

Workshops on the application of the guidelines are expected prior to this winter's operating season. The workshops, coupled with the biophysical inventory (IEG 2001), will help to build the capacity for assessing the cumulative effects of oil and gas activities.

### 6.1 Past, Current, and Imminent Activities

Since the 1960s, the most extensive, industrial land use in the study region has been seismic exploration. The Joint Secretariat obtained and mapped data from the National Energy Board to depict historic seismic activity throughout the Mackenzie Delta, nearby islands and the Beaufort Sea for the period from 1965 to 1992. Seismic activity between 1992 and 2000 has not been compiled and mapped. Last year's programs overlapping spatially with the proposed program area include the AEC West Ltd. Mackenzie Delta Winter 2000/2001 Seismic Program and the Explor Data Mackenzie River Delta Seismic Program.

A quantitative means for evaluating relative intensity of past seismic has been developed and is summarized in Table 5. The proposed program lies within a region of low intensity seismic exploration. Spatial and/or temporal overlap of past activities and planned projects of known location are shown in Figure 3.

**Table 5**

#### **Intensity Of Past Seismic Activity**

<b>Intensity</b>	<b># lines/10km<sup>2</sup></b>
Low	0-25
Moderate	25-50
High	50-75
Extreme	75-Undefined

All activities defined as current have already received approval from the EISC, whereas imminent programs are still awaiting approval from the EISC as of 2 November 2001. Spatial and/or temporal overlap of the projects identified below is summarized in Table 6.

Current activities that could contribute to cumulative habitat alteration and loss are the AOGS Swimming Point Lease Extension and Airstrip Expansion, the AOGS Lucas Point Staging Area, the Petro-Canada Swimming Point Quarry, the Japex Winter Drilling Program on the west side of Mallik Bay, the Shell West Channel Remediation Program, the seismic activities of AEC and Chevron, and the drilling activities of Petro-Canada. Other approved activities that could occur during the winter 2001/2002 period within the study region include a Cape Bathurst Caribou Study and a Grizzly Bear Denning Study that are being conducted by RWED.

Table 6

## Current And Imminent Programs In The Proposed Program Area

Proponent	Activity	Distance from Project Area* (km)	% Spatial Overlap of AEC's Kamik	Temporal Overlap (Y/N)	Duration	Areal Extent
<i>Current Projects</i>						
AOGS	Swimming Point Lease Extension and Airstrip Expansion	9.0	0	Y	Jun. 2001–Ongoing Medium-Long Term	Local
Petro-Canada	Swimming Point Quarry	9.0	0	Y	Dec. 2001 – Dec. 2011 Long Term	Local
AOGS	Lucas Point Staging Area	18.0	0	Y	2001-2011 Long Term	Local
Shell	West Channel Remediation Program	88.75	0	N	June to Sept. 2001 Medium Term	Local
RWED	Cape Bathurst Caribou Herd Satellite Tagging Program	0	100	Y	Year-round, Multi-year Oct. 2001 – Oct. 2004 Long Term	Subregional
Japex	Drilling	26.25	0	N	Nov. – April 2001 Medium Term	Local
AEC	3D and 2D Seismic Burnt Lake	0	0	Y	Nov. 2001-April 2002 Medium Term	Subregional
Chevron	3D Seismic Mallik, Ellice, Langley	12.5	0	Y	Dec. 2001-April 2002 Medium Term	Subregional
Chevron	Tumma, Inuvik 2D, Ogruknang Seismic	23.0	0	Y	Dec. 2001-April 2002 Medium Term	Subregional
Petro-Canada	Napartok Drilling	51.75	0	Y	Nov. 2001 – April 2002 Medium Term	Local
Petro-Canada	Kurk/Kugpik Drilling	40.75	0	Y	Feb. 2002 – Apr. 2003 Medium Term	Local

Proponent	Activity	Distance from Project Area* (km)	% Spatial Overlap of AEC's Kamik	Temporal Overlap (Y/N)	Duration	Areal Extent
<i>Imminent Projects</i>						
Anadarko	Immerk 2D Seismic	12.0	0	Y	Jan. – Apr. 2002 Medium Term	Subregional
Anderson	Drilling	16.0	0	Y	Oct. 2001–Apr. 2002 Medium Term	Local
Anderson	3D Seismic South Tuk	12.0	0	Y	Jan.–Feb. 2002 Medium Term	Subregional
Anderson	3D Seismic Pullen	53.0	0	Y	Jan.–Feb. 2002 Medium Term	Subregional
Conoco	3D Seismic Parsons	0	27.5	Y	Nov. 2001–April 2002 Medium Term	Subregional
Petro-Canada	Nuna 3D Seismic	0	17.4	Y	Nov. 2001 – Apr. 2002 Medium Term	Subregional
Petro-Canada	Ogeoqueeq 2D or 3D Seismic	7.25	0	Y	Nov. 2001 – April 2002 Medium Term	Subregional
Petro-Canada	Napoiak 2D Seismic and Napartok Gravity Survey	37.5	0	Y	Nov. 2001 – April 2002 Medium Term	Subregional
Petro-Canada	Titalik 2D or 3D Seismic	31.0	0	Y	Nov. 2001 – April 2002 Medium Term	Subregional
Petro-Canada	Kugpik Drilling	44.5	0	Y	Nov. 2001 – April 2002 Medium Term	Local
Shell	2D Seismic	28.5	0	Y	Dec. 2001–April 2002 Medium Term	Subregional

## Notes:

1. Distances between proposed activities or programs are based on nearest points.
2. Duration refers to time from mobilization of resources for camp or access construction through to clean up.
3. All survey programs are spatially extensive but have localized effects at sampling locations.

Imminent programs that could occur during the winter 2001/2002 include the seismic activities of Anadarko, Anderson, Conoco, Petro-Canada and Shell, and the drilling activities of Petro-Canada and Anderson. Trails and winter roads required for access to development sites are also considered to be part of the cumulative disturbance in the study region.

## **6.2 Additive and Synergistic Effects**

### **6.2.1 *Wildlife and Habitat***

RWED is continuing a Cape Bathurst caribou herd satellite tagging program, which has received support from the Operators Group. The study will provide information on caribou locations during the winter months to better understand habitat use in order to assess effects of exploration activities on the herd. Access routes created by seismic activity could enhance access for traditional harvesting and permitted hunting by Inuvialuit beneficiaries, residents and non-residents for the Bluenose-west/Cape Bathurst caribou herds in commonly used harvesting areas (see Section 8- Traditional and Other Land Uses). AEC will coordinate its activities with other operators wherever possible to avoid or minimize potential cumulative effects on wildlife and wildlife habitat. To minimize the additive effect of increased access, AEC will only utilize existing or shared transit routes and, wherever possible, will avoid creating new access that may result in improved hunting success. The proposed program is limited in scope, with only five proposed lines covering a relatively large area of land, and will be completed within a short time frame. In addition, the operation of a single crew will limit potential human disturbance to localized areas at any given time. Therefore, potential cumulative effects are considered low in magnitude, limited to short-term disturbance, accidental in frequency and not significant.

Increased disturbance of grizzly bear dens could also occur as a result of combined winter disturbance within the project area. The dens often occur on steep south and southwest facing slopes, where equipment travel would be prohibited for crew safety reasons and to minimize erosion potential. RWED has initiated a grizzly bear denning survey program on Richard's Island, which will track collared animals and identify den sites. AEC will work with Wildlife Monitors to ensure that operations avoid known den sites, by a minimum of 50 m. Steep slopes where bears may be denning will be avoided by a minimum of 25 m and results of the RWED study will be incorporated as appropriate. In addition, as elaborated in Section 12.2.3, the possibility of encountering a grizzly bear den in the program area is low. Cumulatively, the probability that a bear might be disturbed by any current or imminent activities is also low given that no official reports exist thus far on such an occurrence in the past (John Nagy, Pers. Comm.). Hence, the addition of effects by the proposed project to others on denning bears in the study region is negligible.

Aquatic habitat disruption could also occur as a result of combined winter disturbance within the project area. The suspension and transfer of sediment from seismic detonations may have effects that extend beyond the immediate program area.

The incremental contribution of the proposed program to cumulative habitat loss and alteration will be restricted to breaking or cutting of protruding branches of bushes in limited locations, and will be of low magnitude, and medium-term in duration. Preliminary results from consultation with local elders suggest that the natural recovery time for willows that have been cut back or walked down is a couple of years, provided no root damage and further perturbation by local people occurred (Inuvialuit Elders, Pers. Comm., and IEG 2001). Given the mitigation measures described herein, vegetation re-growth may provide significant new forage resources for some of the valued ecosystem components (VEC) such as ptarmigan and hare. Potential fragmentation effects on these VEC are negligible. Habitat gaps of less than 30 m width have no measurable effects on passerines flying over the gaps (Desrochers and Hannon 1997). Moreover, small mammals, such as hare, will retain the use of the habitat because plant litter and a 20 cm height of the woody vegetation will remain intact, and the vegetation will produce new shoots of significant density in the first growing season. Given the re-growth of the vegetation, effects cannot be considered to be cumulative between current and imminent projects because the gaps in habitat are rendered ineffective as travel corridors within one or two growing seasons; hence before they can add to a regionally cumulative effect. As current seismic line density in the program area is low, anticipated cumulative impacts on wildlife habitat are considered to be negligible to minor in magnitude and reversible in the long-term based on estimated re-growth to pre-disturbance height (Table 18).

#### **6.2.2 *Socio-Economic***

The project approval process includes community consultation (Section 16.0 Community Consultation) involving repeat visits to affected communities to discuss possible implications of proposed programs. The repeated nature of these visits by all of the operators planning activities in the region could contribute to consultation fatigue. AEC has worked with other petroleum operators to implement community consultation programs that minimize consultation fatigue. Consultation on the Kamik program was done in conjunction with Anadarko Canada Corporation.

The operating season for minimizing impacts in a northern environment has resulted in periodicity of employment that dominates in the winter season. The recent employment boom created by oil and gas activity has led to the realization that local human resources available to satisfy staffing demands are limited. Available, trained labour may limit the socio-economic benefits that accrue to each community. This may further require recruiting employees from other communities in the Northwest Territories and throughout Canada, in the event of shortages.

Traditional land use activities are anticipated to be ongoing during the proposed operations. Access to traditional use areas may traverse the proposed project area from both Tuktoyaktuk and Inuvik based on the presence of cabins in the vicinity of the proposed program area. To mitigate cumulative effects relating to land use conflict in traditional use areas, AEC is working with local communities and Hunters and Trappers Committees to identify sensitive areas and times to minimize or avoid activities. Special management areas and locations of harvested species' habitats with respect to the proposed project area

are discussed in Section 8.0, Traditional and Other Uses. Residual cumulative effects associated with the proposed AEC Winter Seismic Program are predicted to be low in magnitude and local in extent.

## 7.0 LOCATION

The proposed Kamik 2D program extends from AEC's EL 385 onto Crown, Inuvialuit 7(1)(a) and 7(1)(b) land (Figure 2). The area covered by the program extends from 68°59'N to 69°19'N and from 133°21'W to 134°09'W. Tuktoyaktuk is the community closest to the project area and is approximately 29 km from the nearest line.

## 8.0 TRADITIONAL AND OTHER LAND USES

Land use in the region includes subsistence trapping, hunting and fishing, as well as adventure tourism. The proposed project falls within the Tuktoyaktuk, Inuvik and Aklavik Conservation Planning Areas as defined by their respective Community Conservation Plans (TCCP, IICCP and AICCP 2000). The community conservation plans identify four management categories of lands (B through E) within the proposed project area. These categories are:

Category B: Lands and waters where there are cultural or renewable resources of some significance and sensitivity but where terms and conditions associated with permits and leases shall assure the conservation of these resources.

Category C: Lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These areas shall be managed so as to guarantee the conservation of the resources.

Category D: Lands and waters where cultural or renewable resources are of particular significance and sensitivity throughout the year. As with Category C areas, these lands and waters shall be managed so as to guarantee the conservation of resources.

Category E: Lands and waters where cultural and renewable resources are of extreme significance and sensitivity. There shall be no development in these lands or waters. These areas shall be managed to guarantee absolutely no damage or disruption. This category offers the highest degree of protection, short of legal designation.

The project is located within, or adjacent to, nineteen Special Management Areas. The location of these areas is shown in Figure 4(a-e) and outlined in Table 7, and their significance is discussed below. The program area in the Figure 4 maps has a 5 km buffer around it. Mitigative measures are discussed in Section 12.0, Proposed Mitigation and Anticipated Environmental Impacts.



The proposed program area overlaps habitat for several wildlife species and falls within areas of importance for subsistence harvesting, and areas of historical importance.

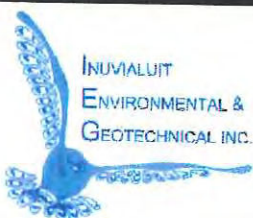
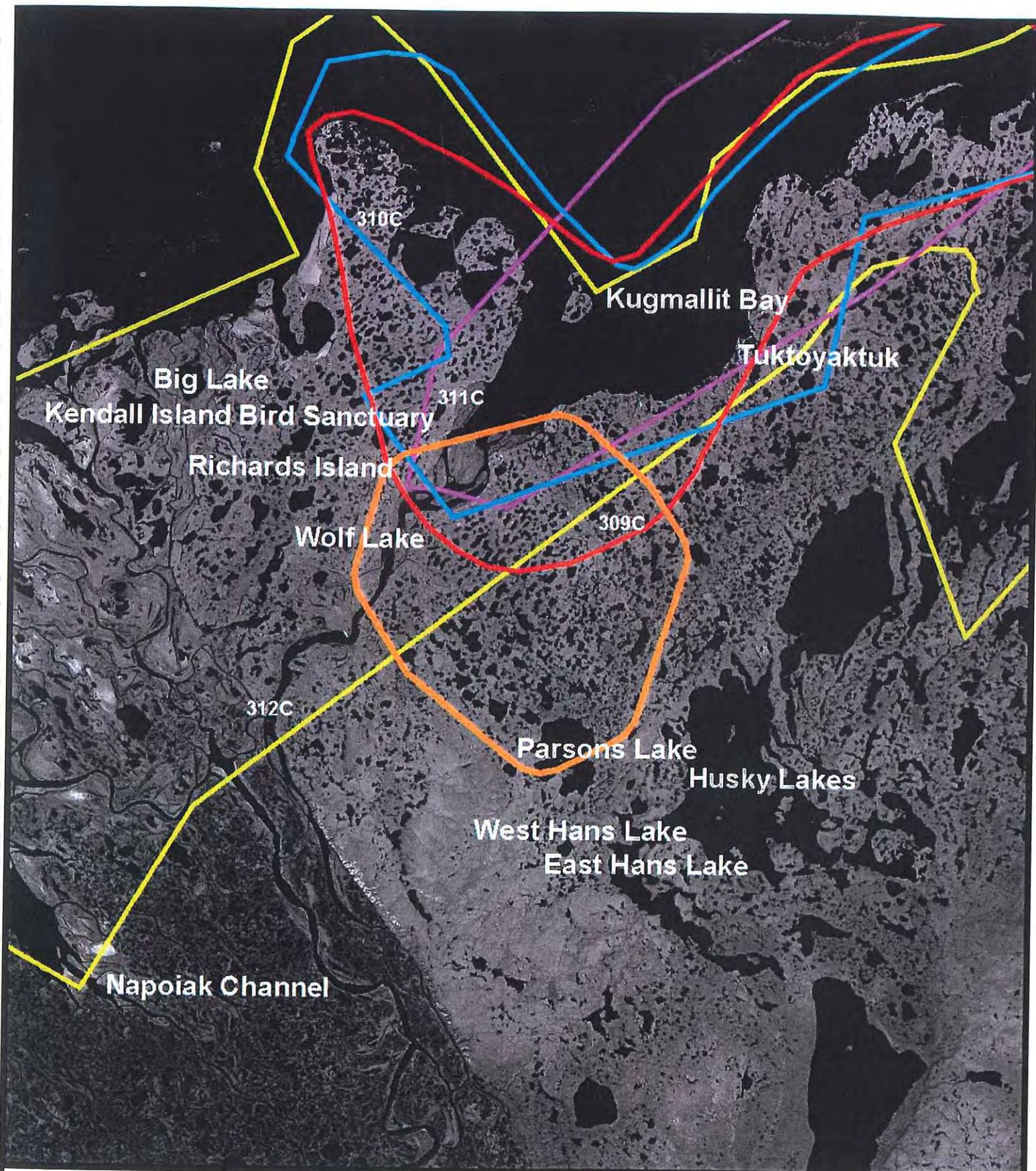
Critical grizzly bear denning habitat overlaps the entire program area (Site No. 322C). The area is also part of the Grizzly Bear Management Area C2-4G Tuktoyaktuk West (AICCP, IICCP, and TCCP 2000). Grizzly bears typically den from October to May, and there is concern that oil and gas activity during this time may disturb dens (TCCP 2000). Grizzly bears are important furbearers (AICCP, IICCP, and TCCP 2000), and as such are considered to be a subsistence species by the Inuvialuit.

The southern portion of the proposed project area is part of the Bluenose-West Caribou Herd Winter Range (Site 701B)(AICCP, IICCP, and TCCP 2000). Caribou is an important subsistence species for Inuvialuit (AICCP, IICCP, and TCCP 2000). Land use activities (oil and gas, sport hunting) may affect herd movement, and in turn make subsistence harvesting more difficult (AICCP, IICCP, and TCCP 2000).

The Fish Lakes and Rivers area (Site No. 704C) is within the proposed project area (IICCP and TCCP 2000). The waterbodies within the Fish Lakes and Rivers area provide important fish habitat for subsistence harvest by people of Inuvik and Tuktoyaktuk. This area has also been identified as an important historical harvest location (IICCP and TCCP 2000).

Beluga Management Zone 1(a) (Site No. 711E) is located on Crown lands and waters within the ISR. This high use area accommodates calving, rearing calves, moulting and socializing for the Beaufort Sea population of beluga whales. It is also used as a subsistence harvesting area throughout the summer months and is designated as a Protected Area according to the Inuvialuit Renewable Resources Conservation and Management Plan (IICCP 2000). The proposed seismic program does not overlap the Beluga Management Zone and is scheduled to take place when the beluga population is wintering in the Beaufort Sea.










**Fall Harvesting Areas  
Kamik 2D Seismic Program**



Source: Inuvialuit Community  
Conservation Plans

 Kamik Study Area

**Community Conservation Plans**

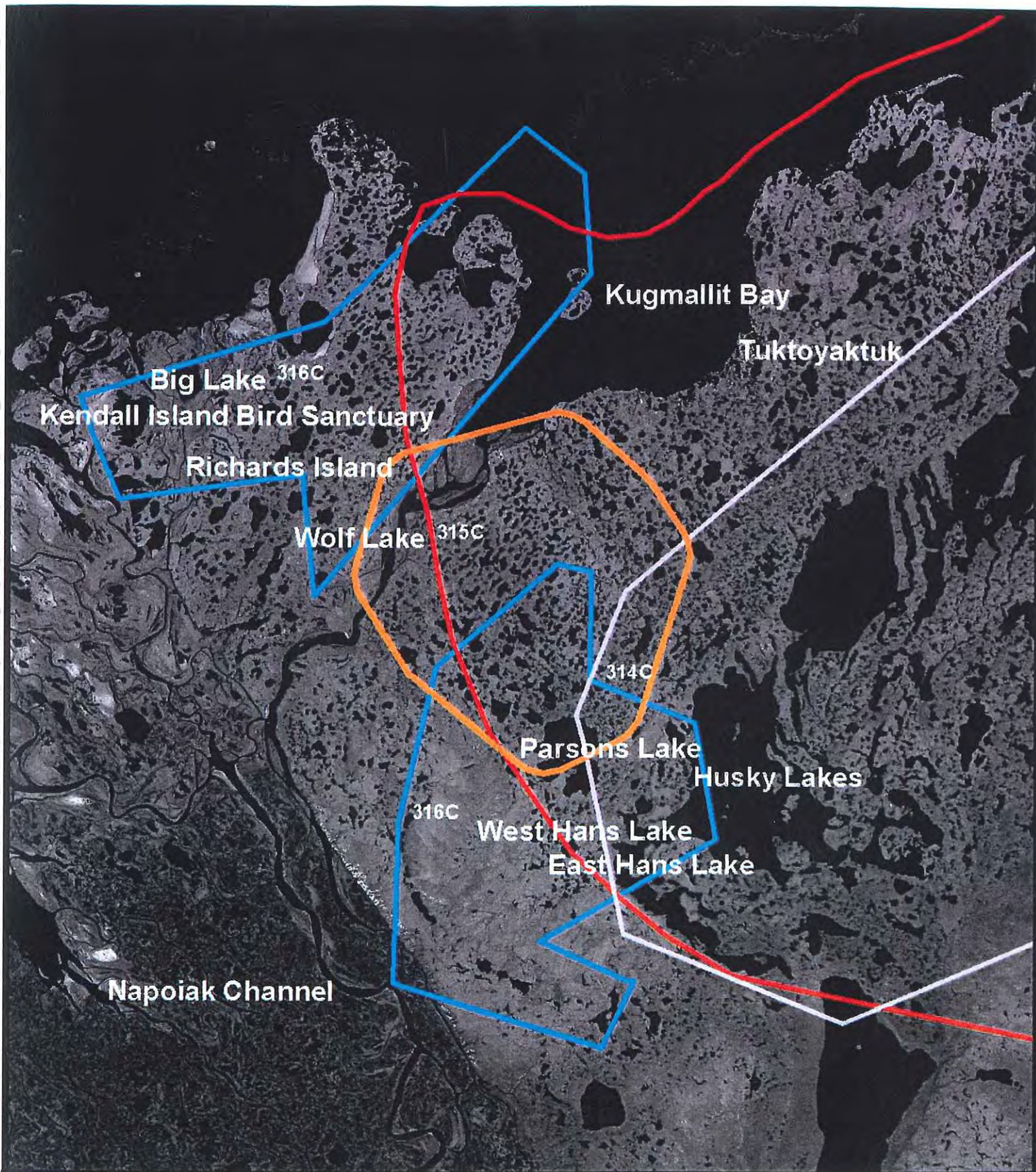
 309C	Fall Caribou Harvesting Area	 311C	Fall Seal Harvesting Area
 310C	Fall Fishing Harvesting Area	 312C	Fall Goose Harvesting Area

5091-01

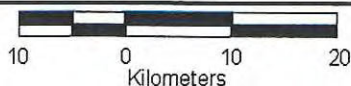
October 2001

Figure 4a






**Winter Harvesting Areas  
Kamik 2D Seismic Program**



Source: Inuvialuit Community  
Conservation Plans

 Kamik Study Area

**Community Conservation Plans**

 315C

Winter Caribou  
Harvesting Area

 314C

Winter Wolverine  
Harvesting Area

 316C

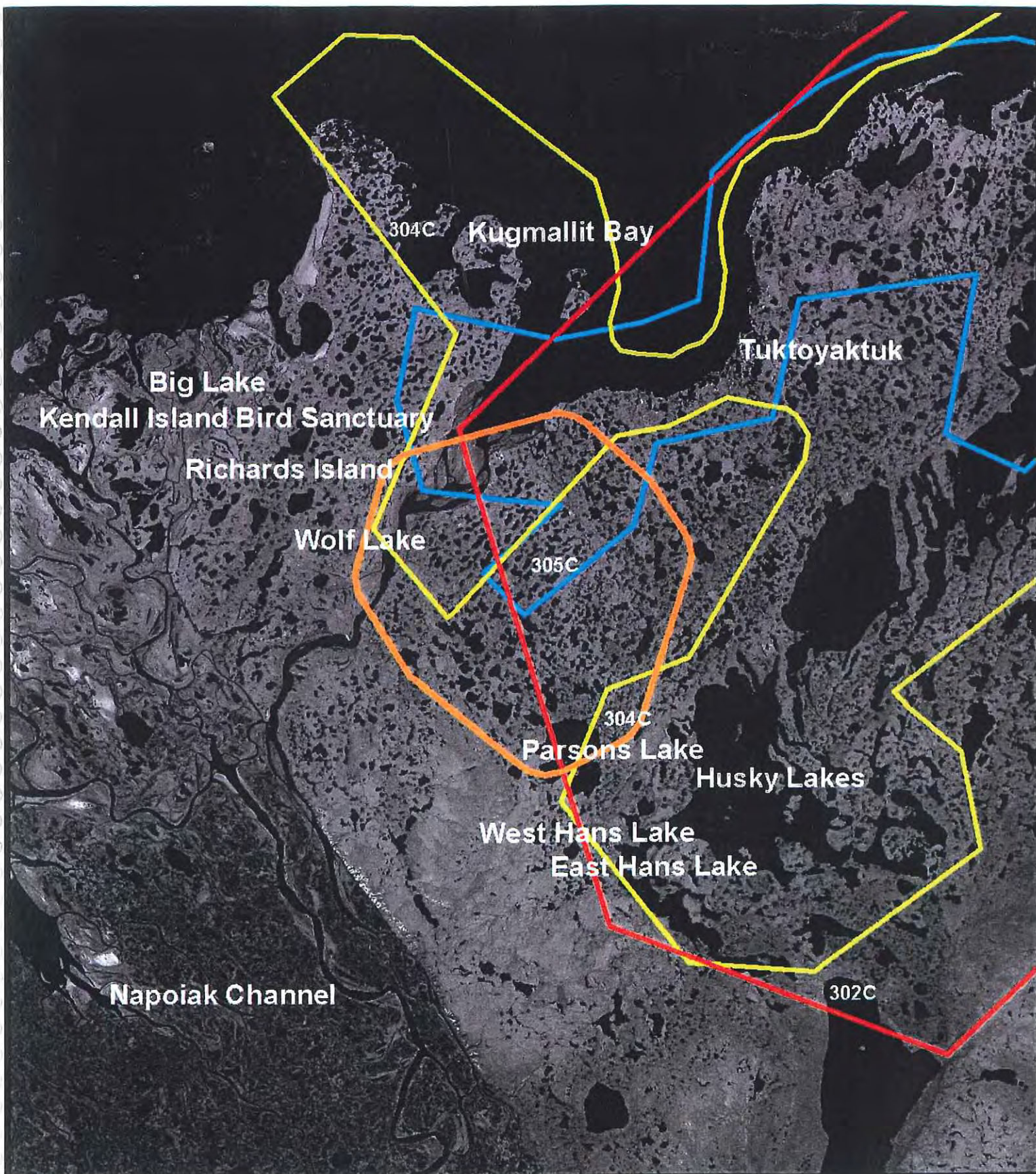
Winter Fishing  
Harvesting Area

5091-01

October 2001

Figure 4b





# Spring Harvesting Areas Kamik 2D Seismic Program



Source: Inuvialuit Community  
Conservation Plans

  Kamik Study Area

## Community Conservation Plans

302C

Spring Caribou  
Harvesting Area

305C

Spring Fishing  
Harvesting Area

304C

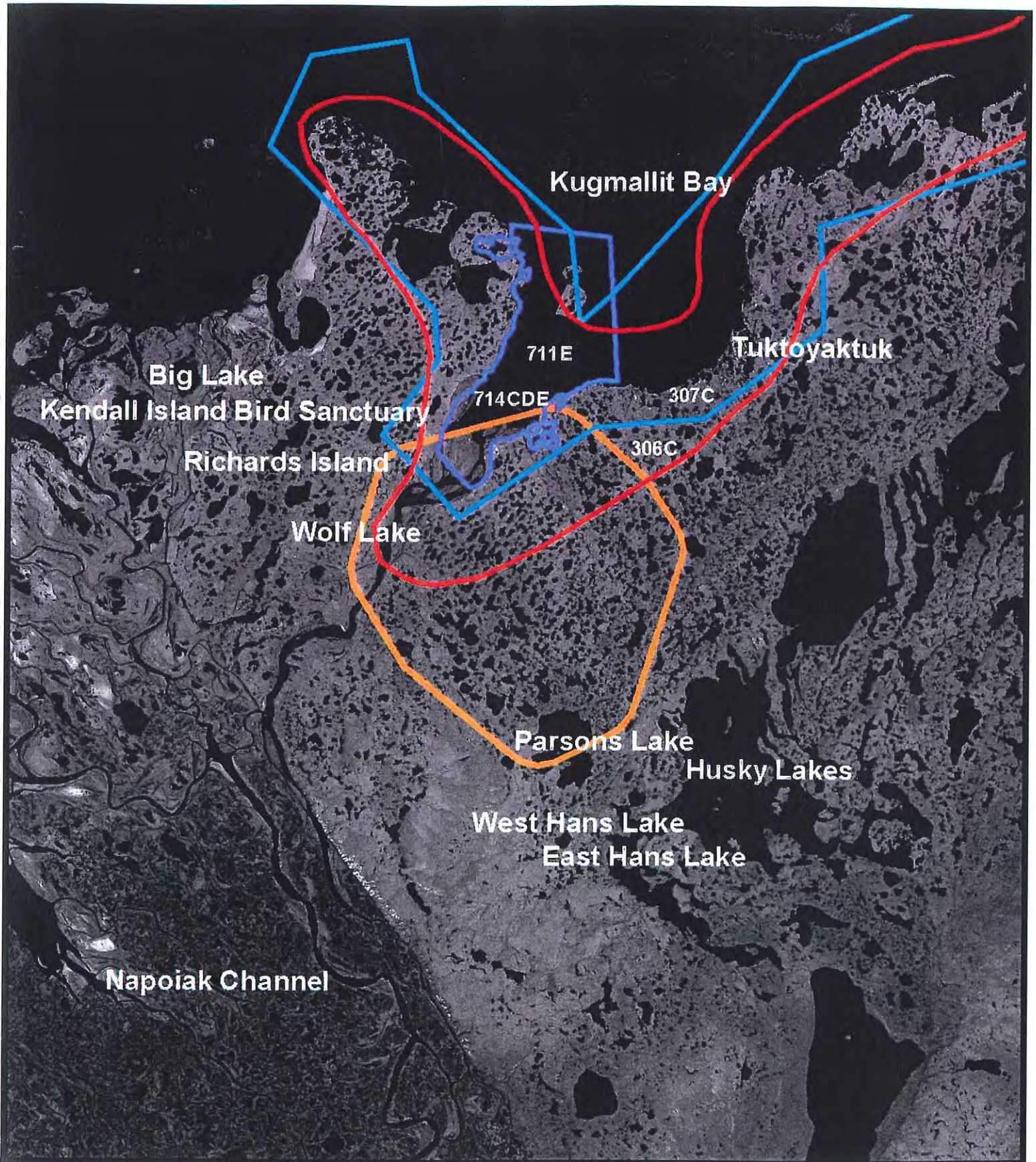
Spring Goose  
Harvesting Area

5091-01

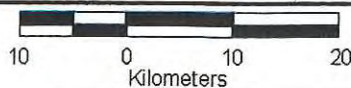
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Figure 4c





**Management and Summer Harvesting Areas  
Kamik 2D Seismic Program**



Source: Inuvialuit Community  
Conservation Plans

Kamik Study Area

**Community Conservation Plans**

306C

Summer Caribou  
Harvesting Area

307C

Summer Fishing  
Harvesting Area

711E

Beluga Management  
Area

714CDE

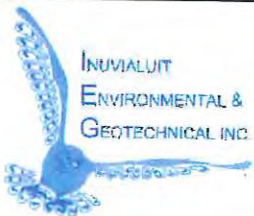
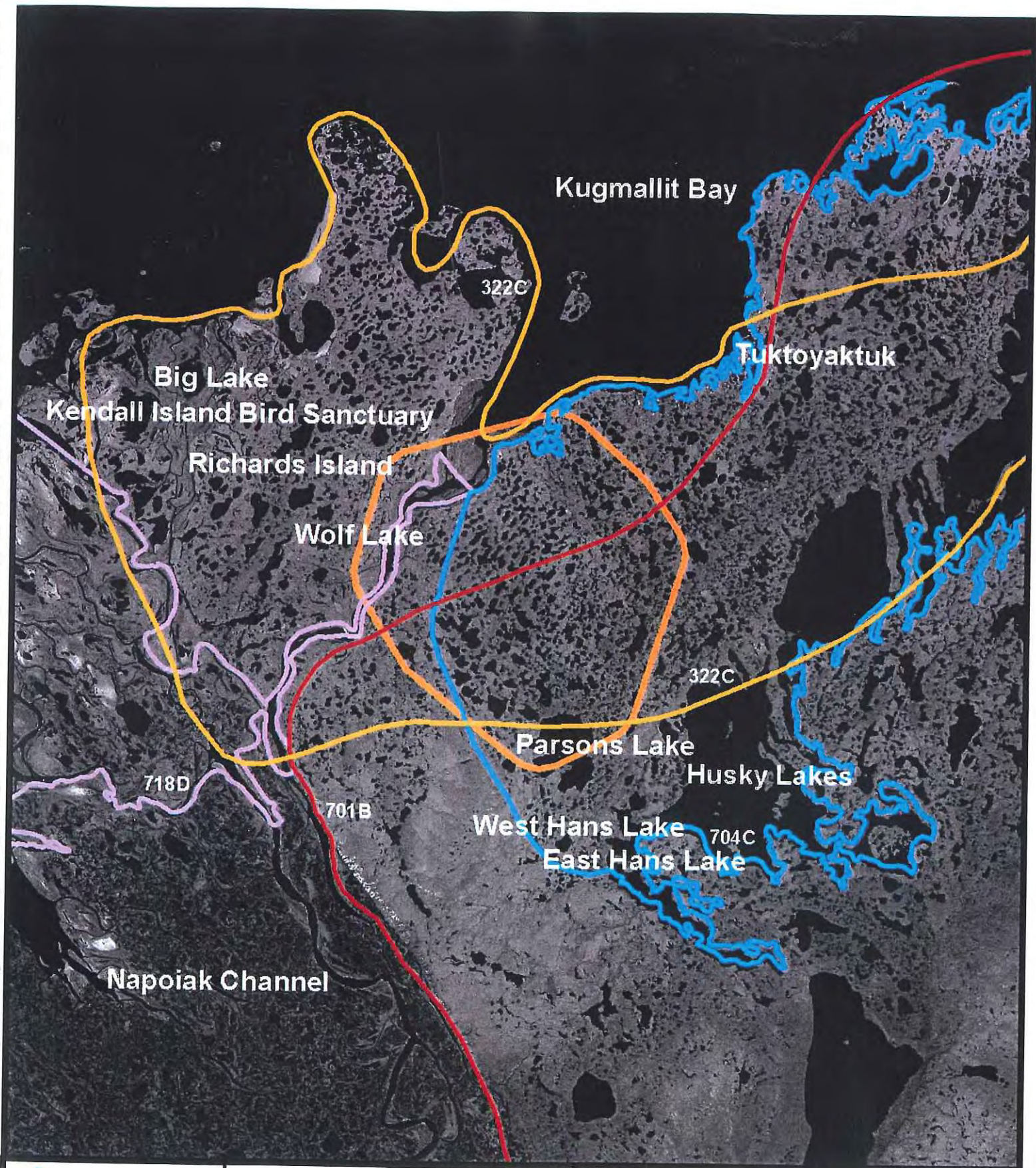
Kugmallit Bay  
Management Area

5091-01

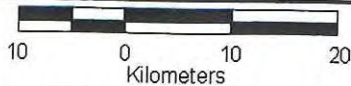
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Figure 4d





**Habitat Areas  
Kamik 2D Seismic Program**



Source: Inuvialuit Community  
Conservation Plans

  Kamik Study Area

**Community Conservation Plans**

701B Blue-nose-west  
Caribou  
Herd Winter Range

704C Fish Lakes  
and Rivers

718D Central Mackenzie  
Estuary

322C Critical Grizzly Bear  
Denning Area

5091-01

October 2001

Figure 4e



Table 7

## Special Management Areas Within Or Near The Project Area\*

Site Number And Protective Status Category	Name	Location Description	Location In Relation To Project
302C	Spring Caribou Harvest	Surrounding Husky Lakes, east of Cape Bathurst, just west of Mason River, extending south from Mackenzie River to Sitidgi Lake, with the Tuktoyaktuk Peninsula at the northern boundary.	Overlaps eastern portion of program area.
304C	Spring Goose Harvest	Inlands in the western portion of the Mackenzie River Estuary, from Eastern Richards Island along the coast, including all of the Tuktoyaktuk peninsula, to Mason River Estuary, and the Husky Lakes. Other areas include sections of the Miner River, Anderson River and Gossley Lakes.	Overlaps northern portion at Kittigazuit Bay and borders the southern area at the Husky Lakes.
305C	Spring Fish Harvest	Southern portion of Kugmallit Bay and Northwestern Tuktoyaktuk Peninsula.	Overlaps northern portion of program at Kittigazuit Bay.
306C	Summer Caribou Harvest	Eastern part of Richards Island, to the mouth of the Mackenzie River, along the coast to Atkinson Point. A second site includes an area southeast of Husky Lakes.	Overlaps northern portion of program.
307C	Summer Fish Harvest	Kendall Island Bird Sanctuary, North Point of Richards Island and Northwestern Tuktoyaktuk Peninsula.	Overlaps northwestern extent of program at Kittigazuit Bay.
309C	Fall Caribou Harvest	Various sites within the Tuktoyaktuk Planning Area, including eastern portion of Richards Island, east along the coast to the beginning of Tuktoyaktuk Peninsula; Anderson River; from Liverpool Bay south through Finger Lakes to a point north of Sitidgi Lake, and southeast of Husky Lakes: Bekee Lake, Klata Lake, and Luemat Lake.	Overlaps northern portion of program.
310C	Fall Fish Harvesting	Kendall Island Bird Sanctuary, southern portion of Kugmallit Bay and Northwestern Tuktoyaktuk Peninsula.	Overlaps northern quarter of program at Kittigazuit Bay.
311C	Fall Seal Harvest	Two sites within the Tuktoyaktuk Planning Area, including: from Kugmallit Bay, extending north to Atkinson Bay, Liverpool Bay/Wood Bay, extending through Fingers Area into Husky Lakes.	Overlaps northern quarter of program at Kittigazuit Bay.
312C	Fall Goose Harvest	All of the coastline from Yukon/Alaska border in the west, to the Mason River in the east, including sites on Anderson River and Crossley Lakes.	Overlaps northern half of the program at Kittigazuit Bay.
314C	Winter Wolverine Harvest	Includes the Husky Lakes, Finger Lakes and an area southeast of the Husky Lakes	Overlaps southern tip of program at Parsons Lake.
315C	Winter Caribou Harvest	Richards Island, south to the northern part of Sitidgi Lake; Anderson River to mouth of Mason River, including Tuktoyaktuk Peninsula.	Surrounds program and extends in easterly and southerly directions.

Site Number And Protective Status Category	Name	Location Description	Location In Relation To Project
316C	Winter Fish Harvest	Various sites within the Tuktoyaktuk Planning Area, including Liverpool Bay.	Overlaps southern half of program and northern tip of program at Kittigazuit Bay.
322C	Grizzly Bear Denning Areas	Coastal areas including Richards Island and Tuktoyaktuk Peninsula.	Overlaps entire program.
701B	Bluenose-west Winter Range	Starting at the southern ISR boundary, up to Tunanuk, northeast to include the western portion of the Tuktoyaktuk Peninsula, southeast to include the Anderson River, and south to the ISR boundary.	Overlaps southern quarter of program.
704C	Fish Lakes and Rivers	The site includes the rivers and lakes along the shoreline west of Tuktoyaktuk, inland to their headwaters.	Overlaps eastern two-thirds of program.
711E	Beluga Management Zone 1(a)	The zone includes about 1800 km <sup>2</sup> of shallow waters at the mouth of the Mackenzie river and encompasses the only known traditional summer concentration areas (Shallow Bay, east Mackenzie Bay and Kugmallit Bay) for the Beaufort Sea stock.	Borders northern extent of program at Kittigazuit Bay.
714DE	Kugmallit Bay	Extends from Pullen Island in the north, southward through portions of Richards Island, surrounding Beluga Management Zone 1A with a buffer zone in Mackenzie Bay.	Overlaps northern extent of program at Kittigazuit Bay
718D	Central Mackenzie Delta	Lands and waters defined by the eastern edge of Mackenzie Bay, bordered to the south by Reindeer Channel, with the eastern border as Main Channel, with an extension along the East Channel.	Overlaps northern tip of program at the mouth of Mackenzie River.
729D	Kitigaaryuit	The village and adjacent graveyards site at the south end of an island which lies at the mouth of the east branch of the Mackenzie River, on the east side of Kugmallit Bay. The peninsula is 1.5 km in length. The village is located south of the isthmus.	Overlaps program at mouth of Mackenzie River on the east side of Kugmallit Bay.

\* AICCP, IICCP and TCCP, 2000

The Central Mackenzie Estuary (Site No. 718D) provides a transit area between Shallow and Kugmallit Bays and is used extensively by feeding anadromous coregonids, by many fish species for overwintering and nursing areas and as a concentrating area for belugas (TCCP 2000).

The traditional harvesting range for many fish and wildlife species coincides with AEC's proposed project area. The proposed project is located in caribou harvesting areas that are used year-round (Site Nos. 302C, 306C, 309C and 315C); spring, summer and fall fish harvesting areas (Site Nos. 305C, 307C and 310C); spring and fall goose harvesting areas (Site Nos. 304C and 312C); fall seal harvesting areas (Site No. 311C); winter wolverine harvesting area (Site No. 314C) and a winter fish harvesting area (Site No. 316C). The proposed project is also located in the Tuktoyaktuk Group Trapping Area (TCCP 2000).

Table 8 presents a timeline comparing traditional harvesting periods with the proposed program. Hunting areas extend beyond the boundaries of the proposed program area so the occurrence of some harvesting activities within the proposed program area is occasional.



Table 8

## Overlap Of Proposed Program With Traditional Harvesting Activities

	Jan. 1-15	Jan. 15-31	Feb. 1-15	Feb. 15-28	Mar. 1-15	Mar. 15-31	Apr. 1-15	Apr. 15-30	May 1-15	May 15-31	Jun. 1-15	Jun. 15-30	Jul. 1-15	Jul. 15-31	Aug. 1-15	Aug. 15-31	Sep. 1-15	Sept. 15-30	Oct. 1-15	Oct. 15-31	Nov. 1-15	Nov. 15-30	Dec. 1-15	Dec. 15-31
Furbearers	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	I/T	I	I															
Muskrat					A	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I													
Polar Bear	A/T	A/T	A/T	A/T	A/T	A/T	A/T	A/T	A/T	A/T														
Grizzly Bear					A	A	A/T	A/T	A/T	A/T	A/T					T	T	A/T	A	A	A	A		
Caribou	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/T	A/T	A/I/T	A/I/T	A/I/T	A/I/T
Moose			I	I	I	I									A/I	A/I	A	A						
Muskox							T	T	T	T														
Fish			T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	T <sup>1</sup>	A/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	A/I/T	I/T	I/T	T	T
Beluga																								
Seal			T	T	T	T	T	T	T							T	T	T	T					
Birds									A/I/T	A/I/T	A/I/T	A/I/T			T	T	A/I/T	A/I/T						
Ptarmigan	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Proposed Program																								

## Legend:

A - Aklavik

I - Inuvik

T - Tuktoyaktuk

## Notes:

1 - Lake Trout are the focus for fish harvesting by the peoples of Tuktoyaktuk during this period.

Preliminary results from interviews with elders as part of the Inuvialuit Settlement Region Operators Biophysical Survey suggests an overall decline in traditional harvesting of a wide range of species. Traditional harvests focus mostly on caribou and fish as a supplementary food source (IEG 2001). Harvesting of fur bearing animals for supplementary income is based on the market price for furs. The preferred species at this time include wolf, mink, lynx and fox (IEG 2001).

Assessing the level and permanency of the impacts of the proposed project is made difficult by a lack of comprehensive analysis illustrating the intensity of traditional harvesting of various species, by season and by location. Data collected through the Inuvialuit Harvest Study could provide an indication of the level of intensity of traditional harvesting in the area. However, confidentiality associated with some of the information has delayed further analyses.

The general AEC program area includes areas of important historic and current traditional use, including Kitigaaryuit (Site No. 729) and Kugmallit Bay (Site No. 714DE). Kitigaaryuit is a semi-permanent settlement that has played an important role in the Inuvialuit culture for hundreds of years. It represents a significant archaeological site in the western arctic and was established as a National Historic Site in 1978 (IICCP 2000). AEC will maintain a buffer around this critical area and report any accidental and significant archaeological finds as described in Section 12.2.5. Kugmallit Bay is a high traffic zone for

marine species including beluga whales that is used for subsistence harvesting throughout the summer (TCCP 2000). Traditional summer whaling camps of people from Inuvik and Tuktoyuktuk are noted at the northeastern limit of AEC's proposed project area (IICCP 2000). Winter operations will minimize land use conflicts.

Increased wage earning jobs as a result of oil and gas exploration prompted settlement throughout the 1970s and 1980s. Seismic activity in other areas near the Parsons Lake and Husky Lakes Region contributed to socio-economic change within nearby communities through the creation of wage earning lifestyles. This lifestyle change contracted hunting ranges as harvesting became limited to holidays and weekends, although the hunting range has been restored with the introduction of the snowmobile (TCCP 2000, MFRI 1976). The resumption of oil and gas exploration in the region is unlikely to bring about the profound socio-economic changes experienced in the 1970s.

AEC's project area accommodates a low level of consumptive (hunting and fishing) and adventure tourism (NWT Arctic Tourism 1998). There is sport hunting and wildlife viewing associated with the caribou herds in this area as well as dog sledding tours that depart from Tuktoyuktuk into Kugmallit Bay (AICCP, IICCP, and TCCP 2000). Table 9 provides information on the Northwest Territories Hunting Regulations for non-land claim beneficiaries (RWED 2001).

**Table 9**

**Seasons For Permitted Hunting And Harvesting**

Species	Hunting Area	Season	
Barren ground caribou	I/BC/06	Residents:	August 15 – November 15
		Non-Residents:	August 15 – October 31
		Non-resident Aliens:	August 15 – October 31
Moose	I	Residents:	July 25 – April 30
Polar Bear	I/PB/03	Residents:	December 1 – May 31
		Non-Residents:	December 1 – May 31
		Non-resident Aliens:	December 1 – May 31
Wolf	I/WF/05	Residents:	August 15 – May 31
		Non-Residents:	August 15 – May 31
		Non-resident Aliens:	August 15 – May 31
Wolverine	G	Residents:	July 25 – April 30

## 9.0 DEVELOPMENT TIMETABLE

Planning for the proposed AEC winter seismic program was initiated in September 2001. AEC may begin access construction, weather-permitting, in December 2001 and data acquisition in January/February 2002, pending regulatory approval. Timing for the program will depend on weather and ice conditions. As AEC is also planning to conduct the Burnt Lake 2D and 3D program on Richards

Island this winter, scheduling for the Kamik and Burnt Lake programs may be modified slightly to accommodate weather and ice conditions. The decision for which program will proceed first in the season will be made with consideration for the safety of the crew and the protection of the environment. Regardless of the start date, the program should be completed by April 15 2002. Table 10 provides the proposed schedule for the program.

**Table 10**

**Development Schedule**

<b>Project Activity</b>	<b>Estimated Time Frame</b>
Planning	September – December 2001
Pre-Survey and Access Construction	December 2001
Set up Mobile Camp at Camp Location	December 2002
Drilling and Charge Placement at Select Locations	January/February 2002
Recording	January-March 2002
Final Clean-up	April; July – August 2002

\* Time lines given in the above table are approximate and subject to change depending upon variables such as weather or ice thickness on proposed routes of travel.

## **10.0 NEW TECHNOLOGY**

In the AEC West Ltd. Winter 2001/2002 Burnt Lake Seismic Program, AEC proposed the introduction of new vibroseis units, which it also intends to use on the Kamik program. New rubber-tracked vibroseis units are being purpose-built in Houston, Texas to undertake the AEC programs. Quality assurance (QA) of the recorded seismic data is going to be undertaken on the recording trucks in real-time, which has not been previously done to this extent. This QA will ensure that the data recorded is useable and will minimize the need for a program or part of a program to be repeated in order to fill in data gaps or replace poor data. The recorded seismic data may also be processed in the field so that areas of interest can be identified quickly. The processing will indicate whether the recording parameters are correct and will minimize the need to potentially repeat portions of the program.

## **11.0 ENVIRONMENTAL OVERVIEW**

### **11.1 Methods**

The baseline information provided in this report was synthesized from existing literature, field surveys conducted during summer 2001, and personal communications with local experts, regulatory agency representatives and knowledgeable professional biologists. A field reconnaissance was also by IEG on behalf of AEC (see Section 4.2). This information was augmented by informal discussions with local residents regarding Traditional Ecological Knowledge. Literature was collected from community reports



obtained from the Joint Secretariat in Inuvik and from the Arctic Institute of North America library, located at the University of Calgary.

A summary of the physical and biological character of the region was then adapted specifically to the proposed program to fully assess design-related issues and suitable mitigation. The physical description includes the physiography and geology, hydrology and climate. These parameters were included to assess, in Sections 6 and 12, the sensitivity of the environment to the proposed program. The species descriptions provided highlight the life cycle and habitat requirements that could be vulnerable to specific interactions with the proposed program for only those species deemed important to local peoples based on Community Conservation Plans and COSEWIC listed species.

## **11.2 Physiography and Bedrock Geology**

The proposed AEC Kamik seismic program lies within the Tuktoyaktuk Coastal Plain Ecoregion of the Southern Arctic Ecozone. The Tuktoyaktuk Coastal Plain Ecoregion covers the outer Mackenzie Delta (including Richards Island and Big Lake Delta Plain) and Tuktoyaktuk Peninsula bordering the Beaufort Sea (ESWG 1995). The geology of the region is variable due to differences in the extent of glaciation events.

There are two main landscape types within the Tuktoyaktuk Coastal Plain Ecoregion. The first type is associated with the active delta plain, and consists of low-lying (i.e. elevations of less than 4 m above sea level) deltaic sediments incised by a network of meandering channels and delta lakes (Todd and Dallimore 1998). These landforms include wetlands, active alluvial channels and estuarine deposits. Characteristic wetlands, which cover 25-50% of the area, are lowland polygon fens, both low- and high-centre varieties (ESWG 1995). The second landscape type consists of broadly rolling uplands rising up to 30 m above sea level, the surfaces of which have been modified by glacial and periglacial processes (Todd and Dallimore 1998). Northeast of the Mackenzie River Middle Channel, delta advancement effectively isolated areas of upland sediments, creating outliers of low relief Tuktoyaktuk coastland (Todd and Dallimore 1998). Discontinuous morainal deposits mantle much of the area, except near the coast where fine-textured marine sediments cover the surface. Occurring less frequently are outwash aprons of crudely-sorted sand and gravel, and raised beach ridges along the shores of preglacial lakes. The resulting undulating terrain is studded with innumerable lakes and ponds. Pingos, some very large, form unique features in the landscape (ESWG 1995). Current topographic maps show several pingos within or nearby the proposed program area.

The surficial geology of the Tuktoyaktuk Coastal Plain reflects the fact that the most recent glaciation did not extend over much of the northernmost part of the area, with older Wisconsinan deposits dominating, and some younger Holocene lacustrine deposits occurring mainly in thermokarst basins (Taylor et al. 1996). Sediments in the Tuktoyaktuk Coastal Plain are predominantly composed of late glacial till or glaciofluvial sand and gravel (Todd and Dallimore 1998).

The hydrocarbon-bearing sequence straddling the outer Mackenzie Delta and Tuktoyaktuk Peninsula has been identified as an upper sequence of weakly consolidated to unconsolidated sandstone and conglomerate, and includes the uppermost Quaternary sediments of the area. Underlying this is a sequence of primarily fine-grained siltstone and shale. The boundary between the two sequences marks a widespread regional unconformity. To the east of the Mackenzie River Middle Channel a break in the unconformity between sequences occurs, resulting in difficulties in describing the non-ice-bonded material (Todd and Dallimore 1998).

Sensitive terrain areas encountered within/near the proposed program area include the eroded banks of the Mackenzie River and associated channels, as well as moderate to steep slopes adjacent to lakes. Pingos located within or adjacent to the program area are also considered to be sensitive terrain. Aklaktuk and Porsild Pingos lie within the proposed program area, while Aklisuktuk Pingo is approximately 6 km to the west, and Whitefish Pingo is approximately 8 km to the north. Other pingos have been geo-located and noted in the vicinity of the program during field reconnaissance. Additionally, the Caribou and North Storm Hills located to the west and the Parsons Lake area to the south are considered sensitive terrain.

### 11.3 Soils

Soils of the proposed AEC Kamik seismic program area have resulted from prolonged cryoturbation, low temperatures and low permeabilities in the mostly fine-textured soils (Timoney et al. 1992). The dominant soils of the Tuktoyaktuk Coastal Plain Ecoregion are Organic and Turbic Cryosols on level to rolling organic, morainal, alluvial, fluvio-glacial and marine deposits (ESWG 1995). The organic soils found in the eskers of this ecoregion are generally shallow, highly acidic and nutrient-poor. The mineral soils are also poorly developed and often frozen (ESWG 1995). The low organic content of these predominantly mineral soils is linked to low levels of biological activity, limiting the soil capacity to recover quickly from anthropogenic disturbance and pollution (Stonehouse 1999).

Hummocks are the most abundant soil microrelief feature in the proposed program area. Hummocks are generally composed of fine-grained, frost-susceptible soils that have been upwardly displaced, and range from those that are completely vegetated (earth hummocks) to those with bare centres (mud hummocks) (Mackay 1980). Sedge dominated vegetation communities usually occur in the depressions surrounding hummocks (Mackay 1995). Hummocks found in the program area are very stable, and may persist for thousands of years. Thermal disturbance to hummocks reduces the mound form; however, regeneration of hummocks has been observed (Mackay 1980).

### 11.4 Climate

The Tuktoyaktuk Coastal Plain Ecoregion is classified as having a low arctic ecoclimate. The mean annual temperature is approximately  $-11.5^{\circ}\text{C}$ , with a mean summer temperature of  $4.5^{\circ}\text{C}$  and a mean winter temperature of  $-26.5^{\circ}\text{C}$  (ESWG 1995). During the proposed AEC Kamik seismic program, temperatures should average between  $-8^{\circ}\text{C}$  and  $-36.4^{\circ}\text{C}$  (RWED 1999). The mean winter temperature in

the coastal Beaufort Sea region is  $-30^{\circ}\text{C}$ , increasing to a mean temperature of  $6^{\circ}\text{C}$  in the summer months (Dome et al. 1982a).

Winters tend to be long due to a roughly two-month period during which the sun does not rise above the horizon. During this period very cold conditions prevail and may last for several weeks. Snow and freshwater ice persist for six to eight months of the year. When the sun begins to rise above the horizon (January), the increased amounts of heat dissipate the high-pressure centre that has developed over the winter and storms prevail. By June most of the snow has melted, though lake ice may persist until July. The mean annual number of frost-free days varies from approximately 12 to 15 days on the coast, compared to about 50 days at Inuvik (Dome et al. 1982a).

In the Beaufort region the frequency of storm tracks is low (Maxwell 1980), occurring between 4% and 6% of the time in October and dropping to less than 2% by January (Dome et al. 1982a). The cold air in the region holds little moisture, which results in low annual precipitation rates (Maxwell 1980). The mean annual precipitation for the Tuktoyaktuk Coastal Plains ranges from 125-200 mm (ESWG 1995). Areas modified by open water tend to receive most precipitation during summer and autumn before freeze-up, while areas further inland are seen to have a higher frequency of precipitation during autumn and winter. The contribution of snowfall to annual precipitation increases with increasing latitude and higher elevations, and can be greater than 60% in some northerly coastal locations (Dome et al. 1982a). Thunderstorms seldom occur in the area (Dome et al. 1982).

Winds are westerly in the summer and northwesterly in winter, with potentially severe weather resulting from deviations in this pattern (Dome et al. 1982a). Wind regimes can be affected by variations in local topography and vegetation cover, particularly between coastal and inland areas. Generally, the wind strength and duration decreases from the coast southwards. While high-pressure centres are dominant, low-pressure systems moving across the Beaufort Sea mainly in January and March produce blizzard conditions along the coast. Spring progresses gradually from south to north with a distinctive eastward movement of the high pressure system, and reaches the Tuktoyaktuk Coastal Plain in early May. Spring is also typified by increased precipitation moving from northern Alaska through the Mackenzie Valley. As a result of ice break-up along the coast during late spring and early summer the climate changes from arctic to more maritime (Dome et al. 1982a). Arctic air masses generated from the pack ice are moderated during transit across open water, and further warming occurs as the air travels across the Tuktoyaktuk Coastal Plain, resulting in slightly increased precipitation. In autumn the dominant airflow direction shifts to a westward direction, and temperatures fall with freeze-up and the advance of arctic air (Dome et al. 1982a).

The extent of reduced visibility along coastal areas varies with season and location, and is mainly due to advection fog, ice fog, ice crystal haze, blowing snow and whiteouts (Burns 1974 in Dome et al. 1982a).



Atmospheric inversions occur in all seasons, as arctic air masses increase in temperature with height above the land surface. This process affects the dispersion of air pollutants. The pollution potential is inversely proportional to the maximum mixing height of the air mass (Dome et al. 1982a).

## 11.5 Permafrost

Permafrost is defined as sediments remaining below 0°C for two or more years (Taylor et al. 1996). Continuous permafrost with low to high ice content occurs beneath all terrestrial and many subaqueous areas of the Tuktoyaktuk Coastal Plain. The widespread occurrence of continuous permafrost in the area raises concerns for development, as ice-bonding in the soil matrix can dramatically alter the physical, geophysical and engineering properties of frozen sediments (Todd and Dallimore 1998).

Ice-rich soils are maintained by extensive vegetation cover. The top layer of vegetation provides a thermal barrier that acts as protection against permafrost degradation. However, these soils are susceptible to permafrost degradation as a result of erosion and increased temperatures.

In the Southern Arctic Ecozone, the depth to base of ice-bonded permafrost increases from the southwest to the northeast. Permafrost thickness at the delta-coastlands boundary is marked by a sharp gradient, with thicknesses increasing from 50 m to 500 m over a few kilometres (Todd and Dallimore 1998). While over 700 m thick beneath Richards Island, permafrost thickness can reach a maximum of 750 m in the Pleistocene Tuktoyaktuk Coastal Plain (Dallimore et al. 1996, Taylor et al. 1996, Todd and Dallimore 1998). Permafrost characteristics are determined by the duration of submersion and the duration and time of subaerial exposure of the ground. Areas that experienced submersion tend to have a horizontally persistent unfrozen zone (talik) within the main permafrost body, while sections that experienced brief or no submersion display more laterally variable ice-bonding, with talik completely absent (Todd and Dallimore 1998).

It is generally agreed that most of the Tuktoyaktuk Peninsula escaped glaciation during the late Wisconsinan (the interval of the last continental glaciation) (Mackay et al. 1972). The great thickness of permafrost in this area is consistent with prolonged exposure to subaerial temperatures during Wisconsinan times (Taylor et al. 1996). The Tuktoyaktuk Peninsula contains numerous lakes formed through the melting of the upper portion of the underlying permafrost layer. It has been suggested that most coastal lakes have undergone one or more drainage events since their formation (Taylor et al. 1996).

In all areas where permafrost is prevalent, permafrost-related processes such as solifluction and soil creep, ice wedge formation, frost shattering of boulders, pingo formation and the heaving of areas formerly covered by water bodies, have a major effect on shaping the landscape (Rampton and Bouchard 1975). Repeated freezing and thawing of these soils creates features on the surface that include cell-like polygons, bulging hummocks, and bare mud boils where the soil is so active that no plants can take root. Intense frost heaving often splits apart the underlying bedrock and forces large angular boulders to the surface (ESWG 1995).

A number of factors influence the mean annual ground surface temperatures, including past glaciation events, climate change, sea level variation, proximity to heat sources such as rivers, channels or lakes, the formation of seasonal ice in areas of standing water, and the effects of vegetation (Taylor et al. 1996, Todd and Dallimore 1998). Thaw of ice-rich permafrost typically results in varying degrees of ground subsidence, collapse of hummocky microrelief, addition of thaw water to the bottom of the active layer and rapid growth of water-loving vegetation such as sedges, alders and willows. The vegetation lowers ground surface temperature by providing shade, allowing permafrost to aggrade upward again (Mackay 1995).

## 11.6 Hydrology

The Tuktoyaktuk Coastal Plain is characterized by a large number of typically shallow, isolated and interconnected lakes that drain into the southern Beaufort Sea through small streams that freeze to the bottom in winter. These lakes cover 30% to 50% of the surface area of the Tuktoyaktuk Peninsula (Ramlal et al. 1994), and are often connected by ephemeral streams. Most of the water flow in the proposed project area occurs through intermittent creeks with very low flows. The lakes, known as thermokarst lakes, were predominantly formed through local melting of the uppermost part of the underlying permafrost layer, and subsequent settling of the ground (Dome et al. 1982a). Few lakes in this area were formed by glacial action. While these lakes are generally shallow (few exceeding 3 m in depth), they play a significant role in the ecology of the coastal plains, supporting populations of fish, waterfowl and mammals, and providing storage for water, sediment and pollutants (RWED 1999). A number of lakes on the Tuktoyaktuk Peninsula have been identified through Traditional Ecological Knowledge (TEK) as lakes known to winter fish, while others vary in ability to winter fish; these lakes will be considered as sensitive areas.

Lakes on the Tuktoyaktuk Coastal Plain tend to remain ice-covered for around 250 days a year, with freeze-up generally occurring in September or October and break-up occurring in late June (Bond and Erickson 1985, Bigras 1990). Break-up on the peninsula is caused by melting, as opposed to flooding of the ice by a warmer water body, as occurs in the Mackenzie Delta. The slower process of ice melting and the lack of a flood regime on the Tuktoyaktuk coastal and tundra lakes contribute to greater year-to-year variability in measured physical properties, compared to lakes of the Mackenzie Delta (Fee et al. 1988). Precipitation and evaporation are the main controls over lake water level. Some lakes lose more water to summer evaporation than is received through precipitation, causing them to have a negative annual water balance (Bigras 1990).

Streams in the coastal plains region begin to flow in mid June, several weeks before the landfast sea ice breaks up, thereby contributing to the freshwater corridor produced by the Mackenzie River along the coast of the Tuktoyaktuk Peninsula that is used by both migratory freshwater and anadromous fish (Bond

and Erickson 1985). Water levels in the lower reaches of the creeks can rise substantially due to storm surges, despite the low tidal activity measured at Tuktoyaktuk (Chang-Kue and Jessop 1992).

## 11.7 Vegetation

Permafrost limits soil productivity by cooling the soil and creating waterlogged conditions in the thawed active layer near the soil surface (Stonehouse 1999). Plant communities in the arctic therefore are relatively simple and dominated by a few species that are well adapted to poor soil conditions and harsh climate.

No distinct succession of plant species is observed on the tundra of the Tuktoyaktuk Coastal Plains, due to the relatively infrequent occurrence of natural disturbances, such as fire, that create places for plants to grow (Wein 1976). Germination from seeds or vegetative growth is minimal, and depends heavily on both site and temporal characteristics (Bell and Bliss 1980, Hobbie and Chapin 1998). Therefore, plant recruitment becomes an opportunistic process (Svoboda and Henry 1987).

Eleven plant species of national significance are found in the Mackenzie Delta Region (McJannet et al. 1995), and six may occur in the proposed project area (Table 11).

**Table 11**

### **Vegetative Species Of Significance Found In The Vicinity Of The Proposed Project**

Common Name	Latin Name	Phytogeography	Habitat	NCR <sup>1</sup>
Pussytoes	<i>Antennaria friesiana</i>	Arctic-alpine	Alpine ridges and snowbeds.	N3T1
Mustard	<i>Braya pilosa</i>	Arctic	Sandy seashores.	NX
Pondweed	<i>Potamogeton subsibiricus</i>	Aquatic	Still waters.	N2
Goose grass	<i>Puccinellia poacea</i>	Arctic	Riverbanks, flood plains and tidal flats.	N1
Buttercup	<i>Ranunculus pallasii</i>	Arctic-alpine	Coasts and estuaries.	N2
Willow	<i>Salix ovalifolia</i> var. <i>arctolitoralis</i>	Arctic	Sand beaches and terraces.	N2T2

Notes:

The Nature Conservancy Ranks

Canada rank (N): national status

Taxon Subrank (T): applied if a taxon is a subspecies or variety

The degree to which a species is imperiled is rated on a scale of 1 – 5 (from extremely rare to abundant), with X indicating the species is extirpated or extinct.

### 11.7.1 Biophysical Assessment

A biophysical study was conducted in the Mackenzie Delta region in July 2001 (IEG 2001). Both vegetation and wildlife habitat use were sampled at more than 500 sites throughout the region, and subsequently mapped. The maps are key management tools because they identify important vegetation communities and wildlife habitat. This permits a more refined description of vegetation and wildlife habitat use in proposed project areas than was previously possible, and provides a basis for determining potential project-specific and cumulative effects.

### 11.7.2 Vegetation Community Composition

Landcover classes, including vegetation, in the immediate vicinity of the proposed project (Figure 5) and for the area occupied by oil and gas leases within the ISR (Figure 6) are described below. A 2 km buffer around the proposed AEC Kamik 2D Seismic program defines the project area, while the region is delineated as the area occupied by oil and gas leases in the ISR. Access for the proposed project will be built by and shared with other operators in the region. Any additional access required will be along the seismic lines used last year. The area covered by each landcover class as well as the percentage of the area covered by each respective class, at a local and regional scale, are outlined in Table 12. The landcover classes depicted in figures and listed in tables below are described in more detail in Appendix C.

**Table 12**

#### **Landcover Classes Within The Proposed Project Area and Region**

Landcover Class	AEC Kamik 2D		Region	
	Local Area (ha)	% of Local Area	Regional Area (ha)	% of Regional Area
Graminoid	2,579.2	2.0	74,018	3
Sedge	10,306.8	8.3	169,922	8
Tussock Tundra	15,009.9	11.9	133,622	6
Low Birch/Dwarf Shrub	19,514.0	15.5	188,680	9
Low Willow Alder	34,794.4	27.6	354,776	17
Tall Willow Alder	537.8	0.4	148,236	7
Woodland Conifer	931.4	0.7	39,128	2
Forest Conifer	0	0	102,146	5
Other Terrestrial	2,178.0	1.7	68,729	3
Ice, Water, & Aquatic Vegetation	40,180.9	31.9	837,503	40
TOTAL	126,032.3	100.0	2,116,758	100