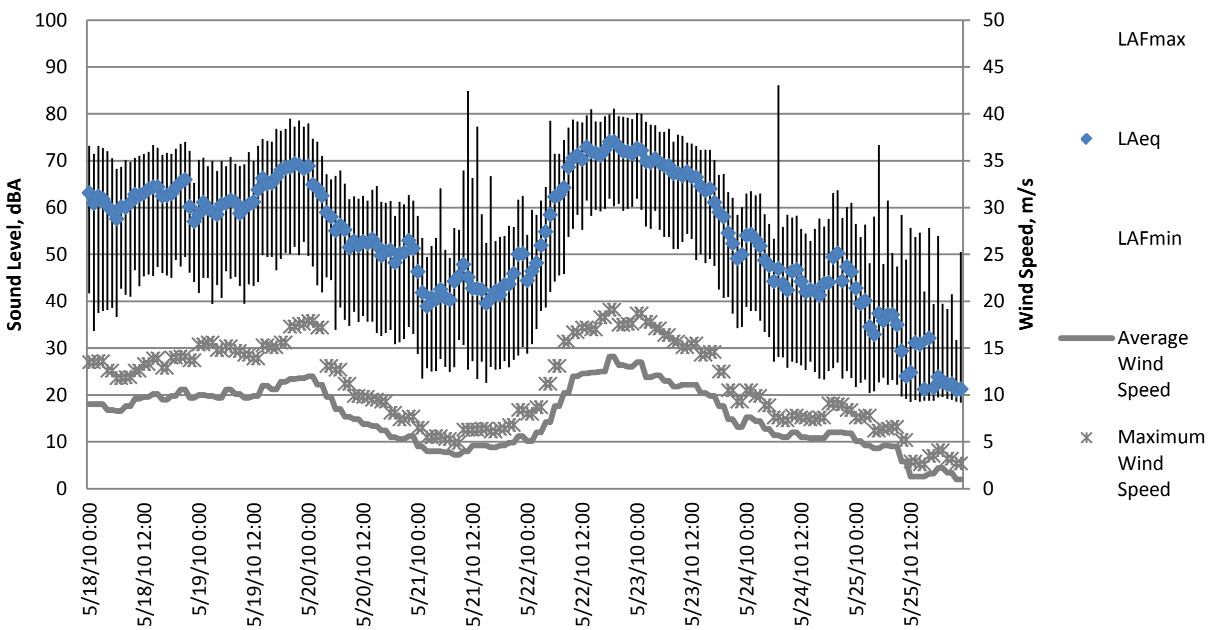
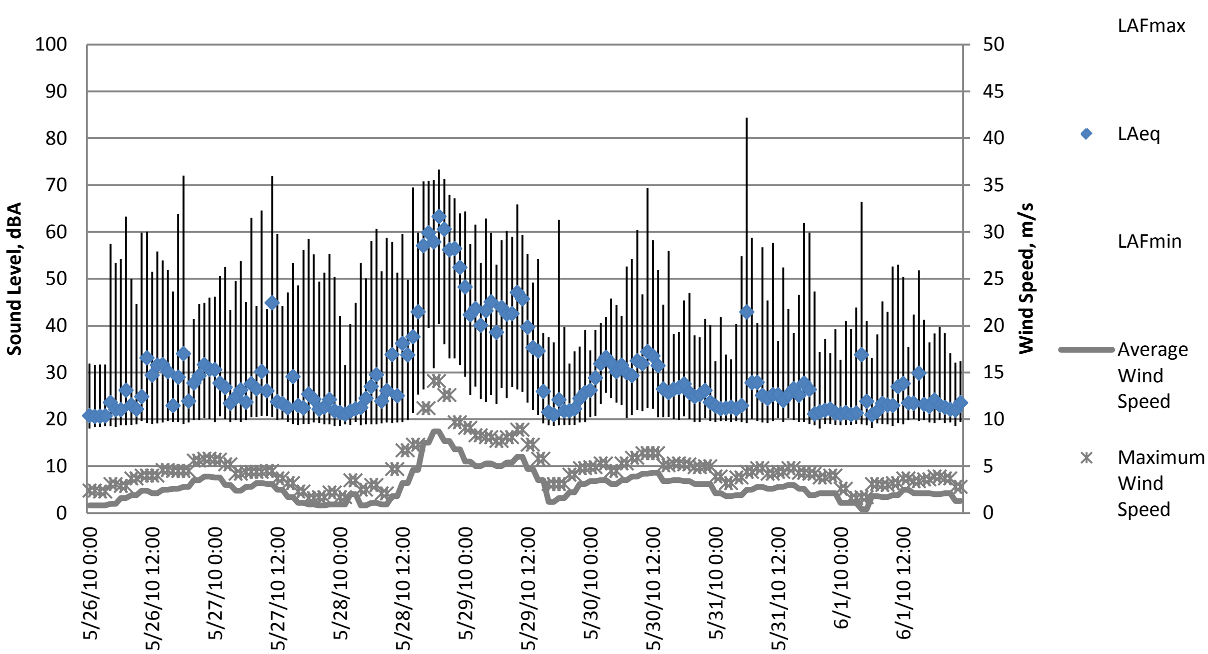
5/10/10 0:00
5/10/10 12:00

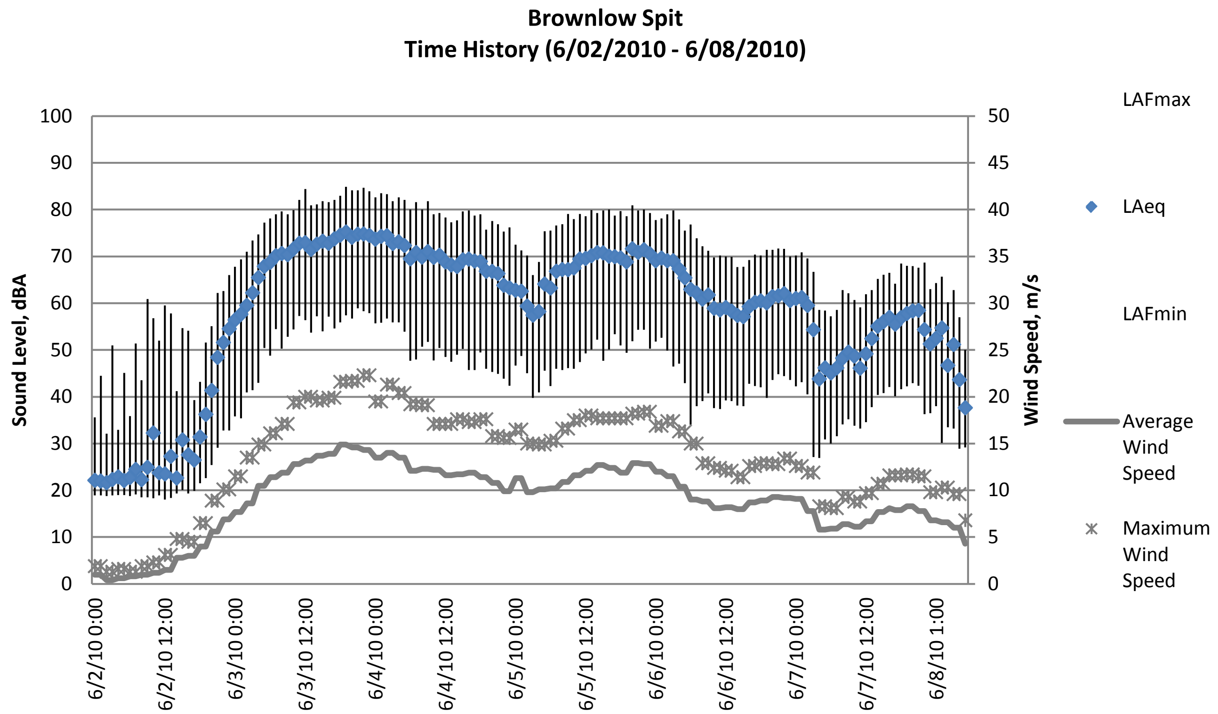

Brownlow Spit
Time History (5/11/2010 - 5/17/2010)
Sound Level, dBA
Wind Speed, m/s
LAFmax
LAeq
LAFmin
Average Wind Speed
Maximum Wind Speed
5/11/10 0:00
5/11/10 12:00
5/12/10 0:00
5/12/10 12:00
5/13/10 0:00
5/13/10 12:00
5/14/10 0:00
5/14/10 12:00
5/15/10 0:00
5/15/10 12:00
5/16/10 0:00
5/16/10 12:00
5/17/10 0:00
5/17/10 12:00

Brownlow Spit
Time History (5/18/2010 - 5/25/2010)



Brownlow Spit
Time History (5/26/2010 - 6/01/2010)

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Wind Speed, m/s
LAFmax
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Average Wind Speed
Maximum Wind Speed
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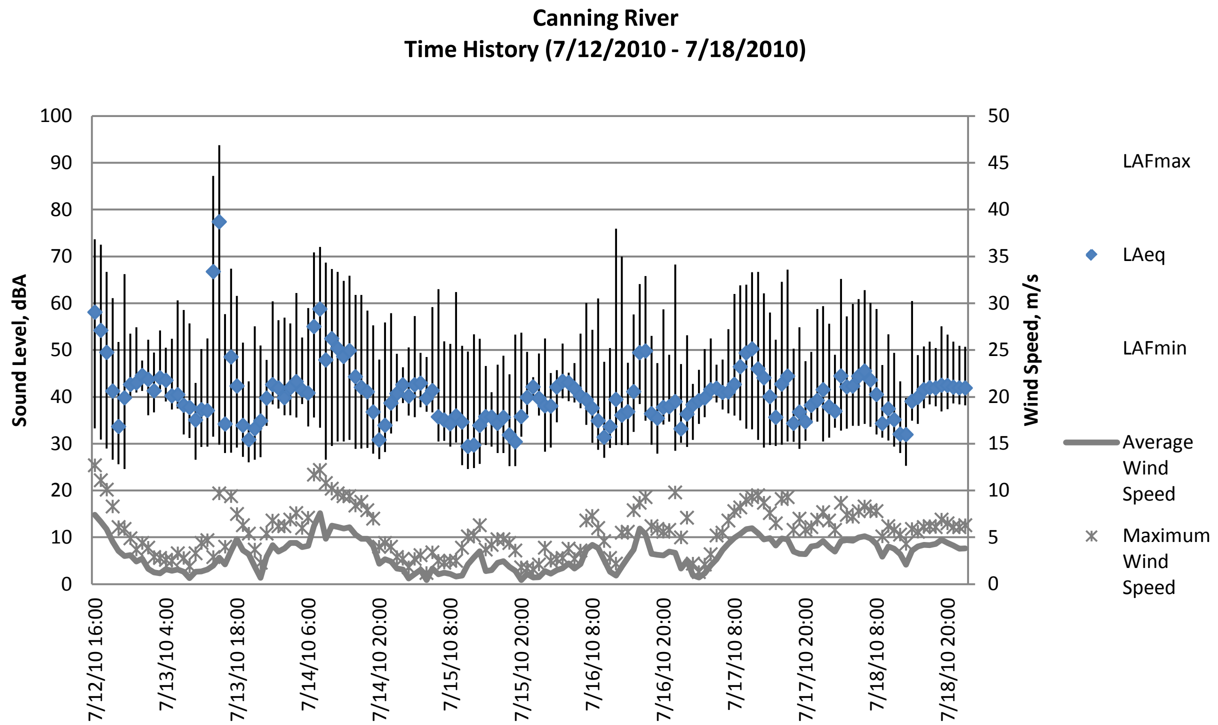
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Canning River
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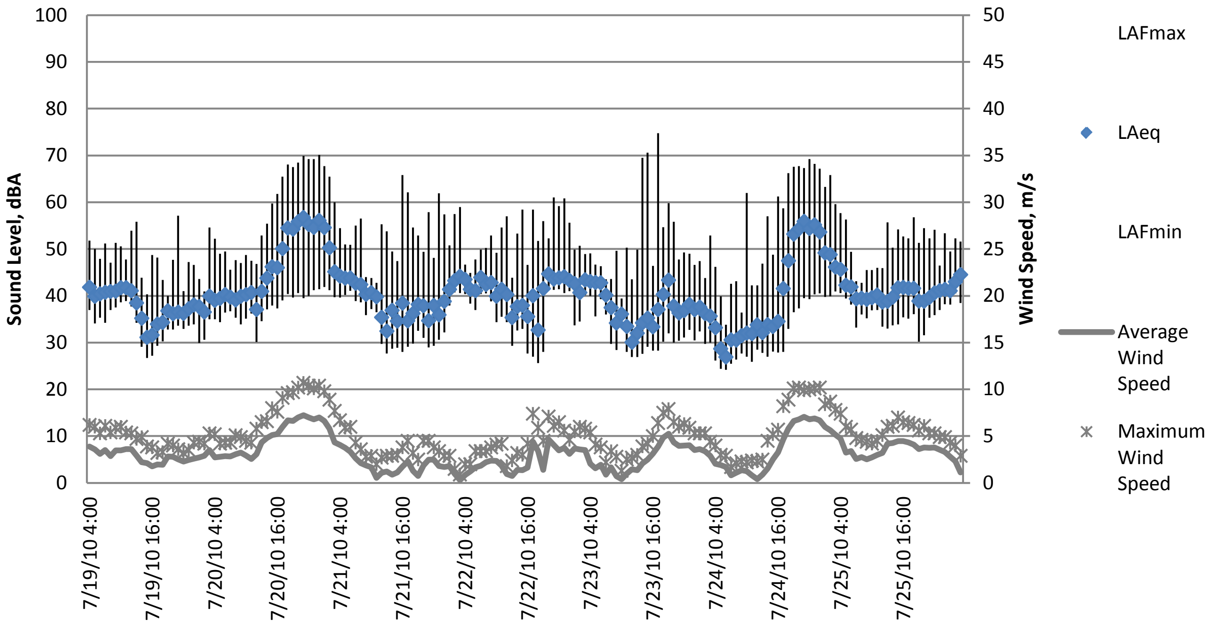

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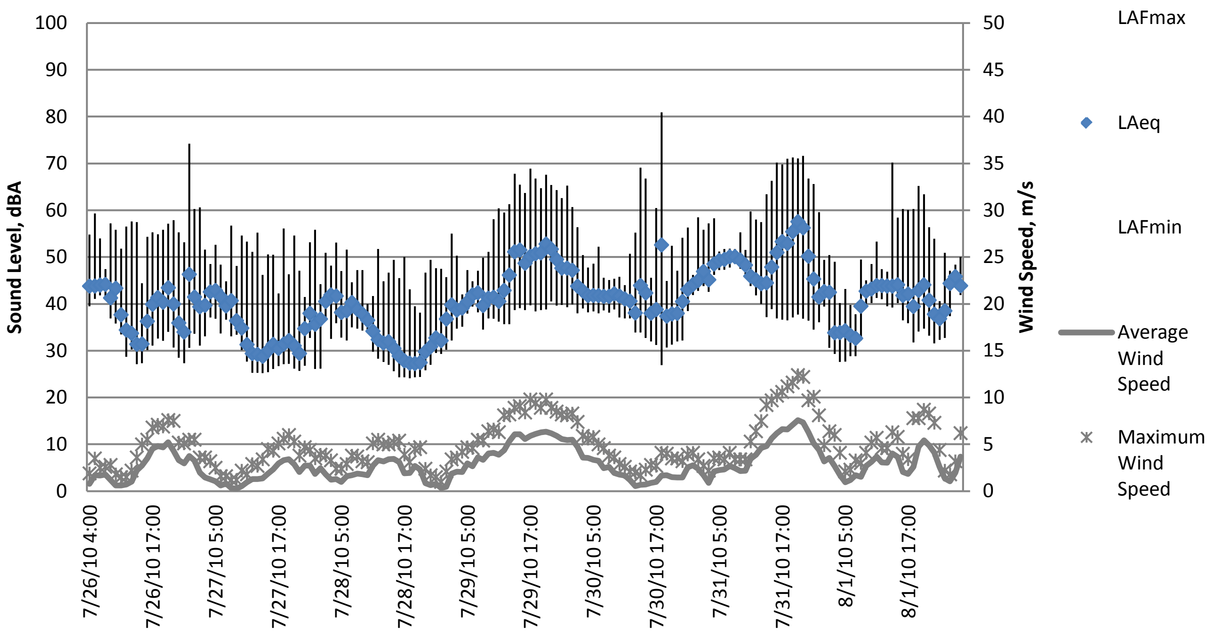

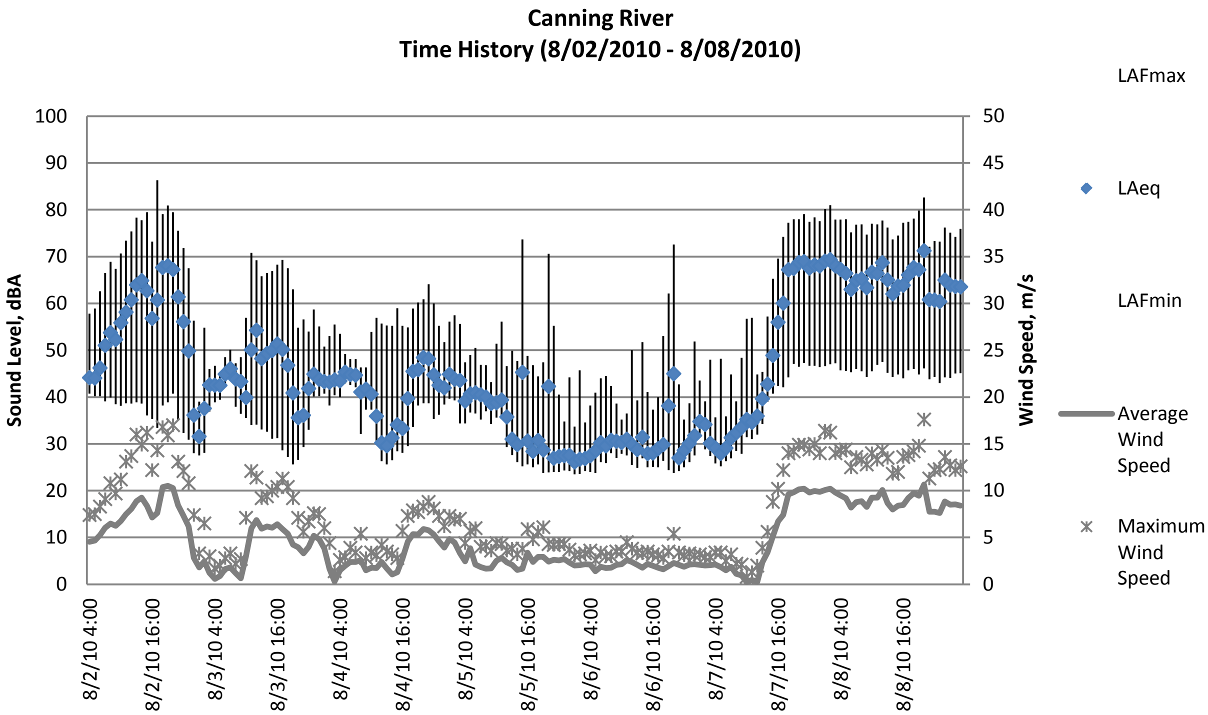
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Sound Level, dBA
Wind Speed, m/s
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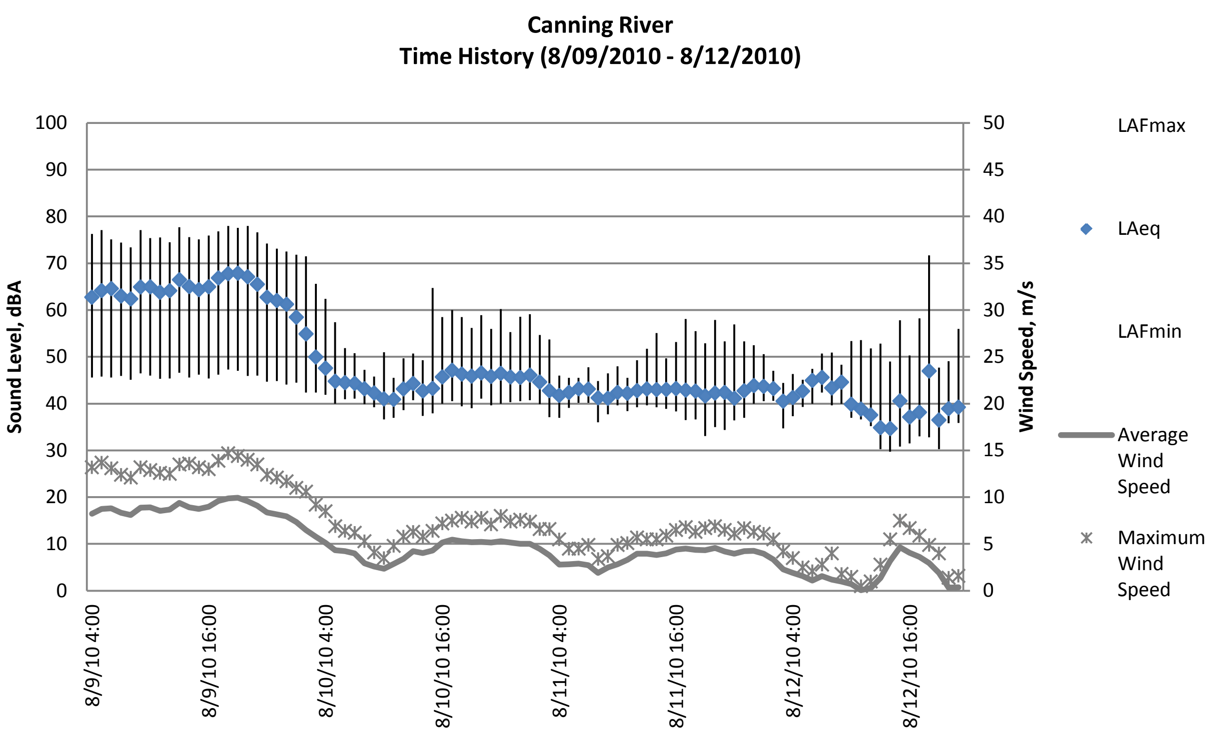
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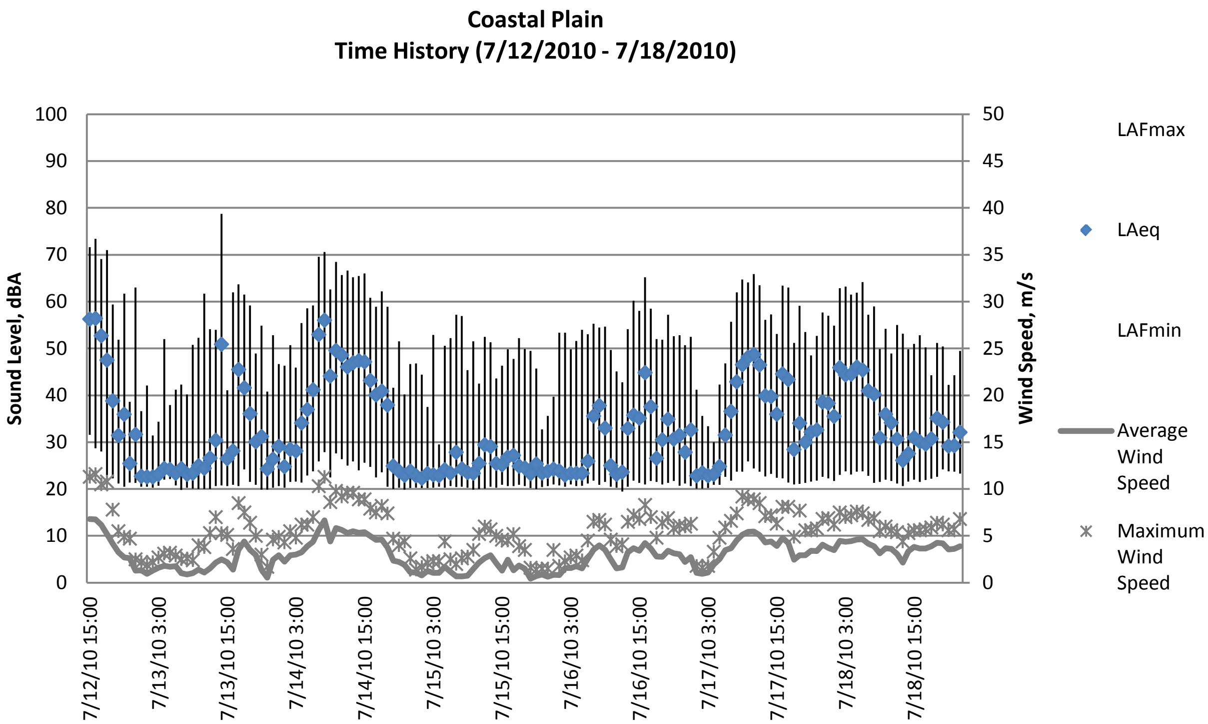
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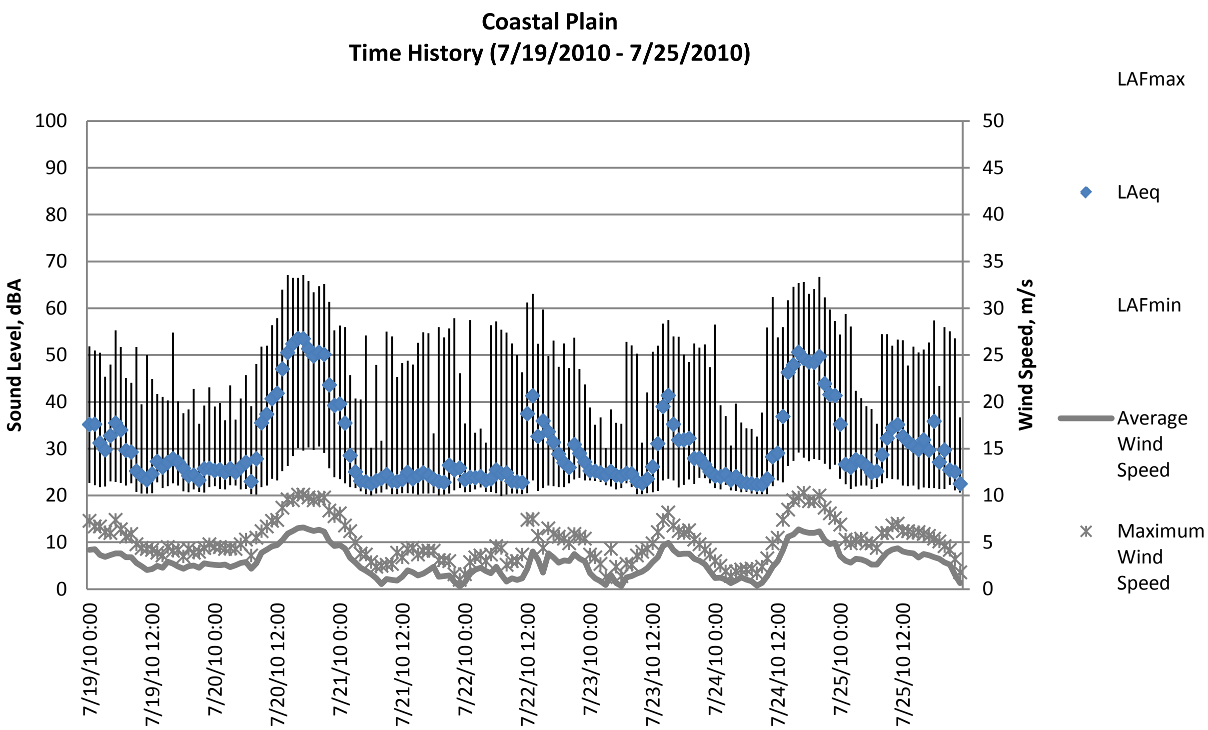
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Wind Speed, m/s
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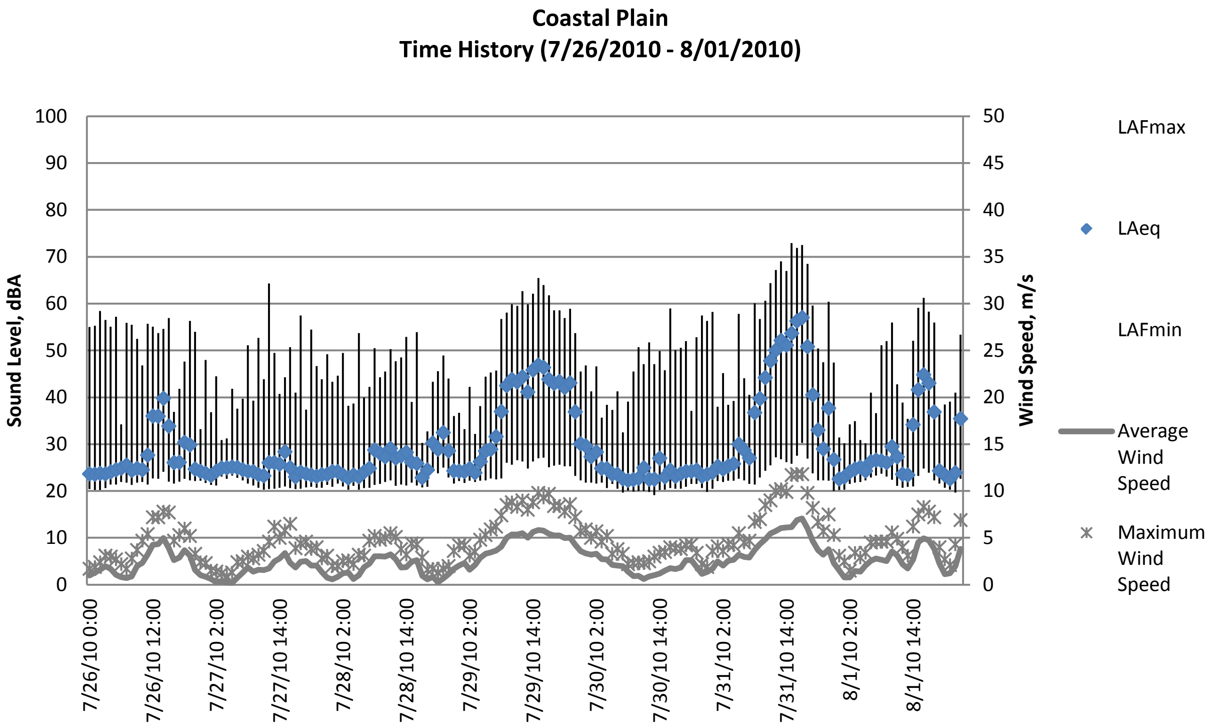
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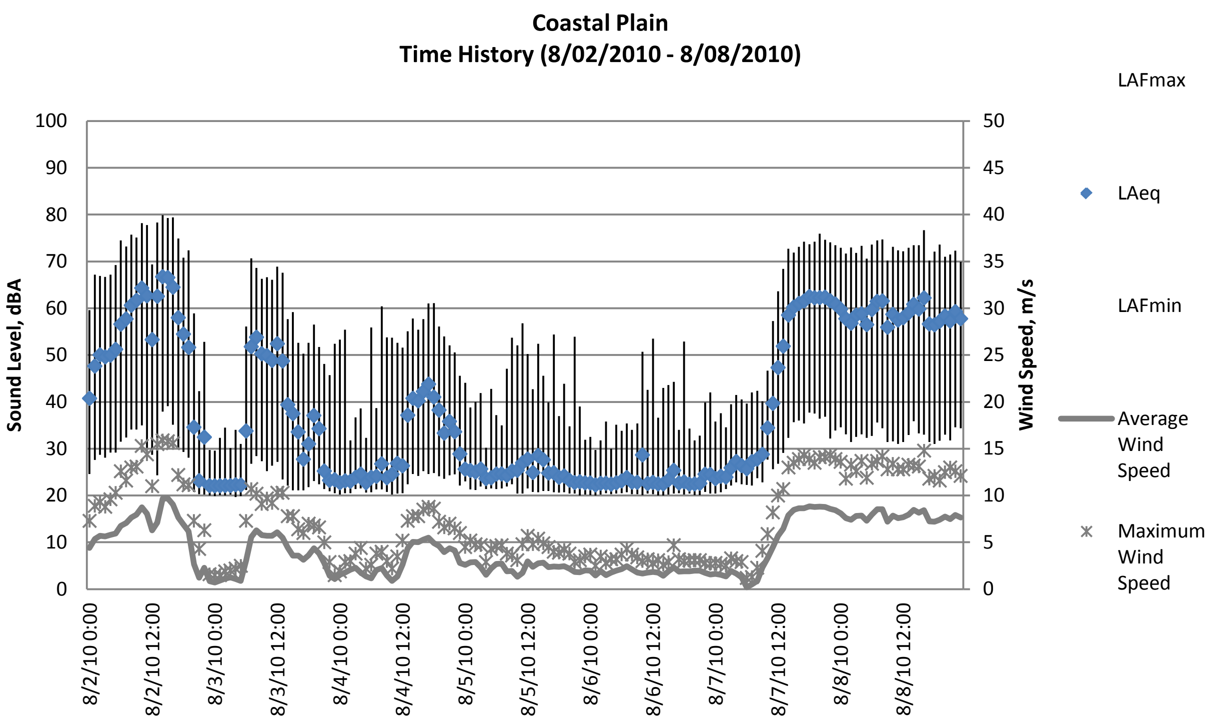
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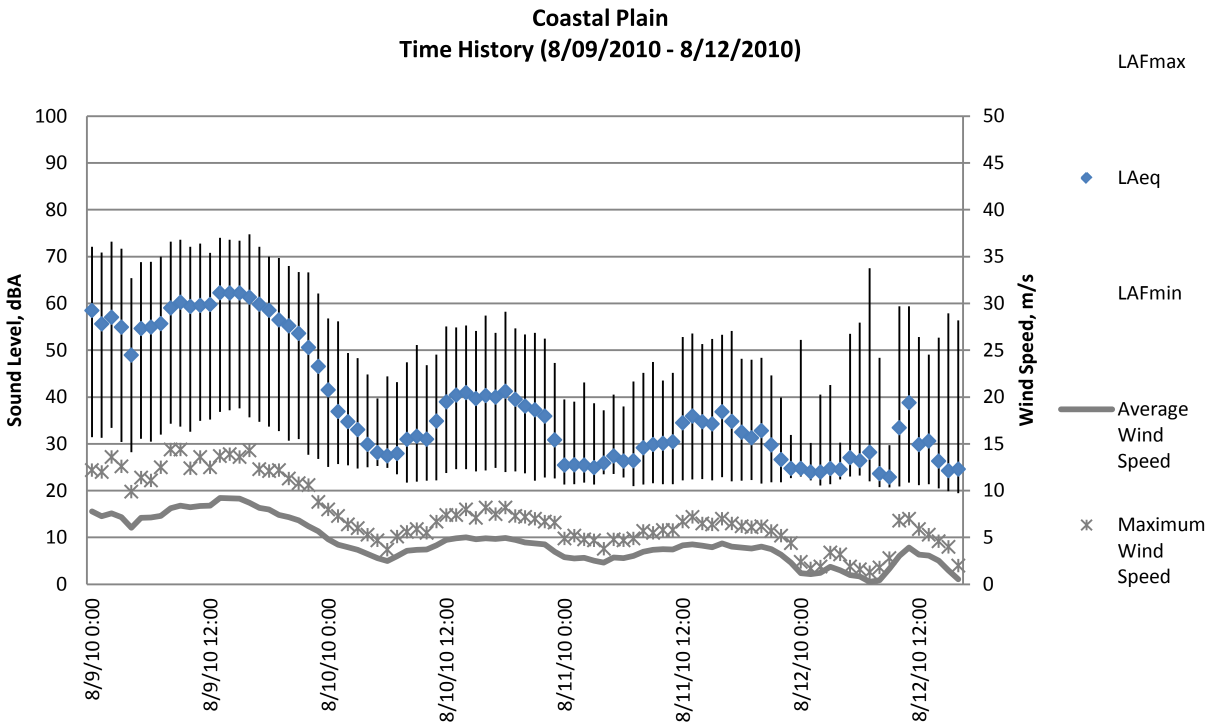
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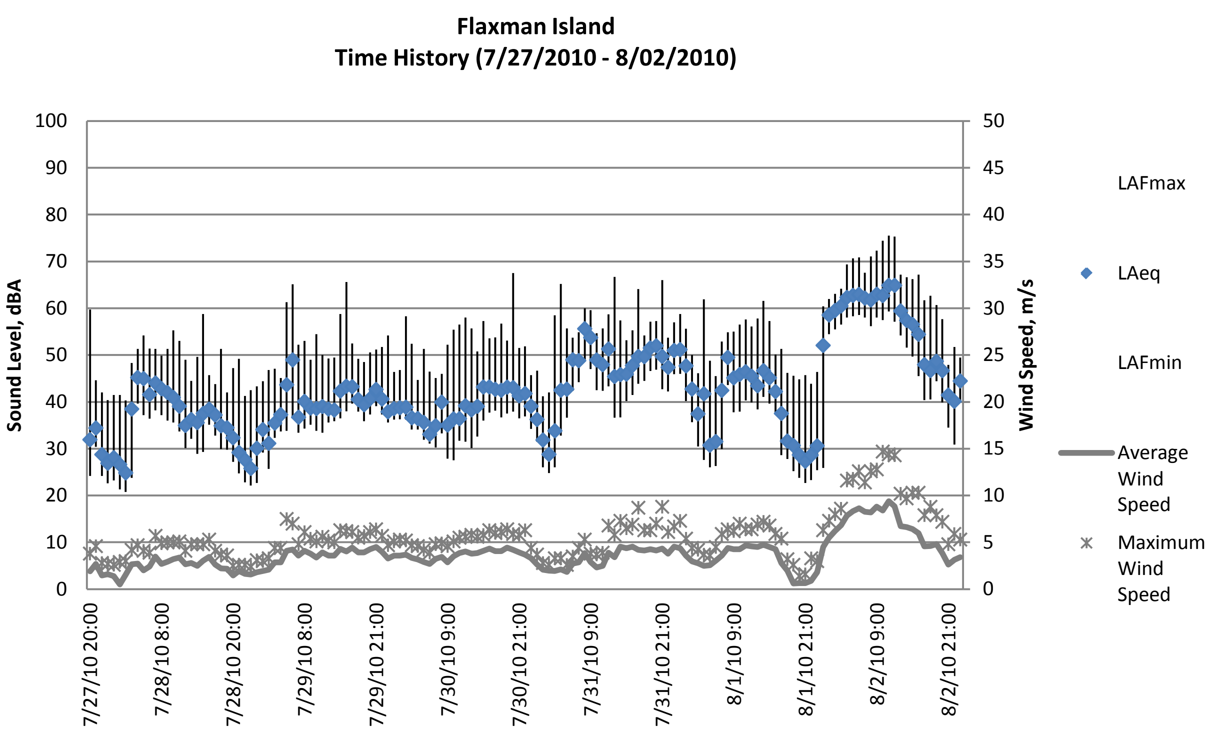
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LAFmax
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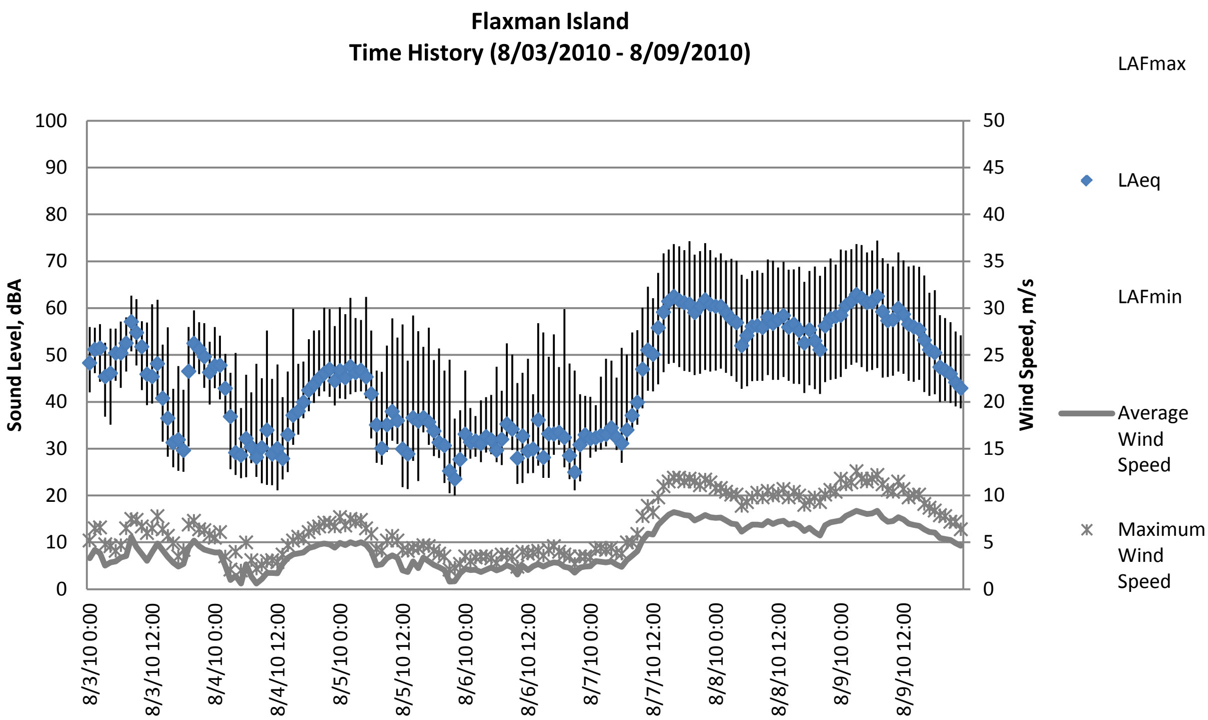
Average Wind Speed
Maximum Wind Speed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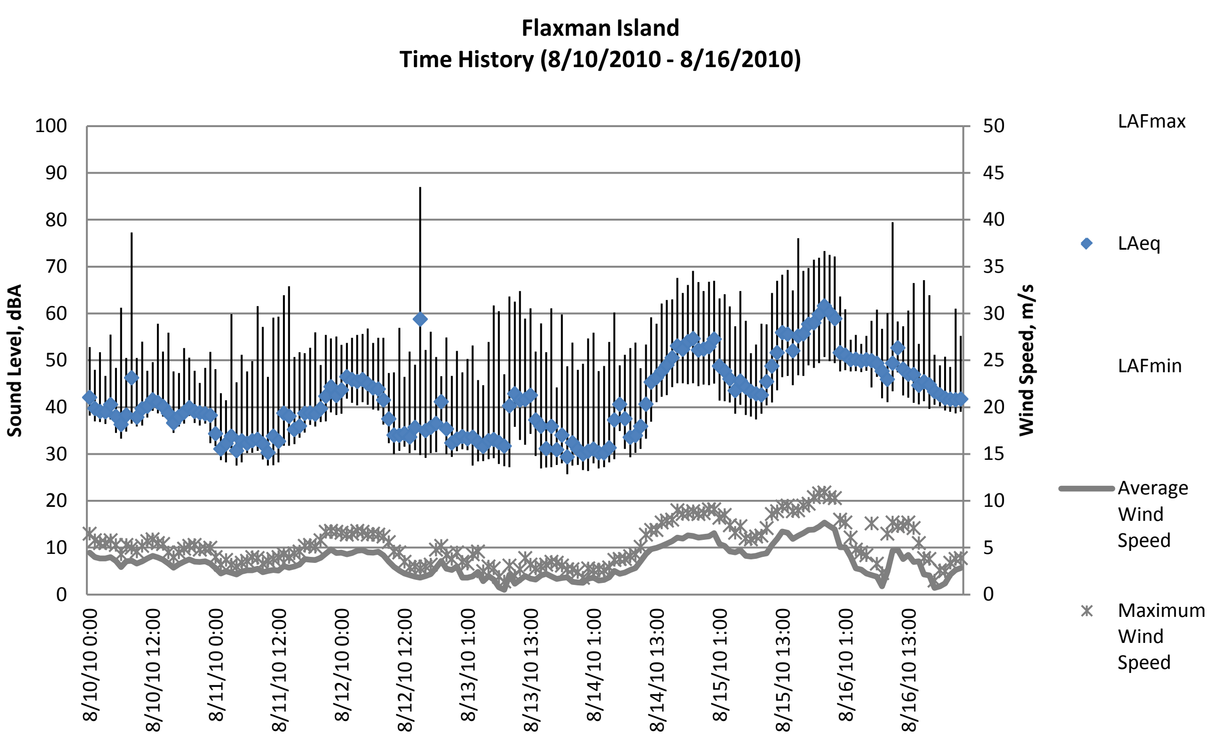
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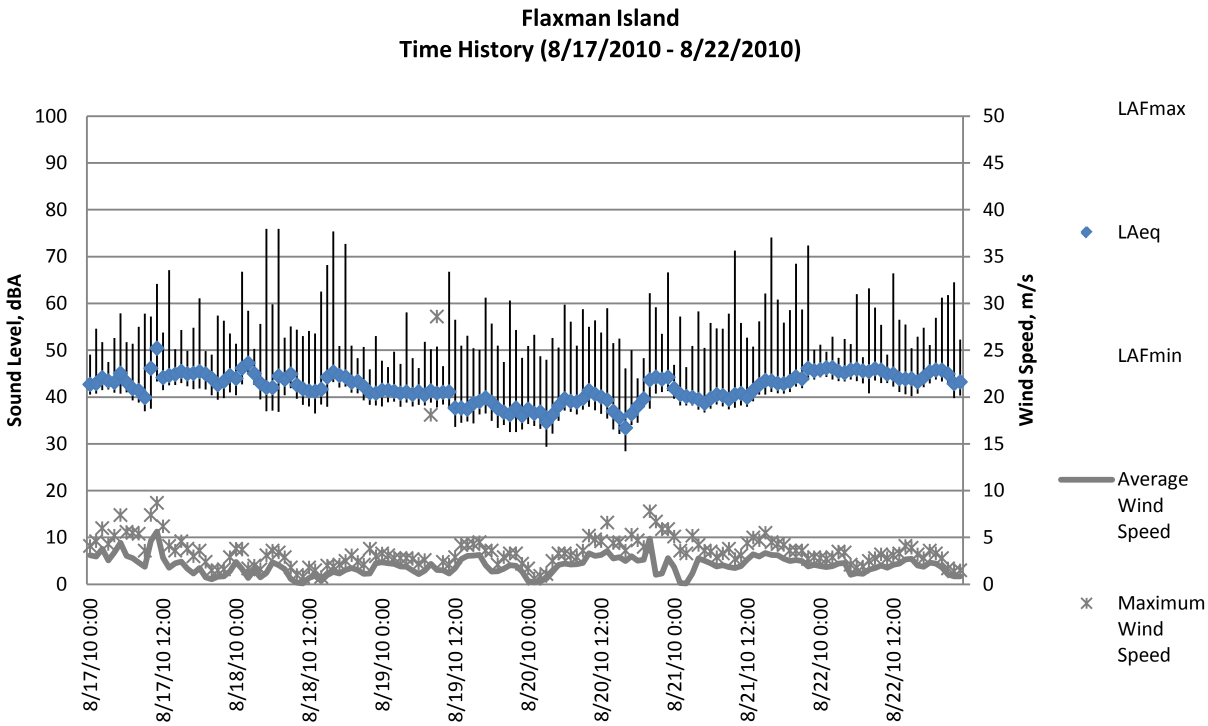
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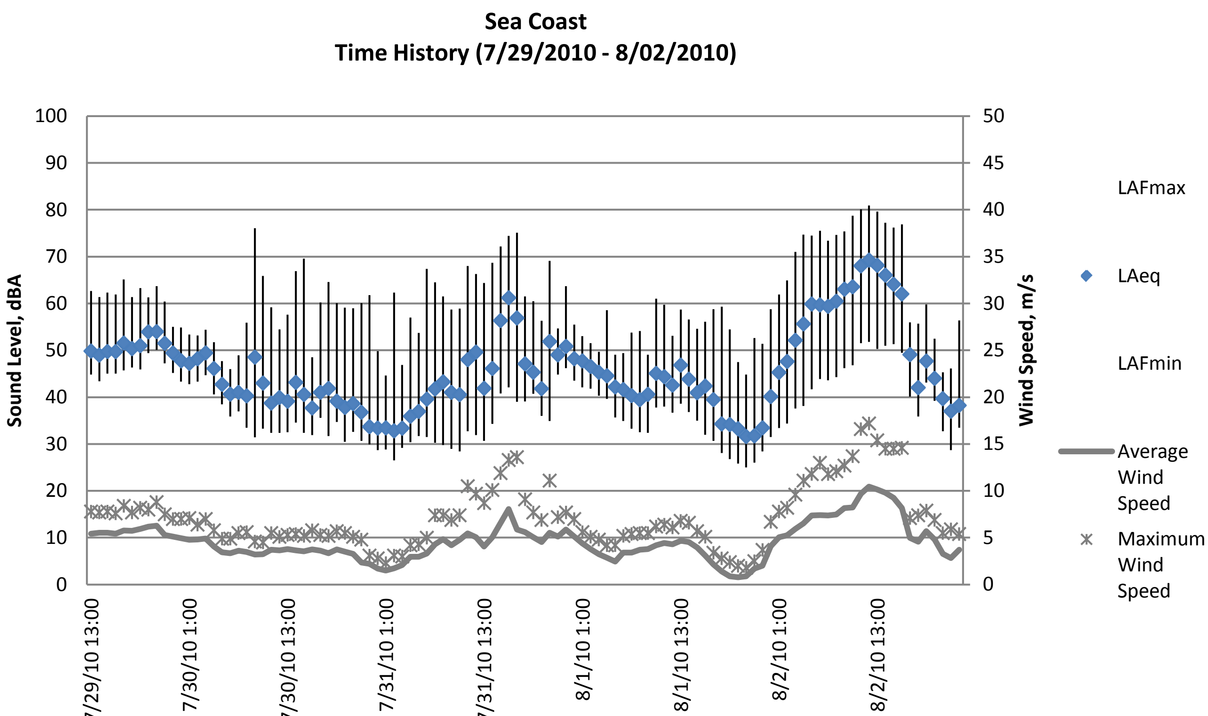
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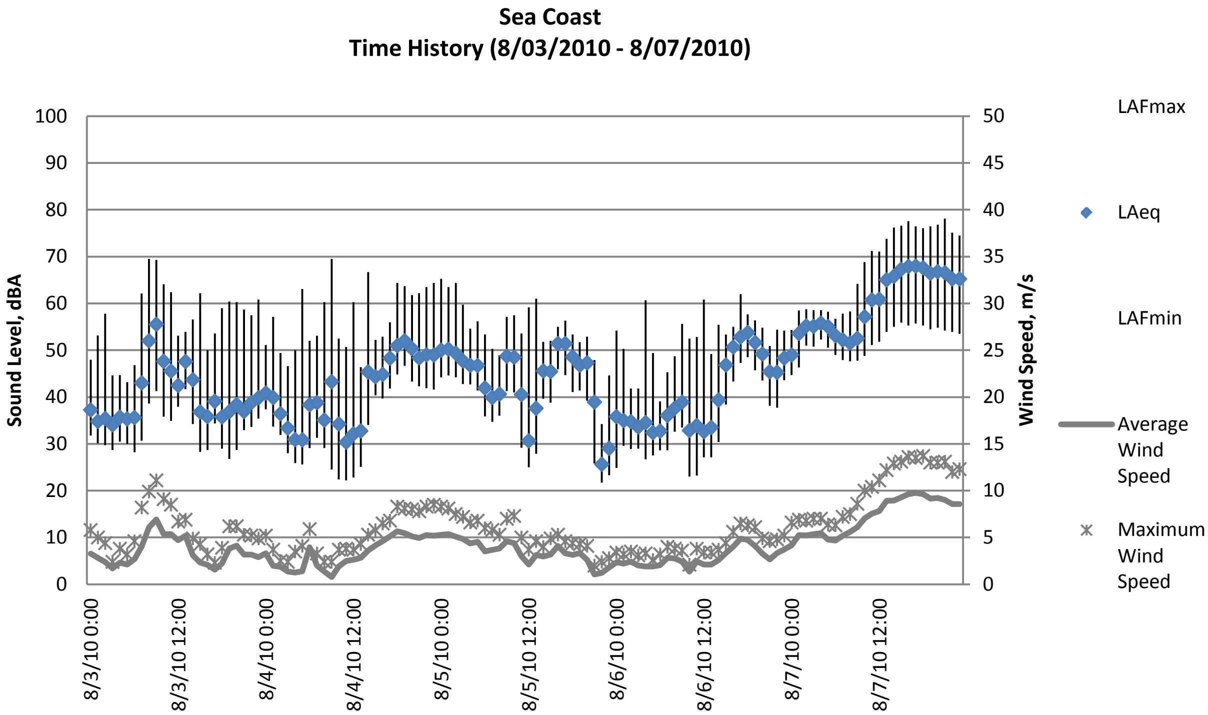
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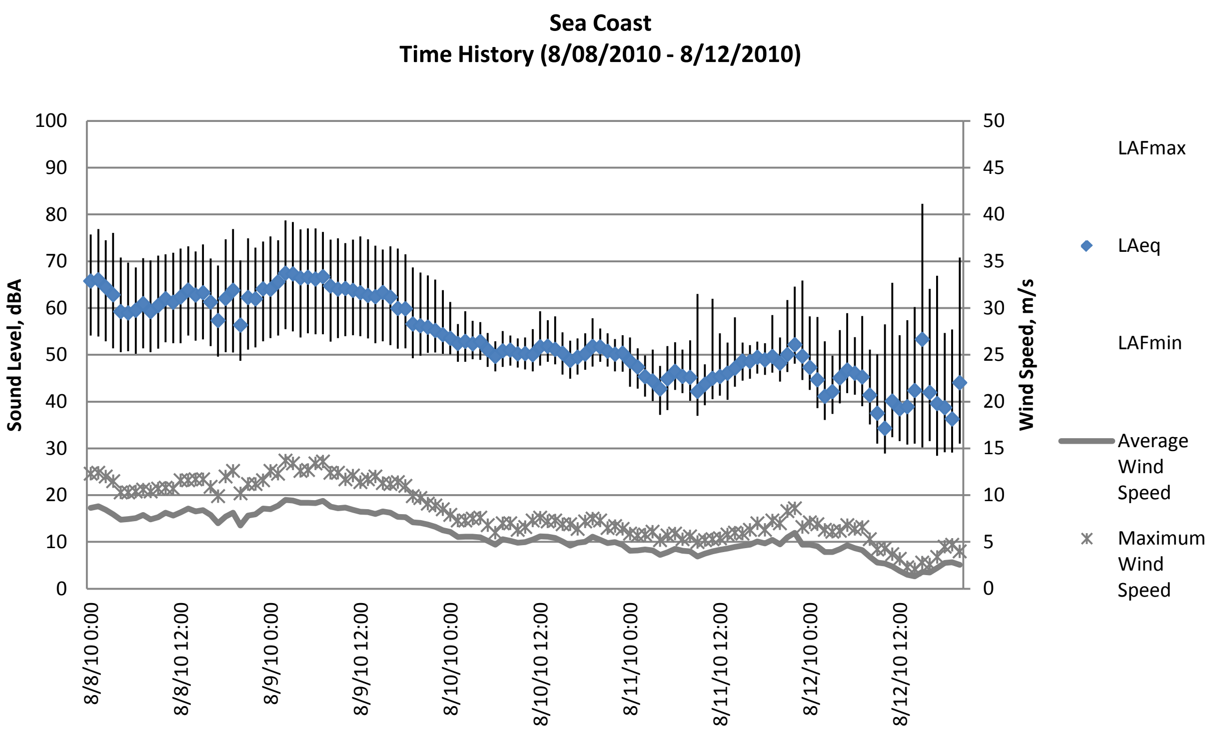
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8/12/10 0:00
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Average Wind Speed
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Appendix P

Section 106 Documentation Programmatic Agreement

- Re-Initiation letter from Corps to SHPO, December 20, 2010
    - Figure 1: Area of Potential Effect
    - Figure 2: APE Detail
    - Initial letter from Corps to SHPO, March 24, 2010

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

DEC 3 0 2010

Regulatory Division
POA-2001-1082-M1

Ms. Judith Bittner
Alaska Department of Natural Resources
Office of History and Archeology
550 West 7th Avenue, Suite 1380
Anchorage, Alaska 99501-3561

Dear Ms. Bittner:

The U.S. Army Corps of Engineers, Alaska District, Regulatory Division (Corps) is preparing an Environmental Impact Statement (EIS) in response to a draft Department of the Army (DA) permit application received from Exxon Mobil Corporation (Exxon Mobil) for their Point Thomson Project. The draft application included requests for authorization under Section 10 of the Rivers and Harbors Act (RHA) and Section 404 of the Clean Water Act (CWA). Exxon Mobil supplemented their draft permit application with a Project Description document. Both October 2009 documents have been provided to other Federal, State, and local agencies as part of a pre-application and National Environmental Policy Act (NEPA) processes. The purpose of the project is to produce natural gas condensate and oil resources.

The Point Thomson Project is located on the North Slope of Alaska, approximately 60 miles west of Kaktovik, on the coast of Lion Bay, and is named after a local geographic landform called Point Thomson. The Federal project area for the EIS is defined to include all facilities and access roads being part of the range of reasonable alternatives being considered in the EIS. Because of a lack of recognizable landmarks in the area, the Federal project area is roughly defined to extend eastward from Deadhorse to the Staines River and from the lagoon side of Flaxman Island and the Maguire Islands along the Beaufort Sea coast south to approximately eight miles south of the coast line. Please see the enclosed Figures 1 and 2.

For purposes of the National Historic Preservation Act (NHPA), this letter follows our initial NHPA consultation letter submitted to your office on March 24, 2010 (copy enclosed). The description below includes current project details so the consulting parties can assist us in identifying historic properties which may be affected by the proposed project.

The Area of Potential Effect (APE) for the Point Thomson Project has been identified as the furthest extent of the range of reasonable alternatives developed for analysis within the EIS. The APE thus encompasses direct project footprints and potential indirect effects, extending 48 miles east-west, and 17 miles north-south.

All project components (described in detail below) would be constructed within the area identified in Figure 1. "Action areas" within the broader APE encompass ½ mile zones to allow for the placement of potential pads and airfields, and ¼ mile zones around potential roads (both ice and gravel).

The EIS reasonable range of alternatives includes five scenarios:

- **Alternative A: No Action**

  Alternative A would involve completing and capping the existing Central Pad Point Thomson Unit (PTU) #15 and #16 production and injection wells, respectively. During one season of summer barge access and one season of winter ice road access, Exxon Mobil would completely demobilize everything else from the Central Pad. Exxon Mobil would also continue to send personnel to the site periodically to monitor the capped wells.

- **Alternative B: Applicant's Proposed Action**

  Alternative B would develop a minimum of 5 production wells on 3 gravel fill pads (Central, East, and West) to extract mostly offshore resources by directional drilling into the Thomson Sand Reservoir. Also included is construction of: 1) a 22-mile long above-ground export pipeline from Point Thomson to BP's existing Badami Production Facility to the west; 2) a 5,600 ft. runway with associated facilities; 3) a marine bulkhead; 4) 5 mooring dolphins, 5) a 120-ft.-long pile-supported dock with six vertical piles; 6) 12 miles of in-field gravel roads; 7) a 60-acre gravel mine; 8) 10 miles of in-field pipelines; 9) a multi-year ice pad; 10) a small fill at Badami; 11) communications towers; and 12) navigational dredging. A natural gas re-injection well, production wells, and processing facilities would be co-located on the Central Processing Pad. The development would use summer barging and winter ice roads to move equipment to and from Point Thomson and Prudhoe Bay, both during construction and ongoing operations.

- **Alternative C: Inland Pads with Gravel Access Road**

  Alternative C involves moving some facilities away from the Beaufort Sea coast to minimize seacoast and near-shore impacts. This alternative would consist of a minimized coastal pad (12 acres) for the existing PTU #15 and #16 production and injection wells, locate two well pads (19 acres) approximately one-half mile inland from the seacoast, and locate a central processing pad (36 acres) approximately 2 miles inland from the coast (for a total of four gravel pads). There would be no summer barging during either construction or operations. During project construction, equipment would be transported to the site via ice roads. Initial construction would include a 44-mile permanent gravel road from the existing Prudhoe Bay infrastructure to Point Thomson. This permanent road would not be usable during construction, but would allow year-round access to Point Thomson for the life of the field.

This alternative would include 17 miles of in-field gravel roads connecting each of the pads and a 5,600-ft. gravel airstrip. A 48-acre gravel mine would supply gravel for all in-field roads and pads. The above-ground pipeline would follow the route of the all-season gravel road and tie into the Endicott pipeline.

- **Alternative D: Inland Pads with Ice Access Road**

  Alternative D is similar to Alternative C, except there would be no construction of an all-season gravel road from Prudhoe Bay to Point Thomson. Instead, ExxonMobil would use a seasonal ice road to move supplies and equipment from Prudhoe Bay to Point Thomson for the duration of the field life. Because of the lack of a permanent gravel road, the above-ground export pipeline (22 miles) would tie-in at Badami, rather than Endicott, and use existing common-carrier pipelines to transport hydrocarbons to the Trans Alaska Pipeline System.

- **Alternative E: Coastal Pads with Mostly Seasonal Roads**

  Alternative E would minimize permanent infrastructure at Point Thomson. The East and West Pads (12 acres of gravel and 10 acres of multi-seasonal ice) would be for production drilling and the Central Pad (73 acres) would combine wells and processing. An inland airstrip would be shorter (3,700 ft.), to accommodate a DeHavilland Twin Otter personnel transport plane, and be supplemented by an ice air strip to accommodate a C-130 during the hydrocarbon drilling season between January and April. The Central Pad and airstrip would be connected year-round by a gravel road (2 miles). Roads between the Central Pad and the East and West Pads would be seasonal ice roads (10 miles). A seasonal ice road and summer barging would be used to transport equipment and supplies to and from Point Thomson. The export pipeline (22-miles) would be above-ground, and would tie-in at Badami.

We will soon contact you to schedule consultation meetings with you and other interested parties to discuss the APE and further coordination.

If you need further detailed information regarding the above five EIS Alternatives, have questions or comments, please contact me at the address above, by calling my office phone at 907-753-2784, my cell phone at 907-350-5097, or by e-mail message at harry.a.baij@usace.army.mil. Your timely response will assist us in incorporating your concerns into the EIS.

Sincerely,

H. Baij

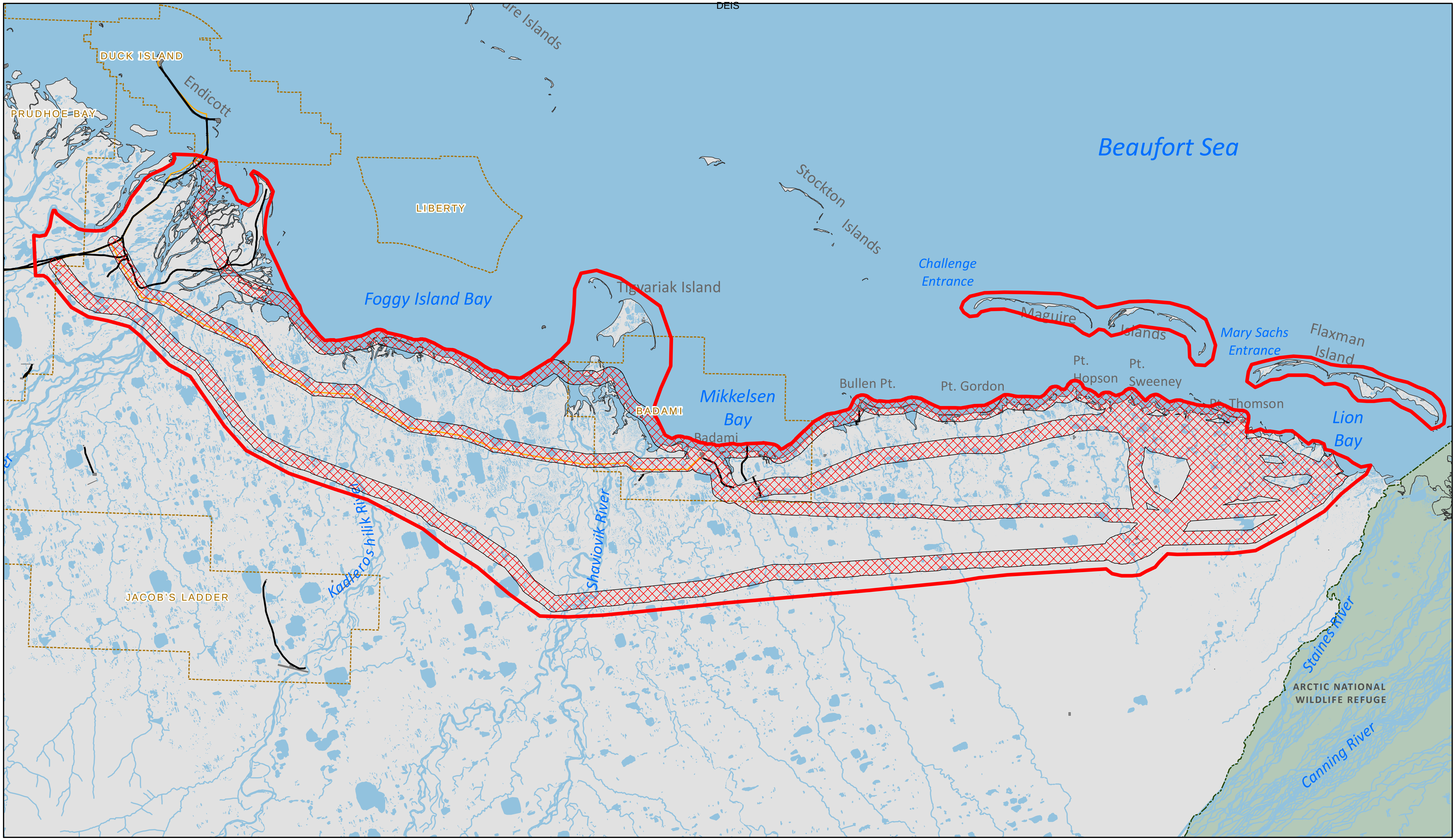
Harry A. Baij Jr.
Project Manager

Enclosures

POINT THOMSON PROJECT EIS

Figure 1
Area of Potential Effect

Date: 3 October 2010
Map Author: HDR Alaska Inc.
Sources: USGS, Alaska DNR, URS, HDR



POINT THOMSON PROJECT EIS

Existing Conditions

- Arctic National Wildlife Refuge
- Oil and Gas Development Unit
- Facilities
- Pipeline
- Road
- Water Body

Project Areas

- Area of Potential Effect (APE)
- Alternatives Action Areas

0 4 8 Miles

N

Figure 2

APE Detail

Date: 22 November 2010
Map Author: HDR Alaska Inc.
Sources: ExxonMobil 2009; PND Engineering 2009; USFWS 2009;
BP Exploration 2008, 2009; Alaska DNR 2009; ESRI 2009; NHD 2009; OASIS 2001; HDR 2010

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

REPLY TO
ATTENTION OF:

MAR 24 2010

Regulatory Division
POA-2001-1082-M1

Ms. Judith Bittner
State Historic Preservation Officer
Alaska Office of History and Archeology
550 West 7th Avenue, Suite 1380
Anchorage, Alaska 99501-3561

Dear Ms. Bittner:

This is in regard to ExxonMobil's proposed Point Thomson Project, which would develop the Thomson Sand Reservoir. The proposed project would include construction and operation of facilities in an area approximately 60 miles east of Deadhorse and 22 miles east of the existing Badami Operations on the Beaufort Sea coast, in the state of Alaska. We are reviewing this project pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. For purposes of Section 106 of the National Historic Preservation Act, we are initiating this consultation to identify historic properties that may be affected by the proposed project.

Enclosed please find one copy of ExxonMobil's Project Description, Point Thompson Project, North Slope, Alaska, dated October 2009. The proposed Point Thomson Project would include three pads, a new 22-mile long, elevated pipeline, a gravel airstrip, a bulkhead and dolphins, in-field gravel roads, ice roads, in-field pipelines, and a gravel mine. Should you have comments or concerns regarding the Project Description, your timely response would be greatly appreciated.

In accordance with the National Environmental Policy Act, an Environmental Impact Statement is being developed for this project and alternatives are currently being refined. Once we have formalized the alternatives, we hope to continue discussions with you to determine the best way forward to identify any effects the proposed project may have on historic properties, and to consult on the Area of Potential Effect (APE). The APE will be defined after comments are received from your agency and other consulting parties.

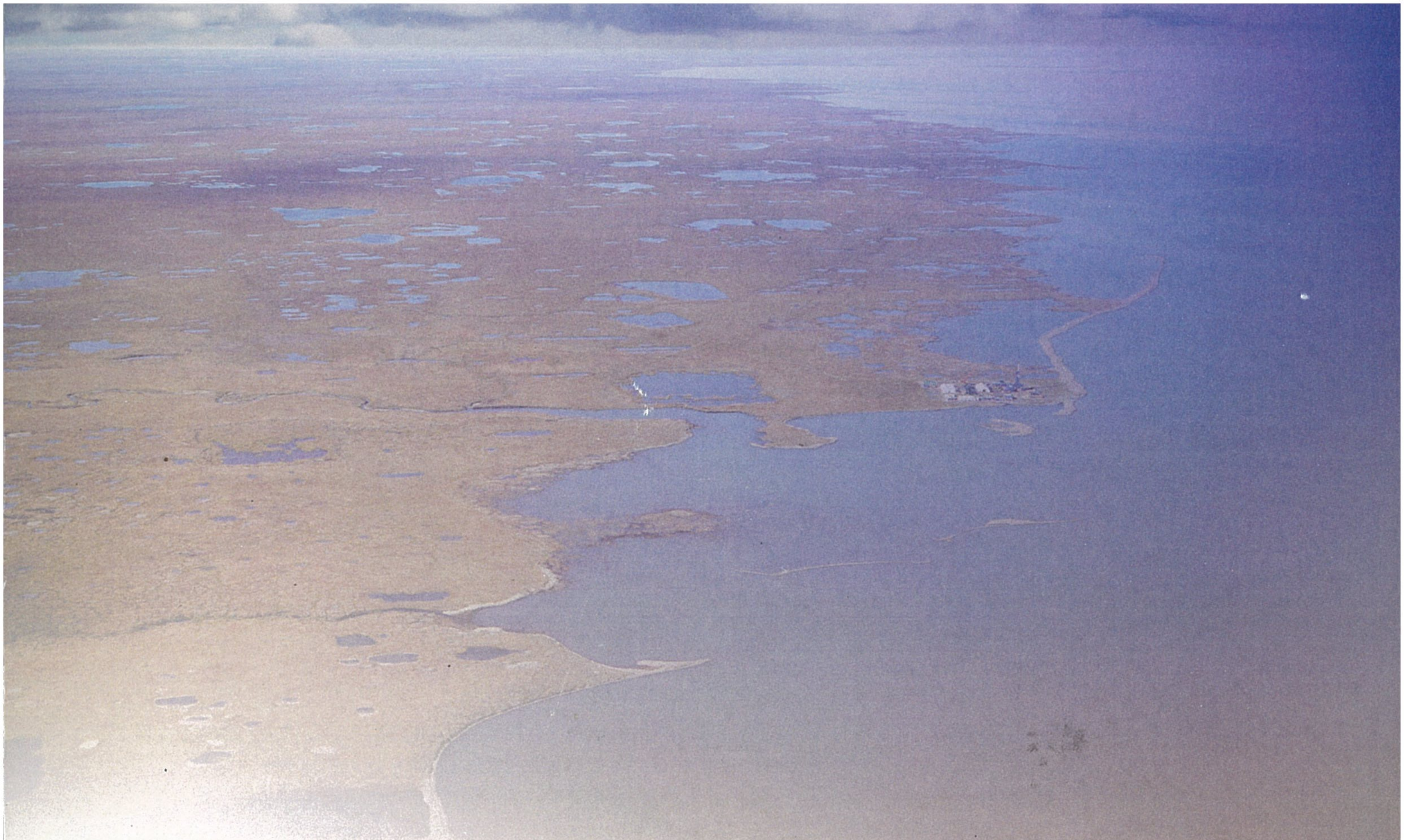
You may contact me via email at julie.w.mckim@usace.army.mil, by mail at the address above, by phone at (907) 753-2773, or toll free from within Alaska at (800) 478-2712, if you have questions.

Sincerely,

Julie W. McKim

Julie W. McKim
Project Manager

Enclosure



US Army Corps
of Engineers