Table 7-9 Pinnipeds Cumulative Effects Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS								Cumulative Effect?	Likelihood that CE Will be significant	Assumptions/Rationale
			Far West Pad [1]	Sourdough Dev.[1]	Slugger Dev.[1]	Gas Sales PTU[1]	Flaxman Island Rem.	Scientific Research & Surveys	Subsistence Hunting	Offshore Seismic Exploration			
HABITAT LOSS and/or ALTERATION[2]	N/A[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DISTURBANCE	Y(NS)[3,4]	N[4]	Y	Y	Y	Y	Y	Y	Y	Y	Y	LOW	• Pt. Thomson project has minimal contribution to CE • Short term disturbance possible during construction; population level effects not expected • Minimal offshore or nearshore disturbance expected during operations
MORTALITY	N	N	N	N	N	N	N	Y	Y	N	N[5]	N/A	N/A

NOTES:
Y = Yes
N = No
N/A = Not applicable
Dev. = Development
NS = Not significant

Footnotes:
[1] Only if existing dock at Badami or proposed dock at Pt. Thomson is dredged for use by one of these other projects.
[2] Habitat effects are considered under the context of disturbance.
[3] Short-term impacts possible due to summer dredging and winter gravel placement
[4] Data collected during Northstar construction efforts showed no impact to distribution or abundance of ringed seals (LGL and Greenridge 2001)
[5] From the perspective of this project there is no cumulative effect since there is no expected impact on direct mortality from development of Point Thomson

Table 7-10. Polar Bear Cumulative Effect Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS								Cumulative Effect?	Likelihood that CE Could Be Significant	Assumptions/Rationale
			Badami	Far West Pad	Sourdough Dev.	Slugger Dev.	Gas Sales PTU	Scientific Research & Surveys	Subsistence Hunting	Flaxman Island Remediation			
HABITAT LOSS and/or ALTERATION[2]	Y(NS)[1]	N[2]	Y	Y[3]	N[4]	N[4]	Y	N/A	N/A	Y	Y	LOW	• Pt. Thomson project has minimal contribution to CE • Denning habitat not limited • Any new developments will minimize footprint and mitigate impacts to polar bear • No known areas of long-term displacement within project geographical scope
DISTURBANCE	Y(NS)[5]	N[6]	Y	Y	N[4]	N[4]	Y	Y	Y	Y	Y	LOW	• Pt. Thomson project has minimal contribution to CE • Any new developments will mitigate disturbance impacts to polar bear • No known areas of long-term displacement within project geographical scope • Population level effects not expected; population not threatened • Polar bears return to Flaxman Island where exploration and remediation has occurred
MORTALITY	Y(NS)[7]	Y[8]	Y[7]	Y[9]	N[4]	N[4]	Y[7]	Y[9]	Y[9]	Y[7]	Y	LOW	• Mortality from Pt. Thomson project and other oil/gas development activities expected to have minimal contribution • Mortality from subsistence hunting and scientific surveys is controlled; population level effects not expected • Population is not threatened

NOTES:

Y = Yes

N = No

U = Unknown

N/A = Not applicable

NS = Not significant

Dev. = Development

Footnotes:

[1]Active denning sites will be avoided

[2]No known areas of long-term displacement within analysis scope

[3]In an area with several former den sites

[4]Dens and area use not anticipated so far inland

[5]Individuals are thought to avoid loud noise but there is no evidence that noise associated with construction or operation disturbs polar bears.

[6]Continued use of numerous den sites on Flaxman Island even though exploration, remediation, and scientific surveys have taken place there.

[7]Impact exists due to potential need to kill a bear to protect life or property, however, the potential that this will happen is very low

[8]Potential lingering effect from past hunting efforts

[9]Could add to potential mortality from project

7.3.2.6 Terrestrial Mammals

The Central Arctic Caribou Herd (CAH) and the Porcupine Caribou Herd (PCH) were identified as the caribou herds of interest in the ER. The CAH has eastern and western segments that utilize different calving and insect relief ranges (Section 4.10.1). The two CAH segments are not isolated from each other in their winter range. In addition, there is some exchange of caribou between the two segments among years. However, caribou that join with one of the segments in a given year are not known to move between segments within a year. The CAH eastern segment range includes the Point Thomson area, whereas the western segment does not range east of the Sagavanirktok River. Therefore, only the CAH eastern segment is brought forward for discussion in this cumulative effect analysis. The geographic scope of the cumulative analysis is redefined as from the Sagavanirktok River east to the Tamayariak River, south to the Brooks Range, and north to the barrier islands for the CAH eastern segment. The PCH geographic scope is the same as the CAH eastern segment for west, north, and south boundaries, but is extended to Kaktovik on the eastern boundary in this cumulative effect analysis.

The geographic scope for muskoxen, grizzly bear, Arctic fox, and moose ranges from the Badami Facility east to the Canning River, north to the barrier islands, and to the southern boundary of the Point Thomson Unit. The CAH and PCH are analyzed separately due to the difference in their summer and winter ranges. Muskoxen, grizzly bear, Arctic fox, and moose are grouped together as "terrestrial mammals" for analysis.

Cumulative effect analyses for CAH, PCH, and terrestrial mammals are discussed in the following sub-sections and summarized in Tables 7-11 through 7-13.

Internal Project Effects

As discussed in Section 5.2.6, potential effects of the Point Thomson Gas Cycling Project on terrestrial mammals are limited to habitat loss and alteration, disturbance, and mortality. The following project actions have been identified as potentially contributing to these effects:

Habitat Loss and Alteration

- Habitat loss due to placement of gravel for construction of roads, pads, and airstrip.
- Habitat alteration due to ice road construction; dust fallout; potential obstruction of flow due to presence of roads, pads, and airstrip; and thermokarst.

Disturbance

- Noise and visual disturbance from construction, operations, and maintenance activities.
- Noise from vehicular traffic.
- Gravel roads, pads, airstrip, and pipeline could disturb movement of terrestrial mammals.

Mortality

- Strikes by vehicles.
- Direct take for protection of human life and property (only relevant for grizzly bear and Arctic fox).

- Increase in prey populations due to new food sources (i.e., garbage and personnel feeding wildlife).

Central Arctic Caribou Herd - Eastern Segment

Habitat loss due to gravel placement will cause long-term alteration of 9,404,666 ft^2 (873,693 m^2) of habitat used by the CAH. Section 5.2.6.1 concludes that although the habitats are important to caribou, they are also among the most abundant habitats in the Point Thomson area. Placement of frozen gravel during winter construction and regrading in the spring is not likely to cause dust fallout effects (Section 5.2.6.1). Dust fallout as a result of operations is anticipated to be minimal (Section 5.2.6.1). The seasonal duration of any minor impoundments during spring runoff is anticipated to be short-term. Placement of culverts or other drainage structures would minimize the potential formation of long term impoundments. Thermokarsting is a naturally occurring process on the North Slope. Minor changes due to thermokarst could occur around the gravel mine site. Therefore, loss or alteration to CAH eastern segment habitat resulting from project actions is rated as not significant, and depicted as Y (NS) on Table 7-11 for habitat in the "Potential Project Effects?" column.

Noise and visual disturbance from winter construction activities (i.e., gravel mining; gravel road, pad, and airstrip construction; drilling; and pipeline construction) will not impact CAH eastern segment since they are not in the Point Thomson area during the winter. The CAH eastern segment could be disturbed due to behavioral reactions in response to road traffic during the summer construction phases; however, this is anticipated to diminish to low levels during operations due to low traffic volume (Section 5.2.6.2). The presence of roads and pads and their associated traffic noise should cause minimal disturbance to female caribou with calves due to availability of other suitable habitat in the area. The 500 ft (152 m) separation between gravel roads and gathering pipelines from the East and West Pads to the CPF and anticipated low traffic volume minimizes disturbance of the caribou movement and improves crossing success (Section 5.2.6.2). Therefore, disturbance of the CAH eastern segment from project actions is rated as not significant, and depicted as Y (NS) on Table 7-11 for disturbance in the "Potential Project Effects?" column.

Risk of vehicle strikes by trucks and aircraft would be highest during the summer months when the CAH eastern segment are more likely to be in the Point Thomson area. Although vehicle-caused mortality is poorly documented, the number of animals killed is thought to be low in the Kuparuk and Prudhoe Bay oil fields. During early spring in the Kuparuk and Prudhoe Bay oil fields, caribou are attracted to roadside areas to forage on vegetation that has "greened up" early due to dust fallout. Although the early vegetation provides nutritious forage, exposure to traffic-related disturbance increases the risk of vehicle strikes. The amount of roads proposed and anticipated traffic rates for the Point Thomson Gas Cycling Project are minimal compared to the road system and traffic rates in the Kuparuk and Prudhoe Bay oil fields. It is unlikely that traffic on Point Thomson gravel roads would generate sufficient dust fallout to induce a "green up" effect that would attract large numbers of caribou near roadside areas. Grizzly bear could also cause caribou mortality since they are known to prey on caribou, especially calves (Section 4.10.3). It is anticipated that waste control and enforced rules against personnel feeding wildlife will minimize artificial attraction of grizzly bear to the Point Thomson area. Therefore, mortality of CAH eastern segment individuals from project actions is rated not significant. This is depicted as Y (NS) on Table 7-11 for mortality in the "Potential Project Effects?" column.

Porcupine Caribou Herd

Potential Point Thomson Gas Cycling Project effects identified above for the CAH eastern segment are the same for the PCH. However, potential impacts to the PCH are unlikely since this herd infrequently visits the Point Thomson area during summer. PCH typically approach the Beaufort Sea coast during the post-calving period until the beginning of insect season. The majority of the herd then moves southeast in to the foothills and mountains of the Brooks Range in July. The last large group of PCH documented in the Point Thomson area was in 1988 (Section 4.10.1.2). Therefore, identified habitat loss and alteration, disturbance, and mortality effects within the defined geographic area are rated as not significant for the PCH. This is depicted as Y (NS) on Table 7-12 in the "Potential Project Effects?" column.

Terrestrial Mammals

Muskoxen, grizzly bears, and moose typically frequent riparian habitats along the Arctic Coastal Plain (Sections 4.10.2, 4.10.3, and 4.10.5, respectively), whereas Arctic fox make use of a wide variety of habitats (Section 4.10.4). Riparian habitats that are used particularly by muskoxen, grizzly bears, and moose comprise less than 1% of areas impacted by the project footprint. Muskoxen are also known to make use of moist tussock and shrub tundra habitats and shrub stands along tundra streams (Section 4.10.2). These habitat types comprise less than 0.1%, respectively, of all vegetation mapped in the Point Thomson area (Table 4-4), and are not impacted by gravel placement (Table 5-3). Therefore, loss or alteration to terrestrial mammal habitat resulting from project actions is rated as not significant. This is depicted as Y (NS) on Table 7-13 for habitat in the "Potential Project Effects?" column.

Muskoxen, grizzly bears, and moose infrequently visit the Point Thomson area. Area use by Arctic fox likely occurs but has not been documented. The three fox dens located during area surveys are far removed from the project site (Section 4.10.4). Disturbance due to noise associated with Point Thomson project activities is anticipated to be minimal. Most of these species are not known to frequent the project area and Arctic fox readily habituate to noise associated with oil filed activities. Therefore, disturbance of these species due to project actions is rated as not significant, and depicted as Y (NS) on Table 7-13 for disturbance in the "Potential Project Effects?" column.

There is a risk of vehicle strikes if muskoxen, grizzly bears, moose, and Arctic fox move within the Point Thomson area. However, due to enforced speed limits and wildlife interaction training for personnel this risk is considered to be minimal. Direct take of grizzly bears and Arctic fox for protection of human life and property could occur. It is anticipated that waste control and enforced rules against personnel feeding wildlife will minimize artificial attraction of grizzly bear and Arctic fox to the Point Thomson area. Therefore, mortality of terrestrial mammals from project actions is rated as not significant. This is depicted as Y (NS) on Table 7-13 for mortality in the "Potential Project Effects?" column.

Past External Effects

Past external actions pertinent to identified potential habitat, disturbance, and mortality effects for CAH, PCH, and terrestrial mammals were as follows:

Habitat

- Oil and Gas Exploration – habitat loss due to exploratory pads from the Point Thomson Unit west to the Sagavanirktok River.
- Endicott – habitat loss due to onshore gravel road from the coastline to the westward boundary of the Sagavanirktok River.
- Badami – habitat loss due to gravel roads, pads, and airstrip.

Disturbance

- Endicott – noise and visual disturbance associated with construction and operations vehicular traffic, and gravel road and pipeline could disturb movement of caribou and other terrestrial mammals.
- Badami – noise associated with construction and operations vehicular traffic, and gravel road and pipeline could disturb movement of caribou and other terrestrial mammals.

Mortality

- Endicott – strikes by vehicles on gravel road.
- Badami - strikes by vehicles; direct take for protection of human life and property (only relevant for grizzly bear and Arctic fox); and increase in prey populations due to new food sources (i.e., garbage and personnel feeding wildlife).
- Scientific Research and Surveys – mortality due to drug overdose, stress from capture, or direct kill (caribou and grizzly bear only).
- Subsistence Hunting – direct kill.
- Sport Hunting – direct kill.

Central Arctic Caribou Herd – Eastern Segment

Habitat has been lost due to past construction of gravel pads associated with past exploratory oil and gas activities; a gravel road connecting the Endicott facility to Prudhoe Bay infrastructure; and gravel roads, pads, and airstrip associated with the Badami facility. The potential that loss of these habitats has affected the CAH eastern segment depends on two factors: the percent of forage made unavailable and the carrying capacity of the area (Cronin et al. 1994). The loss of habitat due to past gravel placement is small relative to forage habitat in the defined geographic area, and the CAH population, as a whole, has been increasing since 1980 (Section 4.10.1.1). Therefore, it is assumed that there are no lingering influences due to habitat loss for the CAH eastern segment. This is depicted as N on Table 7-11 for habitat in the "Lingering Influence From Past External Actions?" column.

Noise and visual disturbance from past Endicott and Badami winter construction activities (i.e., gravel mining; gravel road, pad, and airstrip construction; drilling; and pipeline construction) did not impact the CAH eastern segment since they are not in the area during the winter. The CAH eastern segment could have been disturbed due to behavioral reactions in response to road traffic during the summer construction phases of these facilities; however, it is assumed that disturbance diminished to low levels once operations began due to reduced traffic volume. Separating the

Endicott pipeline and onshore gravel road and elevating the Badami pipeline minimized disturbance of the CAH eastern segment movements. Since the CAH population, as a whole, has not drastically declined since 1980, it is assumed there are no lingering influences due to disturbance of the CAH eastern segment at the population level. This is depicted as N on Table 7-11 for disturbance in the "Lingering Influence From Past External Actions?" column.

Although vehicle-caused mortality is poorly documented, the number of animals killed in the past is thought to be low in the Kuparuk and Prudhoe Bay oil fields. Past mortality of CAH eastern segment individuals due to traffic associated with the small amount of onshore road from Endicott and the minimal roads and airstrip at the Badami facility was not identified. Mortality from scientific research and surveys could have been caused due to drug overdoses, stress from capture, or direct kills. In addition, subsistence and sport hunting caused direct mortality of CAH eastern segment individuals. Potential mortality from these past sources would be minimal relative to population size, and is not thought to have had population level effects on the CAH eastern segment. Therefore, it is assumed that there are no lingering influences on the CAH eastern segment due to past mortality. This is depicted as N on Table 7-11 for mortality in the "Lingering Influence From Past External Actions?" column.

Porcupine Caribou Herd

Potential past external actions identified above for the CAH eastern segment are the same for the PCH. However, the potential for impacts to the PCH are much smaller since this herd infrequently visits the defined geographic area during summer. The last large group of PCH documented near the Sagavanirktok River was in 1988 (Section 4.10.1.2). Therefore, it is assumed that there are no lingering influences on the PCH due to past habitat loss, disturbance, and mortality effects in the defined geographic area. This is depicted as N on Table 7-12 for habitat, disturbance, and mortality in the "Lingering Influence From Past External Actions?" column.

Terrestrial Mammals

Muskoxen, grizzly bears, and moose infrequently visit the defined geographic area. Area use by Arctic fox likely occurs but has not been documented; however, three fox dens have been located in the defined geographic area (Section 4.10.4). Muskoxen, grizzly bears, and moose typically frequent riparian habitats, while Arctic fox make use of a wide variety of habitats. Habitat loss due to construction of gravel pads associated with past exploratory oil and gas activities; a gravel road connecting the Endicott facility to Prudhoe Bay infrastructure; and gravel roads, pads, and airstrip associated with the Badami facility is minimal relative to abundance in the defined geographic area. Therefore, it is assumed that there are no lingering influences due to habitat loss for these terrestrial mammals. This is depicted as N on Table 7-13 for habitat in the "Lingering Influence From Past External Actions?" column.

Disturbance due to noise associated with past Badami construction and operations is thought to have been minimal since most of these species are not known to frequent the area and Arctic fox readily habituate to noise associated with oil filed activities. Therefore, it is assumed that there are no lingering influences on terrestrial mammals due to disturbance. This is depicted as N on Table 7-13 for disturbance in the "Lingering Influence From Past External Actions?" column.

Due to their infrequent use of the defined geographic area, the likelihood of past strikes and mortality of terrestrial mammals by vehicles is considered to be minimal. Direct take of grizzly

bears and Arctic fox for protection of human life and property could have occurred. It is assumed that waste control procedures and enforced rules against personnel feeding wildlife that were implemented in the past lowered the risk of attracting grizzly bear and Arctic fox near facilities. Mortality from scientific research and surveys of grizzly bears could have been caused due to drug overdoses, stress from capture, or direct kills. In addition, subsistence and sport hunting caused direct mortality of muskoxen, grizzly bears, moose, and Arctic fox individuals. Mortality from these sources is thought to have been minimal relative to overall population sizes, and not have had population level effects on these species with the exception of moose. There was a 75% decline in the North Slope moose population from the late 1980s to 1994 from unidentified causes, and hunting was closed in Game Management Unit 26B in 1996 (Section 4.10.5). It is assumed that there are no lingering influences on muskoxen, grizzly bear, and Arctic fox populations due to past mortality. North Slope moose populations remained low through 2000 due to unknown causes; therefore, a lingering influence due to past mortality was identified for moose. This is depicted as Y^2 on Table 7-13 for moose mortality in the "Lingering Influence From Past External Actions?" column, footnoted to indicate that no lingering influences were identified for muskoxen, grizzly bear, and Arctic fox.

Present and Potential Future External Effects

Present and potential future external actions pertinent to identified potential habitat, disturbance, and mortality effects for CAH, PCH, and terrestrial mammals were as follows:

Habitat

- Badami – habitat loss due to gravel placement if facility is expanded for support of potential future projects.
- Far West Pad - habitat loss due to potential construction of gravel pad and road.
- Sourdough Development – potential construction of gravel roads, pads, and airstrip.
- Slugger Development – potential construction of gravel roads, pads, and airstrip.
- Gas Sales Point Thomson – potential construction of additional gravel pad for gas modules(s).

Disturbance

- Endicott – noise from vehicular traffic on gravel road.
- Badami – noise and visual disturbance associated with potential facility expansion to support potential future projects.
- Far West Pad – noise and visual disturbance associated with potential construction and traffic if gravel access road is constructed.
- Sourdough Development – noise and visual disturbance associated with potential operations and vehicular traffic associated with potential gravel road(s) and airstrip, and potential pipelines could disturb movement of caribou and other terrestrial mammals.
- Slugger Development – noise and visual disturbance associated with potential operations and vehicular traffic associated with potential gravel road(s) and airstrip, and potential pipelines could disturb movement of caribou and other terrestrial mammals.

- Gas Sales Point Thomson – noise associated with gas operation of module(s).
- Ecotourism – disturbance due to sightseeing flights and increased number of visitors touring/camping in Arctic National Wildlife Refuge.

Mortality

- Endicott – strikes by vehicles on gravel road.
- Badami – strikes by vehicles; direct take for protection of human life and property (only relevant for grizzly bear and Arctic fox); and increase in prey populations due to new food sources (i.e., garbage and personnel feeding wildlife).
- Far West Pad – strikes by vehicles on potential gravel road.
- Sourdough Development - strikes by vehicles on potential gravel road(s).
- Slugger Development – strikes by vehicles on potential gravel road(s).
- Scientific Research and Surveys – potential mortality due to drug overdose, stress from capture, or direct kill (caribou and grizzly bear only).
- Subsistence Hunting – direct kill.
- Sport Hunting – direct kill.

Central Arctic Caribou Herd – Eastern Segment

Additional habitat loss could occur due to expansion of the Badami facility to support future projects and/or construction of gravel roads, pads, and airstrips for future development projects. Potential habitat loss from these external actions is depicted as Y in Table 7-11 under the Badami, Far West Pad, and Sourdough and Slugger Development columns.

Noise and visual disturbance associated with potential expansion of Badami facilities in support of future projects, construction of a Far West Pad, or construction of potential Sourdough and/or Slugger developments is expected to be minimal. Major construction and drilling activities would most likely take place in the winter when the CAH eastern segment is absent from the area, and noise associated with equipment installation in the summer would be short-term. It is also assumed that these potential construction activities would not occur at the same time. There is evidence that caribou can habituate to operations noises occurring more or less on a regular basis (Cronin et al. 1994). Gravel roads, pads, airstrips, and pipelines could also be associated with potential future development. Noise from vehicular traffic and the physical presence of gravel roads, airstrips, and pipelines could disturb CAH eastern segment movements. Ecotourism and interest in ANWR is on the rise due to the current political atmosphere. Sightseeing flights and touring/camping excursions also have the potential to disturb caribou. This is depicted as Y in Table 7-11 under the Endicott, Badami, Far West Pad, Sourdough and Slugger Development, Gas Sales Point Thomson Unit, and Ecotourism columns.

Construction of additional gravel roads in the defined geographic area could increase the risk of vehicular strikes. Mortality from scientific research and surveys, subsistence hunting, and sport hunting could cause direct mortality of CAH eastern segment individuals. This is depicted as Y in Table 7-11 under the Endicott, Badami, Far West Pad, Sourdough and Slugger Development, Scientific Research and Surveys, Subsistence Hunting, and Sport Hunting columns.

Porcupine Caribou Herd

Present and potential future external actions and potential effects identified above for the CAH eastern segment are the same for the PCH, and depicted as Y on Table 7-12.

Terrestrial Mammals

Present and potential future external actions and potential effects identified above for the CAH eastern segment are the same for the muskoxen, grizzly bears, moose, and Arctic fox, and depicted as Y on Table 7-13.

Cumulative Effects

Based on the analysis of potential impacts associated with the Point Thomson Gas Cycling Project, in conjunction with potential impacts from past, present, and potential future external actions, it was determined that cumulative effects on CAH, PCH, and terrestrial mammal populations in the analysis area due to habitat loss, disturbance, and mortality could occur. This is depicted as Y in Tables 7-11, 7-12, and 7-13 under the "Cumulative Effect?" column.

The likelihood that these cumulative effects could be significant is rated as low (Tables 7-11, 7-12, and 7-13). The rationale for determining the likelihood of significance is based on the following assumptions:

Habitat

- Habitat is not limiting for CAH, PCH, and terrestrial mammals.
- Potential future projects would have small footprints.

Disturbance

- Major construction of potential future facilities would occur in the winter when animals are not present in the area.
- Traffic volumes at Badami and future facilities would be low compared to traffic in the Prudhoe Bay and Kuparuk areas.
- Separation between potential future pipelines and gravel roads would be a sufficient distance to minimize disturbance and proved for successful crossings by animals.
- Potential future aboveground pipelines would be elevated to a sufficient height to allow successful movement by animals through the area.

Mortality

- Vehicle strikes would be minimized by enforced speed limits on current and potential future gravel roads.
- Mortality associated with scientific research and surveys rarely occurs.
- Direct kills from subsistence and sport hunting are small in number compared to overall population levels and monitored by State and Federal agencies.

Table 7-11 Central Arctic Caribou Herd Eastern Segment Cumulative Effect Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS										Cumulative Effect?	Likelihood That CE Could be Significant	Assumptions/Rational
			Human Controlled												
			Endicott[2]	Badami	Far West Pad	Sourdough Dev.	Slugger Dev.	Gas Sales PTU	Scientific Research & Surveys	Subsistence Hunting	Sport Hunting	Ecotourism			
HABITAT	Y (NS)[1]	N[1]	N/A	Y[3]	Y[3]	Y[3]	Y[3]	N/A	N/A	N/A	N/A	N/A	Y[1]	LOW	• Habitat is not limiting. • Potential future projects would have small footprints.
DISTURBANCE	Y (NS)[1]	N[1]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	Y[1]	LOW	• Major construction would occur in the winter. • Traffic volumes are low. • Separation between potential future pipelines and roads. • Sufficient elevation of potential future aboveground pipelines.
MORTALITY	Y (NS)[1]	N[1]	Y	Y	Y	Y	Y	N/A	Y	Y	Y	N/A	Y[1]	LOW	• Vehicle strikes minimized by enforced speed limits. • Mortality associated with scientific work rarely occurs. • Direct kills from hunting are small and monitored.

NOTES:
Y = Yes
N = No
N/A = Not applicable
Dev. = Development
PTU = Point Thomson Unit
NS = Not significant
CE = Cumulative Effect

Footnotes:
[1] = Analysis limited to the eastern segment of the Central Arctic Herd.
[2] = Endicott onshore road and associated pipeline from coastline to western boundary of Sagavanirktok River.
[3] = Habitat loss due to future potential gravel road(s) and pad(s).

Table 7-12 Porcupine Caribou Herd Cumulative Effect Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS										Cumulative Effect?	Likelihood That CE Could be Significant	Assumptions/Rationale
			Human Controlled												
			Endicott[2]	Badami	Far West Pad	Sourdough Dev.	Slugger Dev.	Gas Sales PTU	Scientific Research & Surveys	Subsistence Hunting	Sport Hunting	Ecotourism			
HABITAT	Y (NS)[1]	N[1]	N/A	Y[3]	Y[3]	Y[3]	Y[3]	N/A	N/A	N/A	N/A	N/A	Y[1]	LOW	• Habitat is not limiting. • Potential future projects would have small footprints.
DISTURBANCE	Y (NS)[1]	N[1]	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	Y[1]	LOW	• Major construction would occur in the winter. • Traffic volumes are low. • Separation between potential future pipelines and roads. • Sufficient elevation of potential future aboveground pipelines.
MORTALITY	Y (NS)[1]	N[1]	Y	Y	Y	Y	Y	N/A	Y	Y	Y	N/A	Y[1]	LOW	• Vehicle strikes minimized by enforced speed limits. • Mortality associated with scientific work rarely occurs. • Direct kills from hunting are small and monitored.

NOTES:

Y = Yes
N = No
N/A = Not applicable
Dev. = Development
PTU = Point Thomson Unit
NS = Not significant
CE = Cumulative Effect

Footnotes:

[1] = Porcupine caribou herd infrequently migrates to the Canning River area and westward to the Sagavanirktok River.
[2] = Endicott onshore road and associated pipeline from coastline to western boundary of Sagavanirktok River.
[3] = Habitat loss due to future potential gravel road(s) and pad(s).

Table 7-13 Terrestrial Mammal Cumulative Effect Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS										Cumulative Effect?	Likelihood That CE Could be Significant	Assumptions/Rational
			Human Controlled												
			Endicott[3]	Badami	Far West Pad	Sourdough Dev.	Slugger Dev.	Gas Sales PTU	Scientific Research & Surveys	Subsistence Hunting	Sport Hunting	Eco-tourism			
HABITAT	Y (NS)[1]	N	N/A	Y[4]	Y[4]	Y[4]	Y[4]	N/A	N/A	N/A	N/A	N/A	Y	LOW	• Habitat is not limiting. • Potential future projects would have small footprints.
DISTURBANCE	Y (NS)[1]	N	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	Y	LOW	• Major construction would occur in the winter. • Traffic volumes are low. • Separation between potential future pipelines and roads. • Sufficient elevation of potential future aboveground pipelines.
MORTALITY	Y (NS)[1]	Y[2]	Y	Y	Y	Y	Y	N/A	Y	Y	Y	N/A	Y	LOW	• Vehicle strikes minimized by enforced speed limits. • Mortality associated with scientific work rarely occurs. • Direct kills from hunting are small and monitored.

NOTES:
Y = Yes
N = No
N/A = Not applicable
Dev. = Development
PTU = Point Thomson Unit
NS = Not significant
CE = Cumulative Effect

Footnotes:
[1] = Analysis limited to the muskoxen, grizzly bears, moose, and Arctic fox.
[2] = Lingering past influence for moose only; no lingering influences were identified for muskoxen, grizzly bear, or Arctic fox.
[3] = Endicott onshore road and associated pipeline from coastline to western boundary of Sagavanirktok River.
[4] = Habitat loss due to future potential gravel road(s) and/or pad(s).

7.3.2.7 Threatened and Endangered Species

The cumulative impact analysis for threatened and endangered species is divided into separate discussions considering bowhead whales and spectacled eiders. As described in Section 5.2.7, Steller's eiders have not been recorded in the project area and are unlikely to occur there.

Bowhead Whales

The cumulative impact analysis for bowheads is summarized on Table 7-14 and described in the following paragraphs.

Internal Project Effects

Bowhead whale migration through the Alaskan Beaufort Sea occurs in spring and autumn. The spring migration occurs in a corridor that is located well offshore of Point Thomson (see Section 4.9.1.1). During the fall migration, a few bowheads could be encountered offshore of the project area in late August until the end of the migration in early October.

Potential project impacts on bowhead whales in the area can occur due to habitat loss and alteration, behavioral disturbance, and/or mortality.

Habitat Loss and Alteration

Section 5.2.7.2 concludes that effects of construction and operation of the proposed project on bowhead whales will be minimal. However, if disposed of late in August, increased turbidity due to spoils disposal offshore of the barrier islands could overlap with the beginning of the bowhead whale fall migration. A few animals could encounter a turbidity plume should this occur. The disposal site is not known at this time, and the potential size or duration of a plume has not been characterized. However, any turbidity generated by the plume would be short-term and may not extend far offshore into the migration corridor. Mitigation to minimize the impact will include ensuring that completion of the disposal operation occurs well before the migration period. Therefore, the potential impact on whale habitat is expected to be not significant, and Table 7-14 shows this potential project effects on habitat as Y (NS).

Disturbance

Behavioral disturbance to bowheads migrating offshore of the project area could be induced by:

- Generation of noise and activities associated with onshore and offshore construction during summer construction periods (i.e., construction equipment, dredging and spoils disposal, vessels, airplanes, helicopters and vehicles).
- Longer-term, but likely of less magnitude, generation of noise associated with operation or the facility. This could consist of generators, compressors and other machinery, and operations and maintenance-related vehicle traffic.

Section 5.2.5.2 concluded that construction sounds do not propagate very far (<40ft [12 m]) in shallow waters. In addition, LGL and Greeneridge (2001) determined that even when tugs and barges operated during construction activities at Northstar, broadband sound levels diminished to 115 decibels within an average of 2.5 mi (4 km). Bowheads could detect sounds at this level, but would not be expected to react to them (Williams et al 2001). Since much of the construction at

Point Thomson will be land-based as opposed to offshore, impacts of construction and operations noise on migrating bowhead whales are likely to be even less than those observed at Northstar. Any disturbance will also be mitigated by limiting vessel traffic to inside of the barrier islands and using over-land air routes during migration periods. For this reason, disturbance-related impacts on bowhead whales due to Point Thomson project actions are considered to be not significant. This determination is depicted as Y (NS) on Table 7-14.

Mortality

Direct mortality of bowheads from project actions could occur through:

- Collisions with vessels or barges
- Ingestion of spilled fuels and other operations-related materials (see Section 7.3.4 for a discussion of cumulative impacts of spills).

It is highly unlikely that project construction or operations activities in the nearshore region of Lions Lagoon could cause direct mortality for bowhead whales. During operations, mortality is also not expected due to the relatively small amount of vessel traffic expected for the project and the fact that the whales will be migrating far offshore of the area expected to be used by project vessels. Therefore, project-induced mortality is not anticipated to be an impact for bowhead whales, and is depicted as N on Table 7-14.

Past External Impacts

Past activities in the area of consideration for bowheads could have created additional disturbance or mortality for this species (see Table 7-2). Past external actions in the area include:

- Military operations particularly at the Bullen Point DEW line station.
- Oil and gas exploration, seismic investigations and drilling in the Badami and Point Thomson Units.
- Construction and operation of the Badami facility.
- Scientific research and surveys that have been conducted in the area.
- Flaxman Island Remediation – cleanup of several old exploration drill pads on the island could have caused disturbance to bowheads due to increased air and vessel traffic and noise from heavy equipment.
- Subsistence and Commercial hunting - commercial hunting in particular has likely added to population decline.

The magnitude of past impacts on bowheads due to habitat loss and disturbance from many of these external activities is unknown, but lingering effects on whale habitat are unlikely since the area used by these species is considerably removed from onshore impacts. Since the bowhead population is listed as endangered (see Section 4.9.1.1) lingering population effects due to past development, commercial hunting practices, and other external factors have been identified. These lingering effects are depicted as Y in this column for both disturbance and mortality.

Present and Potential Future External Actions

The following external actions, both human controlled and natural events, have been identified as potentially contributing to bowhead habitat loss, disturbance, and mortality effects in the vicinity of the Point Thomson project:

- Far West Pad, Slugger Development, Sourdough Development, and/or Gas Sales at Point Thomson – habitat alteration and disturbance to bowheads could occur if it became necessary to dredge offshore of either the Badami or proposed Point Thomson dock to support development of these facilities.
- Flaxman Island Remediation – continued cleanup of several old exploration drill pads on the island could cause disturbance to these whales due to increased air and vessel traffic and noise from heavy equipment.
- Scientific Research and Surveys – annual surveys by aircraft and possible collaring efforts could cause disturbance for bowhead whales either due to direct or indirect effects
- Subsistence hunting - could also add to any mortality or disturbance from project actions
- Offshore Seismic Exploration – could contribute to disturbance or mortality effects

Individually, many of these external factors could cause behavioral disturbance or mortality for bowheads. They are shown as Y, N, or N/A on Table 7-14. However, while the potential for an impact from these actions is identified, the significance of an impact from any given action is not rated (see Section 7.2.4).

Cumulative Effects

From the perspective of this project, a cumulative effect of mortality is not identified for bowhead whales. This is shown as an N on Table 7-14 under the cumulative effect column.

Based on the analysis of potential impacts associated with the Point Thomson Gas Cycling Facility, in conjunction with impacts from present and potential future external actions, it has been determined that cumulative effects on the bowhead population due to habitat alteration and disturbance could occur. However, the likelihood that the potential cumulative effect could be significant is low (see Table 7-14). The rationale for determining that the likelihood of significance will be low is based on the following assumptions:

- Incremental impact due to Point Thomson development is expected to be negligible.
- Turbidity impacts associated with other developments would be minor and are not likely to occur when whales are present.
- Bowheads typically migrate offshore of barrier islands; nearshore and onshore activities are not expected to cause an impact.
- Any offshore construction associated with Point Thomson and other developments would be timed so as not to impact migrating whales.
- Mitigation measures and non-harassment procedures would also be in place.

Spectacled Eiders

The cumulative impact analysis for spectacled eiders is summarized on Table 7-15 and described in the following paragraphs.

Internal Project Effects

As described in Section 5.2.7.1, the construction and operations activities associated with the Point Thomson Gas Cycling project can impact spectacled eiders. The project area is located at the eastern end of the species' range and large numbers of birds are not expected to be passing through (see Sections 4.11.2 and 5.2.7.1). However, one brood was observed south of Point Sweeney in July 1998. Point Sweeney is located about 2 mi (3.2 km) east of the proposed West Pad location. For this reason, and due to the fact that the spectacled eider is listed as a threatened species, potential project impacts due to habitat loss and alteration, behavioral disturbance, and/or mortality are considered:

Habitat Loss and Alteration

A brood consisting of one female and four young has been encountered in the project area. However, this sighting occurred several years ago and no other individuals have been observed in subsequent surveys (see Section 4.11.2). Most of the spectacled eiders were observed in the vicinity of the Kadleroshilik and Shavoivik rivers, located to the west of the Point Thomson Unit (see Section 4.11.2). As concluded in Section 5.2.7.1, the direct loss of habitat due to gravel placement could have a potential impact on the eiders because they prefer habitat in drained lake basins and wet coastal tundra for nesting and brood rearing. However, the footprint of the Point Thomson development is small relative to the amount of this habitat available in the area. Less than 10% of all habitats affected by gravel coverage in the Point Thomson area could be considered important habitats for use by spectacled eiders in the region. In addition, spectacled eiders have been known to use impoundments and are not expected to suffer adverse impacts if small areas of surface hydrology are changed due to ponding. Therefore on Table 7-15 potential project effects on habitat are identified, but are anticipated to be not significant. This is shown as Y (NS) on Table 7-15 for the potential project effects column.

Disturbance

Behavioral disturbance to any spectacled eiders found in the vicinity of the project area could be induced by:

- Generation of noise and activities associated with onshore and offshore construction during summer construction periods (i.e., construction equipment, vessels, airplanes, helicopters and vehicles; drilling noise is not expected to create an impact on these birds since at present drilling is only allowed during the winter months)
- Longer-term, but likely of less magnitude, generation of noise associated with operation or the facility. This noise could consist of generators, compressors and other machinery, drill rigs, and operations and maintenance-related vehicle traffic.

Behavioral disturbance of birds using habitats near the roads and pads and the types of potential effects on these species are discussed in Section 5.2.4.1. Similar responses are likely for any spectacled eiders that could use habitats near the Point Thomson facilities. Spectacled eiders have been observed to shift their distribution away from the Central Compressor Plant in the

Prudhoe Bay field, presumably due to increased noise output. A similar displacement is possible at Point Thomson depending on the expected noise of operations. Disturbance will be minimized however, due to the small potential for spectacled eiders to be found in the vicinity of the proposed Point Thomson CPF. For these reasons, a potential project effect of disturbance is identified for spectacled eiders, but the impact is expected to be not significant. This determination is depicted as Y (NS) on Table 7-15.

Mortality

Direct mortality of spectacled eiders from project actions could occur through:

- Collisions with construction equipment, vehicles, or vessels.
- Collisions with structures and aircraft.
- Flare heat-related impacts, particularly for flightless or molting birds caught under the flare tower during flare events.
- Increased predator populations (i.e., foxes, ravens, gulls) due to attraction to oil field facilities (feeding by employees, or incorrectly handled garbage).
- Ingestion of spilled fuels and other operations-related materials (see Section 7.3.4 for a discussion of cumulative impacts of spills).

There is some potential for increased mortality of spectacled eiders during poor weather conditions from collisions with elevated structures. The impact is likely to be limited because the large numbers of birds are not expected to be flying through the project areas (see Section 5.2.7.1). In addition, increased predation due to attraction of predators to the Point Thomson facilities could affect small numbers of breeding spectacled eiders. However, since so few of these birds have been observed in the project area, population level effects are not expected. The effect of mortality on spectacled eiders is considered to be not significant and is depicted as Y (NS) on Table 7-15.

Past External Impacts

Past activities in the area of consideration for spectacled eiders could have had created additional disturbance or mortality for this species (Table 7-2). Past external actions in the area include:

- Military operations particularly at the Bullen Point DEW line station.
- Oil and gas exploration in the Badami and Point Thomson Units.
- Construction and operation of the Badami facility.
- Scientific research and surveys conducted in the area could have caused disturbance and mortality.
- Subsistence hunting - while eiders are not specifically targeted by subsistence hunters, small numbers could be taken when hunting for other eiders.

The magnitude of past impacts on spectacled eiders due to disturbance from many of these external activities is unknown. However, since the species is listed as threatened and has exhibited declining population numbers, lingering impacts from any or all of these past actions are possible. Therefore, there is assumed to be lingering influence from past external actions on the spectacled eider population of the region due to habitat loss/alteration, disturbance, or

mortality. Table 7-15 depicts this conclusion as a Y for all three of these potential impact categories.

Present and Potential Future External Actions

The following external actions, both human controlled and natural events, have been identified as potentially contributing to habitat loss, disturbance, and mortality effects on spectacled eiders in the vicinity of the Point Thomson project:

- Badami – future expansion of onshore facilities could be required to support development in the Slugger Unit. Potential impacts could include spectacled eider habitat loss due to gravel placement, disturbance, and mortality.
- Far West Pad, Slugger Development, and Sourdough Development - impacts to spectacled eider habitat, and disturbance and mortality impacts due to construction and operation of pad facilities could be realized due to development of these areas.
- Gas Sales at Point Thomson - impacts could occur to spectacled eider habitat if it became necessary to enlarge pads.
- Scientific Research and Surveys - annual bird surveys and other research efforts could cause disturbance or mortality.
- Subsistence hunting - could also add to any mortality or disturbance from project actions

Individually, any of these external factors could impact spectacled eiders through habitat loss and alteration, disturbance or mortality. They are shown as either Y or N/A on Table 7-15. However, while the potential for an impact from these actions is identified, the significance of an impact from any given action is not rated (see Section 7.2.4).

Cumulative Effects

Based on the analysis of potential impacts associated with the Point Thomson Gas Cycling Facility, in conjunction with impacts from present and potential future external actions, it has been determined that cumulative effects on spectacled eiders due to habitat loss/alteration, disturbance, and/or mortality could occur. However, the likelihood that any of the potential cumulative effects could be significant is low (see Table 7-15). The rationale for determining that the likelihood of significance will be low is based on the following assumptions:

- Incremental impact due to Point Thomson development expected to be negligible.
- Point Thomson region is a marginal use area for spectacled eiders; area is at the eastern edge of their range.
- Nesting habitat for spectacled eiders in the area is not limiting.
- Any new developments will minimize footprint and mitigate impacts to spectacled eiders.
- Mitigation and avoidance of observed nest sites will minimize disturbance impacts.
- Surveys will continue to determine if nesting sites in the vicinity of development are used; these areas will be protected.
- Minimal mortality from subsistence hunting or scientific surveys would not contribute to population-level effects.

Table 7-14. Bowhead Whales Cumulative Effect Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS								Cumulative Effect?	Likelihood that CE Could Be Significant	Assumptions/Rationale
			Far West Pad[1]	Sourdough Dev.[1]	Slugger Dev.[1]	Gas Sales PTU[1]	Flaxman Island Rem.	Scientific Research & Surveys	Offshore Seismic Exploration	Subsistence Hunting			
HABITAT LOSS and/or ALTERATION[2]	Y(NS)[2]	N	Y[1,2]	Y[1,2]	Y[1,2]	Y[1,2]	N/A	N/A	N/A	N/A	Y	LOW	• Incremental impact due to Point Thomson development expected to be negligible • Turbidity impacts associated with other developments would be very minor and are likely to occur when whales are not present
DISTURBANCE	Y(NS)[3]	Y[4]	Y	Y	Y	Y	Y	Y	Y	Y	Y	LOW	• Incremental impact due to Point Thomson development expected to be negligible • Bowheads typically migrate offshore of barrier islands; nearshore and onshore activities not expected to cause an impact • Any offshore construction associated with other developments would be timed so as not to impact migrating whales • Mitigation measures and non-harassment procedures would also be in place
MORTALITY	N	Y[4]	N	N	N	N	N	N	N	Y	N[5]	N/A	N/A

NOTES:

Y = Yes
N = No
N/A = Not applicable
NS = Not significant
CE = Cumulative Effect
Dev. = Development

Footnotes:

[1]Only if existing dock at Badami or proposed Point Thomson dock is dredged for use by one of these other projects.

[2] Potential habitat impacts due to lingering increased turbidity in vicinity of bowhead migration route due to possible dredging and spoils disposal; duration expected to be short-term

[3]Non-significant effects since bowheads will not be in the area during winter construction. Summer dredging efforts will occur inside the barrier islands and spoils disposal will be completed prior to the fall migration. There could be some disturbance due to boat and vessel traffic, but will be mitigated.

[4]Lingering impact from commercial and subsistence hunting

[5]From the perspective of this project there is no cumulative effect since there is no expected impact on direct mortality from development of Point Thomson

Table 7-15. Spectacled Eider Cumulative Effects Analysis Summary

POTENTIAL IMPACT	Potential Project Effects?	Lingering Influence From Past External Action?	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS							Cumulative Effect?	Likelihood That CE Could Be Significant	Assumptions/Rationale
			Badami	Far West Pad	Sourdough Dev.	Slugger Dev.	Gas Sales PTU	Scientific Research & Surveys	Subsistence Hunting			
HABITAT LOSS and/or ALTERATION	Y(NS)[1]	Y[2]	Y	Y[3]	Y[4]	Y[4]	Y	N/A	N/A	Y	LOW	• Pt. Thomson project has minimal contribution to CE • Pt. Thomson region is a marginal use area for Spectacled eiders • Nesting habitat not limiting • Any new developments will minimize footprint and mitigate impacts to these birds • Surveys will continue to determine if nesting sites in the vicinity of development are used; these areas will be protected
DISTURBANCE	Y(NS)[5]	Y[2]	Y	Y[3]	Y[4]	Y[4]	Y	Y	Y	Y	LOW	• Mitigation and avoidance of observed nest sites will minimize disturbance impacts • Pt. Thomson region is a marginal use area for Spectacled eiders • Surveys will continue to determine if nesting sites in the vicinity of development are used; these areas will be protected
MORTALITY	Y(NS)[6]	Y[2]	Y	Y	Y[4]	Y[4]	Y	Y	Y[7]	Y	LOW	• Pt. Thomson region is a marginal use area for Spectacled eiders • Minimal mortality from subsistence hunting or scientific surveys would not contribute to population-level effects

NOTES:

Y = Yes
N = No
NS = Not significant
CE = Cumulative Effect

N/A = Not applicable
Dev. = Development
PTU = Point Thomson Unit

Footnotes:
[1]Although spectacled eiders prefer drained lake basins and wet coastal tundra for nesting and brood rearing, the population is not expected to suffer additionally due to changes in surface hydrology potentially caused by this project.
[2]Population has declined due to unknown causes leading to listing as a threatened species
[3]Nest site previously sighted near the proposed location of this pad
[4]Not generally found this far inland; impacts could only be realized if additional infrastructure at Badami or Point Thomson is built, or roads connecting the sites to existing developments are considered
[5]Very few of these birds found in the area; mitigation and avoidance of observed nest sites will minimize disturbance impacts
[6]Potential for collisions is limited since Pt. Thomson is at the eastern end of the species' range and large numbers of these birds are not expected to be passing through the area
[7]Not specifically targeted for subsistence but a few could be taken during hunting for other eider species

7.3.3 Socioeconomic and Cultural Resources

See Table 7-2 for a detailed description of external factors under consideration for cumulative impact, and Table 7-16 for a summary of the socioeconomic cumulative effect analysis. With regard to the geographic scope of consideration for cumulative effects on socioeconomic characteristics, some specific effects are evaluated on a regional and statewide basis. Potential population and employment effects are evaluated at the village, Borough and statewide levels. Fiscal effects are evaluated at the Borough and statewide level. In addition to immediate effects in the project area, land use effects are also evaluated on a regional basis. Finally, transportation effects on the North Slope and the Dalton Highway are also evaluated.

7.3.3.1 Population

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on population, see section 5.3.1. The principal effects can be summed up as follows:

- Population change in the State of Alaska, the NSB, and in individual North Slope villages resulting from jobs created through the construction and operation of the Point Thomson project

Past, Present and Reasonably Foreseeable Future External Considerations

External oil and gas exploration and development on the North Slope has not directly impacted the population of the NSB, although employment, income and tax revenue has allowed village and regional populations to remain relatively stable. While a high percentage of Alaska residents are employed, the majority of these are not residents of the NSB and commute between the North Slope and their areas of residence. A short-term increase in population numbers in the NSB may be noted during construction phases, as such activity generally requires a larger personnel. Even so, it is likely that some percentage of these jobs will be filled by local residents, thus decreasing still further the potential for a population influx. In the long-term, few people will be required on site to maintain operation of such facilities. These personnel are likely to be residents of the NSB or elsewhere in Alaska, and the projects will have little relative impact on NSB population.

Within individual villages, even small fluctuations in population numbers can be of significant impact; however, present or projected oil and gas development is unlikely to result in a direct population increase. The villages of Nuiqsut and Kaktovik are some distance from the project, and are inaccessible by road. Project access is by barge or aircraft from Prudhoe Bay or Endicott. The availability of oil and gas employment, however, could result in an indirect effect on the village populations. The Point Thomson project could help to offset the decrease in revenue, due to declining value of the oil and gas tax base, that has been projected for the NSB over the next few years. The NSB employs about two-thirds of the resident workforce (see Section 5.3.2), and a decline in NSB revenue may make continued residence in the villages more challenging. This is discussed at greater length in Section 7.3.3.3. However, to the extent that reasonably foreseeable oil and gas projects increase employment and the revenue of the NSB, they have the potential to influence native village populations by offsetting current trends.

With respect to the State of Alaska, many employees commute to the work site, and North Slope projects involve management personnel and related businesses which are often located in Anchorage. Given reasonably foreseeable oil and gas development projects and the historically high percentage of resident hire, a significant cumulative population increase in Alaska is not expected.

No other external factors are considered important to this analysis of cumulative population change in the NSB or the State of Alaska.

7.3.3.2 Employment and Income

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on employment and income, see Section 5.3.2. The principal effects can be summed up as follows:

- Job creation on the North Slope, with high Alaska-hire targets, benefiting the residents of the NSB and the State of Alaska

Past, Present and Reasonably Foreseeable Future External Considerations

External factors, in combination with the Point Thomson project appear likely to significantly benefit the economic environment in the NSB. The further development of oil and gas projects on the North Slope has the potential to provide employment for NSB residents, benefiting individuals directly and communities through the contract services provided by local Native Corporations. Previous experience on the North Slope indicates that it is more likely that jobs will taken by residents during the construction phases, where the seasonal nature of employment is better suited to the subsistence lifestyle, than the long-term operations jobs. Nonetheless, the projected development of a number of such projects would still benefit NSB residents for some years to come.

With the current forecast of reduction in NSB revenue over the next years due to decreasing returns on oil revenue taxation (as discussed in further detail in section 7.3.3.3), and the current importance of the NSB as a regional employer, the role of new revenues from developing oil and gas projects in offsetting any reduction in NSB jobs is also significant.

Viewed cumulatively, the net climate for employment and income in the NSB as analyzed from the perspective of the Point Thomson project is significantly beneficial.

The State of Alaska also benefits from job creation and employment related to North Slope oil and gas development. Further, the oil and gas development projects positively impact the State economy due to the demand for additional management employment and support services located around Anchorage. As with the NSB, revenue from oil and gas taxes and royalties fund State programs and related employment. The cumulative effect of Point Thomson and other oil and gas development creates a significant beneficial effect by maintaining or increasing indirect employment.

Additionally, media attention regarding potential oil development in ANWR has increased tourism and recreation to the area, the benefits of which are mainly captured by Alaskan firms that operate tours out of the major cities. Although it is obvious that these effects would be

beneficial, a more comprehensive analysis would be required to quantify the significance of these activities within the larger scope of the Alaskan State economy.

7.3.3.3 Public Revenue and Expenditures

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on public revenue and expenditures, see section 5.3.3. The principal effects can be summed up as follows:

- Funding for municipal employment, capital improvement plans, health and social services through incoming public revenue to the NSB and the State of Alaska derived from taxation and gas royalty revenue
- Offset of decreasing oil and gas tax base for the NSB and the State of Alaska

Past, Present and Reasonably Foreseeable Future External Considerations

Because the NSB is the municipal entity that taxes oil and gas revenue, the geographic scope for cumulative effects analysis includes the entire Borough. Similarly, the State of Alaska receives revenue from taxation and royalties associated with North Slope oil development, and is addressed in this analysis. The primary external factors for public revenues and expenditures are oil and gas development and operations on the North Slope, and current fiscal trends for both the NSB and State of Alaska.

The Point Thomson project, in combination with other pending North Slope oil and gas development, will result in significant benefits to both the NSB and the State of Alaska by providing revenue from development of oil and gas resources. Within the NSB, property tax revenues fund capital project programs and amortization of debt, health and social services, and result in the employment of NSB residents. Point Thomson and other reasonably foreseeable oil and gas revenues would partially offset a decline in public revenues associated with the decline in property value on the North Slope. The current decline in revenues makes it difficult to implement new NSB capital projects and maintain current levels of service and employment. Beneficial cumulative effects from the Point Thomson project are expected to be long term (i.e., for the life of the project).

Similarly for the State of Alaska, the decline in Prudhoe Bay oil production has resulted in a decrease in state revenues from property tax and royalties from the state owned share of the oil. In conjunction with other North Slope oil and gas development, development of Point Thomson will generate revenues that will fund State programs and services. Cumulative oil and gas development will also help offset the decline in state revenues for declining oil production.

7.3.3.4 Subsistence and Traditional Land Use

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on subsistence and traditional land use, see section 5.3.4. The principal effects can be summed up as follows:

- Disruption to subsistence use of marine resources, including whales and seals, and terrestrial resources
- Disruption, contamination or mortality of subsistence resources due to oil spills

Past, Present and Reasonably Foreseeable Future External Considerations

The cumulative impact of Point Thomson and other external factors on subsistence use of marine resources is unlikely to be great. There are two potentially harmful actions of reasonably foreseeable oil and gas development projects on marine resources: first, an increase in marine vessel traffic traveling along the coast and coming into the Point Thomson dock; and second, increased noise and activity onshore at the project site causing disturbance to marine mammals. The first of these is potentially the most significant in its impact on whales and whale migration patterns. The bowhead whale is of paramount cultural significance to the Native populations on the North Slope, and any action interfering with or altering the whales' migration pattern, and in particular driving them further offshore, would be significantly detrimental. This would have related effects of expense, safety, and harvest success of a whale hunt. Mitigation could be incorporated to avoid project related vessel traffic outside of the barrier islands during the time of the fall whale hunt. Vessel traffic may have localized impact on seals, but the Point Thomson coastline is not an important site for subsistence sealing.

Regarding the second potential impact, noise and activity onshore, this would be of less significance with the future projects as they are planned on the far side of the Point Thomson project. There is little chance that any noise from the projects would be sufficient to pass beyond the barrier islands to affect the whales. For seals, again, any impact would be localized, and neither Nuiqsut nor Kaktovik villagers depend upon the area for sealing.

Disruption to the use of terrestrial subsistence resources is also a potential impact, with the primary concern being the effects on the caribou herds. The reasonably foreseeable gas and oil developments should not, however, provide a barrier to migration, as there would still be plenty of area for caribou to pass through. The cumulative loss of habitat through development from subsistence access is not anticipated to present an adverse impact, as the lands in question are not relied upon for terrestrial subsistence use.

Competition for subsistence resources is a potential impact of the Point Thomson project. There is potential for additive cumulative effect when the increase in staff employed at Point Thomson as well as other oil and gas projects is taken into consideration. However, this effect should not be significant since appropriate mitigation measures would be enforced to prohibit project personnel from engaging in sports fishing and hunting at project sites.

The contamination and mortality of subsistence resources is a potential effect, which is amplified by additional oil and gas developments in the region. The impact related to cleanup of an oil or gas spill in any of these facilities would most likely be of short-term duration, but depending on the range and direction of impact could still be significant to local populations. Subsistence might be adversely affected by local perception of contamination, even if the actual effects were harmless or dissipated. Perceived contamination of subsistence resources and related subsistence effects, regardless of the size of a spill, can be more long-term in nature. The risk of occurrence of a spill is statistically increased by further oil and gas development in the region. However, the contribution of Point Thomson development is minimal given its location onshore and low probability of a spill reaching the marine environment.

7.3.3.5 Land Ownership, Use and Management

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on land ownership, use and management, see section 5.3.5. The principal effects can be summed up as follows:

- Regional gas and oil development in an area where activities have been limited to exploration, clean-up, and scientific studies
- Extension of relatively contiguous onshore oil and gas land use to the east

Past, Present and Reasonably Foreseeable Future External Considerations

Historically, the Point Thomson area, including Flaxman Island and the Sourdough prospect, has been explored for oil and gas resources and has been the subject of related scientific studies. These land uses have been seasonal and temporary, supported by temporary facilities. They have not resulted in a cumulative long-term change in land use, nor have they generated significant conflicts with other uses of the area (subsistence, recreation), which also tend to be seasonal and intermittent.

Development of Point Thomson could facilitate development of the Sourdough prospect by sharing infrastructure and reducing development costs. Should this occur, operational facilities and infrastructure would be developed in an area where there are no year-around structures, and there would be a long-term change in land use. Potential cumulative land use conflicts would be greatest for recreation use along the Canning River, roughly four mi (6.4 km) to the east within ANWR. Some project facilities and operational noise would be detectable to recreation users and may affect the quality of the recreational experience (see Section 7.3.3.7 for further detail), although these impacts could be, at least partially, mitigated. Historic and current subsistence use of the area is primarily opportunistic and infrequent. Cumulative land use conflicts are not expected to be significant (see Section 7.3.3.4 for further detail)

From a perspective of changes in regional land use change, development of Point Thomson will extend long-term oil and gas development eastward along the northern portion of the Arctic coastal plain. The current limits of developed oil and gas facilities on the North Slope are the Alpine field to the west and Badami to the east. Linking the Point Thomson facility to Badami with a pipeline, and potentially facilitating the development of Sourdough and Slugger prospects, would extend relatively contiguous oil and gas development on the North Slope another 30 mi (48 km) eastward.

7.3.3.6 Transportation

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on transportation, see section 5.3.6. The principal effects can be summed up as follows:

- Increase in marine, highway, and aircraft traffic into the North Slope region

- Increase in marine and aircraft traffic along the coast between Prudhoe Bay and Point Thomson

Past, Present and Reasonably Foreseeable Future External Considerations

The Point Thomson project is likely to increase the number of marine vessels traveling along the north coast between Prudhoe Bay and Point Thomson associated with construction and operation activity support. Cumulative effects would occur in conjunction with marine support for Badami and development of Sourdough and Slugger Prospects. The potential impacts of more marine traffic include disturbance or disruption of local subsistence resources and activities as well as aesthetic detraction for visitors and residents transiting the area. Various external factors potentially occurring concurrently with the Point Thomson project during its scope of operation may amplify the significance of this project impact. Other projected gas and oil developments could utilize the Point Thomson dock, and so to some extent these projects will be able to combine their resupplying journeys. These projects are likely to provide a significant increase to the marine traffic along the north coast during their construction phases, however it is likely that once in operation the increase will cease to be significant. Other sources of marine traffic are scientific research and survey teams exploring along the north coast. It is unknown to what degree these are likely to be significant during the temporal scope of the Point Thomson project, however, it is probable that they will continue at similar levels to the present, which should not cause an undue impact on local resources or the aesthetic environment.

A specific marine transportation impact is the increase in volume of annual sealifts required in order to transport project related construction modules to the North Slope. This impact would be proportionately additive for each new construction project in the region. Planning should, however, be sufficient to mitigate any adverse effect of such increases.

The Point Thomson project does not generate a significant impact on overland vehicular traffic within the North Slope as no direct land access route has been planned connecting the project with the road system. There may be some project specific construction of ice roads, and some associated traffic, but would be seasonal in nature. It is expected that the same model would be followed for other gas and oil developments projected in the region.

The Dalton Highway will experience an increase in traffic due to the Point Thomson project. The other potential gas and oil projects in the region would amplify this increase for the transportation of materials and supplies, which would be most evident during their construction phases. If such projects follow the pattern of Point Thomson, the cumulative traffic increase should not be significant.

Air traffic is the other principal transportation impact of the Point Thomson project. An increase in air trips both between the project and Prudhoe Bay, and from other principal support locations would occur. As before, projected gas and oil developments in the Point Thomson region would have a similar impact. In the case of aerial travel, another external factor is also at play. The recent media attention over oil development in ANWR has spurred an increase in tourism to that area. Such trips are generally run by charter services out of Fairbanks, and an increase in aircraft over the Point Thomson and ANWR region will most likely results. The increase in the number of aircraft flying in the region may degrade the quality of the aesthetic environment for residents and visitors, through noise and visual impacts. The increases are more likely to be limited to the summer months, and are not expected to be significant.

7.3.3.7 Recreation

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on recreation, see section 5.3.7. The principal effects can be summed up as follows:

- Impairment of localized recreational experience along the Canning River, in ANWR, and elsewhere in the Point Thomson area due to the presence of an industrial facility.

Past, Present and Reasonably Foreseeable Future External Considerations

One destination for tourism on the North Slope is the ANWR, where most visitors float down the Canning River and other rivers. This activity takes place during the summer months; currently existing oil development on the Slope is not visible from ANWR and does not affect the experience. Unlike prior North Slope development, the Point Thomson unit will be within sight and earshot of a portion of a Canning River float trip, and likewise potential future regional development (such as Sourdough) on the ANWR border. Potential Sourdough development would be closer to an airstrip used to take off from the Canning River, located about 19 mi (31 km) to the southeast of Point Thomson. Visitors coming to ANWR may consider the presence of an industrial facility to be an impairment of their recreational experience. While each additional industrial facility on the horizon would not necessarily capture the full detrimental impact of the first (Point Thomson), nonetheless, the cumulative effect of all such development on visitors floating the Canning River could be significantly adverse.

7.3.3.8 Aesthetic Value

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on aesthetic value, see section 5.3.8. The principal effects can be summed up as follows:

- Decrease in localized aesthetic environment, both visual and aural, for North Slope visitors and residents.

Past, Present and Reasonably Foreseeable Future External Considerations

The Point Thomson facility, when taken with other external effects, does have the potential to cumulatively impact the aesthetic experience for residents of the North Slope and visitors who transit the area. The increased presence of people and buildings in the region, both due to oil and gas development projects, and heightened interest in North Slope tourism and recreation, actively impair the aesthetic surroundings, with obtrusive noise and activity, unnatural visual horizon features, and occasional flares. Taken cumulatively, the aesthetic environment for North Slope residents and visitors who use the area has the potential to be significantly and adversely affected by the Point Thomson project when viewed in the context of other external effects. However, use of the area is relatively infrequent and occurs primarily during a short summer and fall season.

7.3.3.9 Cultural Resources

Internal Effects

For a detailed discussion of the potential direct and indirect effects of the Point Thomson project on cultural resources, see section 5.3.9. The principal effects can be summed up as follows:

- Disruption, artifact removal, or destruction of cultural resource sites, both identified and undiscovered, in the region.

Past, Present and Reasonably Foreseeable Future External Considerations

Any new development that increases the number of persons present in the region also increases the possibility for disruption or destruction to cultural resource sites. While measures can be taken to protect those sites which have been identified, undiscovered sites are susceptible to damage in direct correlation to the number of construction activities and people in the region. There are a number of factors that lead to an increased human presence in the eastern North Slope. These include personnel related to oil and gas exploration and development, scientific research and survey teams, and tourists and recreationalists including those present for sports fishing and hunting. Because of the ability to mitigate any potential adverse effects once sites have been discovered, however, and the inclusion of cultural resource site surveyance in the planning of any location-specific activity in the area, it is unlikely that the cumulative effect of human presence in the area will be adversely significant.

Table 7-16. Socioeconomic and Cultural Resources Cumulative Effect Analysis Summary

PROJECT IMPACT	DURATION	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS					CUMULATIVE EFFECT?	LIKELIHOOD THAT CUMULATIVE EFFECT WILL BE SIGNIFICANT	ASSUMPTIONS / RATIONALE
		Oil and Gas Exploration and Development	Pollutants	Sports Fishing and Hunting	Decrease in NSB property values / taxes	Tourism / Recreation			
POPULATION									
Population change in NSB	construction & operations	N	N	N	N	N	N		
Population change in AK	construction & operations	Y	N	N	N	N	N		
Population change in NSB villages	operations	Y	N	N	Y_+	N	Y	Low	• Employment opportunities and increases in NSB revenues would offset current declines
EMPLOYMENT									
Increase in employment opportunities in NSB	construction & operations	Y_+	N	N	Y_+	N	Y	High	• Project-generated local employment is significant in a climate of decreasing NSB and other employment opportunities
Increase in employment opportunities in AK	construction & operations	Y_+	N	Y_+	Y_+	Y_+	Y_+	High	• A high Alaska-hiring target is anticipated for this project • Project-generated Alaska-resident employment is significant given present trends in declining employment in the oil and gas sector of the Alaska economy
PUBLIC REVENUES AND EXPENDITURES									
Increased public revenues to NSB (capital improvement plans, health and social services by NSB)	operations	Y_+	n/a	N	Y_+	N	Y_+	High	• Project-generated revenue for the NSB is significant in a climate of decreasing NSB revenues
Indirect employment benefits (NSB as employer)	operations	Y_+	n/a	N	Y_+	N	Y_+	High	• Project-generated NSB revenue that funds local employment is significant in a climate of decreasing NSB and other employment opportunities
Increased public revenues to AK (capital improvement plans, health and social services by NSB)	operations	Y_+	n/a	N	Y_+	N	Y_+	High	• Project-generated revenue for the State of Alaska is significant in a climate of decreasing State of Alaska revenues
Indirect employment benefits (AK as employer)	operations	Y_+	n/a	N	Y_+	N	Y_+	High	• Project-generated State of Alaska revenue that funds state employment is significant in a climate of decreasing State of Alaska and other employment opportunities

Table 7-16. Socioeconomic and Cultural Resources Cumulative Effect Analysis Summary

PROJECT IMPACT	DURATION	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS					CUMULATIVE EFFECT?	LIKELIHOOD THAT CUMULATIVE EFFECT WILL BE SIGNIFICANT	ASSUMPTIONS / RATIONALE
		Oil and Gas Exploration and Development	Pollutants	Sports Fishing and Hunting	Decrease in NSB property values / taxes	Tourism / Recreation			
SUBSISTENCE									
Disruption of fall whale hunt	construction & operations	Y	N	N	n/a	N	Y	Low	• Incremental impact due to Point Thomson development expected to be negligible • Bowheads typically migrate offshore of barrier islands; nearshore and onshore activities not expected to cause an impact • Any offshore construction associated with other developments would be timed so as not to impact migrating whales • Mitigation measures and non-harassment procedures would also be in place
Disruption of sealing and other marine subsistence	construction	Y	N	N	n/a	N	N		
Disruption to subsistence use of terrestrial mammals	construction	Y	N	N	n/a	U	Y	Low	• Major construction would occur in the winter. • Traffic volumes are low. • Separation between potential future pipelines and roads. • Sufficient elevation of potential future aboveground pipelines.
Competition for subsistence resources	construction & operations	Y	n/a	Y	n/a	N	N		
Disruption/mortality/contamination of subsistence resources from oil spill or cleanup activities	short-term	Y	Y	n/a	n/a	Y	Y	Low	• Probability of a spill occurring is extremely low • Mitigation measures and spill prevention response measures would be in place
Perception of contamination of subsistence resources by native villages	long-term	Y	Y	n/a	n/a	Y	Y	Low	• Probability of a spill occurring is extremely low • Mitigation measures and spill prevention response measures would be in place
LAND USE									
Point Thomson area gas and oil development	operations	Y	n/a	n/a	n/a	Y	Y	High	• Facilities constructed for this project could be used to support the development at Sourdough and Slugger prospects

Table 7-16. Socioeconomic and Cultural Resources Cumulative Effect Analysis Summary

PROJECT IMPACT	DURATION	PRESENT and POTENTIAL FUTURE EXTERNAL ACTIONS					CUMULATIVE EFFECT?	LIKELIHOOD THAT CUMULATIVE EFFECT WILL BE SIGNIFICANT	ASSUMPTIONS / RATIONALE
		Oil and Gas Exploration and Development	Pollutants	Sports Fishing and Hunting	Decrease in NSB property values / taxes	Tourism / Recreation			
Extension of North Slope onshore oil and gas development to the east	operations	Y	n/a	n/a	n/a	Y	Y	High	• Project represents an expansion of oil and gas land use east of the existing development at Badami
TRANSPORTATION									
Increased vessel traffic on annual sealift	construction	Y	n/a	n/a	n/a	Y	Y	Low	• Any significant effect can be mitigated through logistical planning
Increased traffic on Dalton Hwy and within Prudhoe Bay	construction	Y	n/a	Y	n/a	Y	Y	Low	• The direct volume of increased traffic on the Dalton Highway is not significant
Increased marine traffic along coast	construction & operations	Y	n/a	n/a	n/a	Y	Y	Low	• The direct volume of increased marine traffic along the coast is not significant
Increased air traffic on the North Slope	construction & operations	Y	n/a	n/a	n/a	Y	Y	Low	• The direct volume of increased aerial traffic on the North Slope is not significant
RECREATION									
Impairment of localized recreational experience through presence of industrial facility within view and earshot	construction & operations	Y	n/a	n/a	n/a	Y	Y	High	• Introduction of construction and operation of industrial facilities and activities into a relatively undeveloped area adjacent to non-resident recreation areas
AESTHETIC VALUES									
Decrease of localized aesthetic beauty for residents	construction & operations	Y	n/a	Y	n/a	Y	Y	Low	• Borough residents infrequently use the project area
Decrease of localized aesthetic beauty for visitors	construction & operations	Y	n/a	Y	n/a	Y	Y	High	• Introduction of construction and operation of industrial facilities and activities into an undeveloped area adjacent to non-resident recreation areas
CULTURAL RESOURCES									
Disturbance to or destruction of cultural resource sites	construction	Y	n/a	Y	n/a	Y	Y	Low	• Mitigation measures for avoiding disruption to or destruction of cultural resources sites will be implemented

NOTES:

Y = Yes

Y_+ = Yes (emphasizes the effect is beneficial rather than adverse)

N = No

n/a = not applicable

7.3.4 Oil Spills

In considering whether the Point Thomson project has a significant cumulative effect related to oil spills, the impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions in the vicinity is considered. Cumulatively, the effect of existing and reasonably foreseeable future actions is to increase the probability that such a spill, and related adverse effects, will occur.

In addition to Pt. Thomson, the projects included in this cumulative analysis include the existing Badami oil development and the reasonably foreseeable crude oil prospects at Sourdough and Slugger. All of these projects are located onshore, thus minimizing the risk of a large offshore oil spill.

The probability of a major spill associated with the Point Thomson project is low. No significant oil spills from well blowouts associated with natural gas developments are known to have occurred. In Section 5, the probability of an oil spill at Point Thomson was discussed and determined to be similar to Badami's exploration and production spill history which consists of a total of three spills ranging from 55 to 150 gallons (209 to 570 liters) since 1987. In regards to pipeline spills, there are no records of large spills (i.e., 1,000 barrels or more) since 1981 related to North Slope production, which has over 1,100 mi (1,700 km) of onshore pipeline and has produced over 13 billion barrels through 1999 (MMS 1998). In fact, there are no large spills on record at North Slope oil wells, facilities and feeder pipelines leading to the Trans Alaska Pipeline System (TAPS) Pump Station #1 (ITC 2001). MMS (1998) estimated cumulative oil spill occurrence in northeastern National Petroleum Reserve Alaska (NPRA) is 26 to 119 spills with a total volume ranging from 104 to 476 bbl. When compared with the projected Pt. Thomson spill occurrence of about one spill per year averaging about 2.6 bbl, this data corresponds to Point Thomson contributing a negligible percentage of the total oil spills for this cumulative impact analysis. Additionally, the chance of spills occurring at multiple projects at the same time is also very low, thus reducing the overall cumulative effects from oil spills on individual resources.

Given this risk data, the following cumulative effects discussion focuses on small onshore oil releases, primarily due to pipeline and other equipment failure/leaks, consisting of crude and refined oils rather than natural gas/condensate.

7.3.4.1 Fish

Marine and diadromous fishes are widely distributed across the Beaufort Sea nearshore waters and fish exist in freshwater streams and ponds. Small numbers of fish in the immediate area of an offshore or onshore oil spill may be killed or otherwise harmed, but an oil spill assumed by this analysis is not expected to have a measurable effect on fish populations.

The cumulative effect of oil spills on fishes would depend on the number of spills, the season and time of exposure, the hydrocarbon concentration, and stage of fish development for each spill encountered. As stated previously, the risk of an offshore spill is very small at any of the projects considered in this analysis.

Onshore, over-wintering areas may be effected by contact with oil during winter spills. During summer, if a sufficiently sized spill occurred in a small fish-bearing waterbody with limited

water exchange, the fish and food resources in that waterbody may be harmed or killed. Sub-lethal effects may occur, including temporary displacement and changes in growth, feeding, and productivity. Due to the low diversity and abundance of fish onshore near Point Thomson, the unlikelihood of a spill interrupting fish migrations or occurring in overwintering areas, an onshore oil spill associated with Pt. Thomson is not expected to have a measurable effect on fish populations.

While small numbers of fish in the immediate area of an oil spill may be killed or harmed, oil spills are not expected to have measurable cumulative effects on fish populations.

7.3.4.2 Whales

The cumulative effects of oil spills on whales is expected to be low since it is unlikely that any significant offshore spills will occur from any of the projects considered in this analysis. Very few bowheads occur near the study area until the migration period from September through October, and only strays are likely to travel close enough to shore to come within range of any small oil spill associated with barges or other nearshore spills from the projects considered in this analysis. Contact with spilled oil in the Beaufort Sea may cause temporary, non-lethal effects to some bowhead and beluga whales, but the amount of oil that would be required to kill a whale is not expected to occur offshore of the study area. Non-lethal effects include inhalation of hydrocarbon vapors, ingestion of oil (either directly or by contaminated prey), displacement or loss of prey to the oil spill, skin and sensory organ damage, and baleen fouling which may decrease feeding efficiency.

Activities not related to oil and gas may contribute to cumulative effects on whales. These include entrapment in fishing nets, collisions with ships, and subsistence and cultural harvest by Native Alaskan and Russian whalers under authorized quota by the International Whaling Commission.

However, offshore spills are not likely within the study area, and even less likely within the whale migration corridor located outside of the barrier islands. Therefore, the cumulative effect of oil spills on whales in the study area is expected to be unmeasurable.

7.3.4.3 Seals

Similar to whales, the cumulative effects of oil spills on seals is expected to be low since it is unlikely that any significant offshore spills will occur from any of the projects considered in this analysis. Small oil spills associated with barge leaks or other minor nearshore spills from the projects considered in this analysis may cause direct oiling of ringed or bearded seals, which may contribute to cumulative effects. Seal densities are lower inside of the barrier islands, especially during winter; however, seals are present in open-water areas during summer and early autumn. Therefore, impacts on local populations of seals may occur if oil is spilled in the coastal areas. Depending on the extent of oiling and the characteristics of the oil, externally oiled seals often survive and become clean with only temporary effects such as eye and skin irritation (MMS 1996). The size of spill required to cause seal mortality is not probable. Activities not related to oil and gas, such as Native Alaskan subsistence harvest and entrapment in nets may contribute to the cumulative effects on seals. Since a large offshore oil spill is unlikely within the study area, the risk of a seal coming into contact with spilled oil from Point Thomson is low.

7.3.4.4 Polar Bears

The cumulative risks from oil spills to polar bear habitats within the area of this analysis are lower than risks from other contributing activities. The majority of bears spend their time on the pack ice, located offshore of the barrier islands, however polar bears can be found onshore feeding on whale carcasses and they occasionally den onshore. Polar bears may not avoid oiled areas and may consume oiled prey or oil from grooming. Oiling reduces insulation quality of the fur and will cause significant thermo-regulatory problems. Ingested oil can lead to toxic internal effects including anemia and renal impairment. Indirect effects include the loss of food sources, toxic effects from ingesting contaminated prey, and possible displacement caused by disturbance during spill cleanup activities. Polar bear mortality caused by Alaska Native harvest in this area is low, since most kills are due to opportunistic kills rather than intentional hunting.

Past exploration and drilling operations have displaced a few bears but have had no known effect on the polar bear population (MMS 2001). Most likely, only the occasional onshore polar bear that is oiled due to contact with an onshore spill may be effected. Since the probability of a large spill within the study area is low, the potential for polar bears to contact spilled oil from this project is also low. Thus, Point Thomson's contribution to the cumulative effect on polar bears from spilled oil is considered to be insignificant.

7.3.4.5 Birds

The effects of an oil spill on birds will vary depending on the season. For example, spills occurring in the winter should not have an immediate effect on birds since they are not present in the area. Any oil remaining the following spring may affect birds by contact with the oil or by reduction or contamination of food sources. However, this effect would be minimized by winter cleanup efforts. A large onshore spill during the summer could cause losses of molting and broodrearing waterfowl if it enters a heavily used lake, plus smaller numbers of nesting waterfowl, shorebirds, and passerine birds. Mortality from small spills, whether originating from field pipelines or spills of refined products, is expected to be prevented by expedient cleanup. In general, Pt. Thomson is expected to be a minor contributor to the cumulative case and most spills are expected to be cleaned up before measurable cumulative effects to birds can occur.

7.3.4.6 Caribou and Other Terrestrial Mammals

Terrestrial mammals, including caribou, muskoxen, moose, grizzly bear, and fox that become oiled by direct contact with spilled oil could die from inhalation of toxic hydrocarbons or adsorption through the skin (MMS, 1996). Caribou are the most likely to contact oil spilled offshore if the oil is washed onto the beaches where caribou may go to escape from insects.

Small spills of either crude or refined petroleum products could occur onshore near pipelines, roads, and other facilities. These minor spills would have a very small additive effect on terrestrial mammal habitats near these areas since most spills occur on gravel areas and minimal vegetated area is expected to be affected (See Section 7.3.4.8). Caribou and muskoxen probably would not ingest oiled vegetation because they are selective grazers. Grizzly bears and foxes may be indirectly affected by feeding on oiled prey. Control and cleanup operations at a spill site may disturb and temporarily displace most terrestrial mammals away from the spill area, thereby avoiding contact with oil. Hence, any expected oil spills from Point Thomson and other

existing and reasonably foreseeable oil and gas developments are expected to have little cumulative effect on caribou, muskoxen, moose, grizzly bear, fox and other terrestrial mammals.

7.3.4.7 Threatened and Endangered Species

Bowhead whales and spectacled eiders are on the federal threatened and endangered species list and are known to occur within the area considered for this cumulative analysis. Point Thomson is not expected have a significant contribution to the cumulative effects caused by oil spills on these species.

The Western Arctic stock of bowhead whales is listed as endangered and classified as a strategic stock by the National Marine Fisheries Service. The cumulative effects of oil spills on whales, discussed previously in Section 7.3.4.2, also pertain to bowhead whales.

Spectacled eiders are listed as threatened by U.S. Fish and Wildlife Service and are known to nest within the area considered for this cumulative analysis, specifically in the vicinity of Badami. They nest close to shore above the high tide line during June. In the unlikely event of an onshore pipeline spill in this area, nests or breeding birds could be directly affected. The cumulative effect of numerous small spills projected over the entire life of oil and gas projects considered in this cumulative analysis would more likely result in greater mortality rates than that from a pipeline leak near Badami. Although most small spills are expected to be cleaned up before many eiders come into contact with the oil, if a moderately sized onshore spill entered freshwater habitat during the summer, eider mortality could occur (MMS 2001). Overall, Point Thomson is not expected to contribute much to the cumulative effect of oil spills on eiders due to the rarity of eider occurrence in the project area.

7.3.4.8 Vegetation

Historically, construction causes more than 99% (acreage wise) of the effects on vegetation and spills cause relatively little destruction of vegetation. The additive effect of onshore spills would cause minor damage and vegetation should recover within a few years (MMS 2001).

Most onshore spills occur on gravel pads, and their effects do not reach the vegetation. A majority of oil spills cover less than 0.01 acre (<1 ha), but if the spill is a windblown mist, it may cover up to 4.8 acres (1.9 ha) (MMS 2001). In the past, only 20-35% of crude-oil spills reached areas beyond pads (MMS 2001). The corresponding proportion for refined oil is likely to be much lower. Since winter conditions exist most of the year, about 60% of the time when spills occur, the oil can be cleaned up from the snow cover before it reaches the vegetation. Thus an estimated 11% of all onshore spills could affect vegetation. Overall, past spills on Alaska's North Slope and along the TAPS have caused minor ecological damage and ecosystems have shown a good potential for recovery. For these reasons, unmeasurable cumulative effects on vegetation due to oil spills are expected.

7.3.4.9 Subsistence

The cumulative effect of oil spills on subsistence harvest is difficult to measure due in part to human perceptions and confidence regarding species health. An oil spill, if it occurred and affected any part of the bowhead whale's migration route, could impact this culturally important resource. Hunting whales, polar bears, and/or seals may be disrupted, regardless of whether

sufficient numbers of these animals are available for harvest, due to traditional and cultural concerns of contamination that may make these animals less desirable. In the unlikely event of a large oil spill, subsistence resources could be affected in Kaktovik and possibly Nuiqsut. Additionally, a large spill could cause short-term but potentially significant effects to oldsquaw and other subsistence bird populations, and a large onshore pipeline spill that contacted fish-bearing streams could affect some fish populations. Details on the effects of spilled oil on each resource were discussed previously in this section.

7.3.4.10 Socioeconomic

If a large oil spill, or numerous simultaneous smaller spills occurred anywhere in the study area, cleanup activities may generate jobs. Based on the Exxon Valdez spill, Native residents were employed in cleanup work and losses of subsistence resources were alleviated by the significant increase in income by many residents. Many North Slope Borough residents have been trained in cleanup procedures and have indicated interest in participating in any cleanup response activities (Lampe 1999).

7.3.4.11 Summary

In summary, the incremental contribution of the Pt. Thomson project to any cumulative effects related to oil spills is minimal. The potential for cumulative effects due to offshore and onshore oil spills was identified. The Point Thomson project, in conjunction with existing and reasonably foreseeable future developments (Badami, Sourdough, and Slugger) are unlikely to cause offshore oil spills (see Section 7.3.4). Therefore, the potential for an oil spill from these facilities to cause a significant cumulative effect on marine resources is considered low.

Potential onshore oil spills associated with the Point Thomson project as well as the existing and reasonably foreseeable future developments described above, are anticipated to be small in volume and readily cleaned up to minimize effects. Additionally, is unlikely that large oil spills would occur at multiple locations at the same time such that the magnitude of effects is increased. Therefore, resources are expected to recover from a potential disturbance caused by an oil spill before any measurable increase in cumulative effects occurs. For these reasons, the potential for an onshore oil spill(s) from these facilities to cause a significant cumulative effect is rated as low.

7.4 CUMULATIVE EFFECTS SUMMARY

Analyses were conducted to assess the potential for project actions in combination with external actions from the past, present, and reasonable foreseeable future to cause a cumulative effect. The likelihood that an identified cumulative effect could be significant was rated as either high or low based on available information and basic assumptions. Table 7-17 summarizes the results of the cumulative effect analyses conducted for physical/chemical, biological, and socioeconomic and cultural resources.

Table 7-17 Cumulative Effects Summary
Physical/Chemical, Biological, Socioeconomic, and Cultural Resources

RESOURCE/IMPACT	CUMULATIVE EFFECT IDENTIFIED?		LIKELIHOOD THAT CUMULATIVE EFFECT COULD BE SIGNIFICANT
	Yes	No	
Physical/Chemical			
Air Quality	✓		LOW
Surface Hydrology	✓		LOW
Freshwater Quality	✓		LOW
Marine Water Quality	✓		LOW
Marine Circulation	✓		LOW
Permafrost/soils	✓		LOW
Marine Benthos			
Habitat Loss and Mortality	✓		LOW
Habitat Alteration and Disturbance	✓		LOW
Vegetation			
Habitat Loss and/or Alteration	✓		LOW
Fish			
Habitat		✓	N/A
Disturbance	✓		LOW
Mortality	✓		LOW
Birds			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Pinnipeds			
Disturbance	✓		LOW
Mortality		✓	N/A
Polar Bears			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Central Arctic Caribou Herd			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Porcupine Caribou Herd			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Other Terrestrial Mammals			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Bowhead Whales			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality		✓	N/A

Table 7-17 (Cont.) Cumulative Effects Summary
Physical/Chemical, Biological, Socioeconomic, and Cultural Resources

RESOURCE/IMPACT	CUMULATIVE EFFECT IDENTIFIED?		LIKELIHOOD THAT CUMULATIVE EFFECT COULD BE SIGNIFICANT
	Yes	No	
Spectacled Eider			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Socioeconomics			
Population Increase		✓	N/A
Increase in Employment Opportunities	✓		HIGH
Increase in Public Revenues	✓		HIGH
Subsistence			
Disruption of fall whale hunt	✓		LOW
Disruption of other marine subsistence		✓	N/A
Disruption or competition to terrestrial subsistence resources	✓		LOW
Disruption from contamination or perception of contamination	✓		LOW
Land Use			
Extension of gas and oil development	✓		HIGH
Transportation			
Increased marine, terrestrial and aerial traffic	✓		LOW
Recreation			
Impairment of localized recreational experience	✓		HIGH
Aesthetic Values			
Decrease in localized aesthetic beauty to residents	✓		LOW
Decrease in localized aesthetic beauty to visitors	✓		HIGH
Cultural Resources			
Disturbance to Destruction of Cultural Resource sites	✓		LOW

[1]Disturbance and mortality effects considered as habitat loss.
[2]Habitat effects considered under context of disturbance

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