

**TABLE 11**  
**LANDCOVER CLASSES WITHIN THE PROJECT'S DIRECT FOOTPRINT UTILIZING THE**  
**(WELL PADS & ROADS), LOCAL PROJECT AREA, AND REGIONAL STUDY AREA**

Landcover Class	Proposed Program				Regional Study Area	
	Well Pads & Road <sup>1</sup>		Local Project Area <sup>2</sup>			
	Total Surface Area (ha)	% of Total Surface Area	Total Surface Area (ha)	% of Total Surface Area	Total Surface Area (ha)	% of Total Surface Area
Graminoid	0.5	0.4%	3.6	0.3%	74,018	3.5%
Sedge	7.8	6.0%	130.7	10.0%	169,922	8.0%
Tussock Tundra	3.3	2.6%	30.8	2.3%	133,622	6.3%
Low Birch / Dwarf Shrub	7.9	6.1%	134.7	10.3%	188,680	8.9%
Low Willow Alder	22.4	17.3%	356.9	27.3%	354,776	16.8%
Tall Willow Alder	0.1	0.0%	0.6	0.0%	148,236	7.0%
Conifer Woodland	0.6	0.4%	11.4	0.9%	39,128	1.8%
Conifer Forest	0.0	0.0%	0.0	0.0%	102,146	4.8%
Other Terrestrial	1.2	0.9%	25.9	2.0%	68,729	3.2%
Ice, Water & Aquatic Vegetation	85.8	66.2%	615.3	47.0%	837,503	39.6%
TOTAL	129.5	100.0%	1,309.8	100.0%	2,116,758	100.0%

<sup>1</sup>This area includes two potential well pads and a 20 m wide access road.

<sup>2</sup>This area includes two potential well pads buffered by 1 km on each side and an access road buffer by 50 m on each side.

'Ice, Water & Aquatic Vegetation' is the main landcover class within the direct project footprint, the proposed local project area, and in the region as a whole (Table 11).

The main terrestrial vegetation community in the local project area is 'Low Willow Alder' (27.3%) followed by 'Low Birch/Dwarf Shrub' (10.3%) and 'Sedge' (10.0%) landcover classes.

The 'Low Willow Alder' class consists of shrubs with heights between 0.25 and 1.5 m with *Salix* and *Alnus* as characteristic species. A sparser cover of dwarf shrub or herbaceous vegetation may also be present. The 'Low Birch/Dwarf Shrub' community is either dominated by *Betula* species <0.25 m in height or by other dwarf species <0.25 m in height, mainly *Ledum* and the berry species, *Vaccinium*, *Arctostaphylos*, and *Rubus*. In addition to these dominant species, the 'Low Birch / Dwarf Shrub' sometimes includes a sparse cover of herbaceous plants. Found throughout the Mackenzie Delta region, 'Low Birch / Dwarf Shrub' has a thin distribution within the delta. The 'Sedge' class consists primarily of members of the sedge genus, *Carex*. The 'Tall Willow Alder' includes shrubs >1.5 m in height. The predominant species are willow (*Salix* spp.) and alder (*Alnus* spp.), with an understorey that varies from sparse herbaceous vegetation when the canopy is closed, to low shrubs when the canopy is open.

On a regional scale, 'Low Willow Alder' is the dominant terrestrial vegetation class. It covers approximately 17% of the region. All other classes cover small areas (<10% each), but are relatively equally abundant.

## 11.7 Wildlife




### 11.7.1 Mammals

The habitats in and around the proposed program area support a variety of wildlife species (Table 12). The selection of these species for discussion was based on their potential for overlap with the program timing and area, their importance to local subsistence harvesters and recreational users, their identification as a research or management priority, and their identification by COSEWIC as a species at risk. While other species, such as moose, may occasionally make use of the general program area environment, these isolated occurrences do not substantiate concern of impact, and will be omitted from further discussion in this report.

**TABLE 12**  
**MAMMAL SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROPOSED PROGRAM WITH LIFE HISTORY AND PROGRAM OVERLAP**

		Time											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Species	Habitat	PROPOSED PROGRAM											
		October 2002						April 2003					
Arctic Fox ( <i>Alopex lagopus</i> )	Coastal areas from Shallow Bay to Tuktoyaktuk Peninsula. Den in sandy soils, riverbanks, or eskers above the water table.	Feeding/Scavenging Offshore on Sea Ice						Breeding Offshore on Landfast Ice		Denning/Birthing Onshore Coastal		Feeding/Scavenging Onshore Coastal	
Caribou ( <i>Rangifer tarandus groenlandicus</i> )	Ranges between the Mackenzie River, encompasses the Husky Lakes (HL)/ Tuktoyaktuk Peninsula and extends to the Cape Bathurst Peninsula.	Summer Feeding	Rut in vicinity of HL	Winter Movements and Feeding West and South of HL				Spring Migration To Calving Grounds (Cape Bathurst Pen.)		Calving	Summer Feeding East of Husky Lakes		
Grizzly Bear <sup>1</sup> ( <i>Ursus arctos</i> )	Denning on Richards Island in steep lake, river and creek banks and Pleistocene uplands.	Feeding	Denning			Birthing		Denning		Breeding		Feeding	
Muskrat ( <i>Ondatra zibethicus</i> )	Burrow in banks of waterbodies or create pushups where emergent vegetation is available. Require >1m of water in winter.	Move to deeper water	Burrowing/Feeding						Move to shallower water		Breeding/Burrowing/Feeding		
Red Fox ( <i>Vulpes vulpes</i> )	Dwarf-shrub heath and lowland willow sedge-herb habitat. Denning on slopes, including waterbody edges.	Feeding						Breeding		Denning/Birthing		Feeding	
Wolf <sup>2</sup> ( <i>Canis lupus arctos</i> )	Inhabits treeline-tundra transition zone from the Caribou Hills to east of the Husky Lakes. Follows Bluenose caribou wintering range.	Following and Feeding on Caribou						Breed		Denning/Pups Born/Feeding Near Den East of Husky Lakes Near Treeline			
Wolverine <sup>1</sup> ( <i>Gulo gulo</i> )	Tundra and forested areas of Mackenzie Delta and Husky Lakes region. Caves, rock crevices, fallen logs, and holes in the snow are also used for shelter.	Feeding				Denning/Birthing			Breeding		Feeding		

COSEWIC Designation: <sup>1</sup>Special Concern - A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. <sup>2</sup>Data Deficient - A species for which there is insufficient scientific information to support status designation (COSEWIC 2001).

-  — Important/Sensitive life history event occurring within habitat the program is within or may impact
-  — Life history event occurring within habitat the program is within or may impact
-  — Life history event occurring outside habitat the program is within or may impact

### **Arctic Fox (*Alopex lagopus*)**

During spring and summer arctic foxes occupy areas near terrestrial denning sites remaining there during the relatively snow-free period from May to August (Burgess 2000). Important denning sites occur within the northern Tuktoyaktuk Peninsula.

Arctic fox population dynamics are intimately linked with prey and denning site abundance (Nowak 1991, Burgess 2000). In the southern Beaufort Sea region a migration occurs from Banks Island out to the sea ice in winter, with a return to the island in the spring. Similar migrations occur off the outer Mackenzie Delta and Tuktoyaktuk Peninsula, at times in large numbers (Martell et al. 1984).

Arctic fox form breeding pairs in mid February to late April and courtship and mating occur offshore on landfast ice during this period (Burgess 2000). Dens excavated the previous summer are occupied after courtship and mating, and are often found in light, stable, sandy soils in the active layer of river banks, eskers, or small hillocks (Banfield 1974). Dens are used repeatedly by generations of arctic foxes and are considered permanent components of the landscape (Burgess 2000). Snow is removed from dens in mid-March (Banfield 1974), litters of 8 to 20 young are born between mid May and mid June and the weaned young are abandoned by mid August (TCCP 2000). During winter months, arctic fox shelter in tunnels in snowbanks (Banfield 1974) and in anthropogenic structures such as utility corridors and culverts (Burgess 2000).

### **Caribou (*Rangifer tarandus*)**

Caribou is the most important subsistence and cultural resource in the Mackenzie Delta region (AICCP, IICCP, TCCP 2001). The well being of caribou populations is often regarded as an indicator of arctic ecosystem health (Murphy and Lawhead 2000), and as such a sound understanding of caribou biology, distribution and movements is needed to mitigate for potential impacts in the face of increasing industrial development.

The proposed program area overlaps with the range of the Cape Bathurst herd, and to a lesser extent, the Bluenose West herd. The combined population of these herds was estimated at 88,000 to 106,000 individuals in 1992 (Nagy et al. draft 2001) and, according to recent community interviews, the herds are perceived to be increasing in numbers (IEG 2002).

Habitat requirements of barren-ground caribou vary seasonally. Table 12 presents the life history timeline of the Cape Bathurst herd. Calving caribou display a preference for tussock tundra habitats (Murphy and Lawhead 2000), and overall diet selection alternates between preference for: new green sedges and grasses in spring; deciduous shrubs (especially willow, birch and blueberry) in summer; and lichens, evergreen shrubs, grasses and sedges in fall/winter (Bergerud 2000). Caribou generally winter on lichen pastures with reduced snow cover, which decreases the risk of predation and increases forage ease. A primary habitat requirement during all seasons is sufficient space for predator avoidance (Bergerud 2000). The Inuvialuit have indicated that important locations for caribou during winter include areas east of Caribou Hills and around Husky Lakes (particularly the southern portions). In these areas caribou require spongy lichen, grasses and shrubs, and make use of game trails (IEG 2002). Within the direct

program footprint, 95.2 ha of caribou habitat are available, with 774.7 ha and 1,144,936.7 ha of caribou habitat available within the local program area and regional area, respectively (Table 13).

The spring migratory movement to calving grounds north of the tree line is a marked, directional movement, while fall migration is less clear (Bergerud 2000). The spring migration tends to follow frozen lakes and rivers and snow-free uplands and eskers (CWS 2000), with barren-ground caribou demonstrating fidelity to traditional calving grounds (Gunn and Miller 1986, Case et al. 1996, Ferguson and Messier 2000). In fall the herd crosses central Husky Lakes and generally occupies areas to the west of Husky Lakes and north of Parsons Lake. During this time caribou have been observed to range as far west as the Caribou Hills. During the post-rut period (November) and winter period (defined by RWED's study as December 1 to March 31), movements have been tracked in the broad area surrounding Parsons Lake, extending north to Kugmallit Bay, west to the Caribou Hills, south past Sitidgi Lake, and east beyond Husky Lakes. In the spring (April 1) the herd is generally located north of Parsons Lake prior to beginning the migration east across the central Husky Lakes area (RWED 1999).

The Bluenose West herd is less likely to be encountered during program operations, as satellite tracking data have shown their movements to be generally concentrated in areas east of the Kugaluk and Miner Rivers (i.e. east of Husky Lakes).

The size and growth of caribou herds are affected by a number of factors including: harvest levels, predation, condition of the range, weather events, human disturbance, and possibly competition with other species (Nagy et al. draft 2001). Ferguson and Messier (2000) suggest that the mechanisms limiting caribou populations vary depending on the ecosystem. While the main cause of mortality in some herds may be predation (Nagy et al. draft 2001, Bergerud 2000), others support that migratory forest-tundra caribou populations may be regulated largely by forage availability (Messier 1995, Ferguson et al. 2001). Information is currently lacking on the contribution of natural density-dependent (e.g. predation) and density-independent (e.g. weather) factors to population level changes in caribou herds. Therefore difficulties arise in attributing observed changes to anthropogenic causes (Murphy and Lawhead 2000).

**TABLE 13**  
**AVAILABLE CARIBOU HABITAT WITHIN THE DIRECT PROJECT FOOTPRINT, LOCAL PROJECT AREA, AND REGIONAL STUDY AREA**

Habitat	Program footprint <sup>1</sup>		Local Project Area <sup>2</sup>		Regional Study Area <sup>3</sup>	
	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>
Caribou Habitat	95.2	73.5%	774.7	59.1%	1,144,936.7	54.1%
Non-Caribou Habitat	34.3	26.5%	535.1	40.9%	971,821.2	45.9%
<b>Total</b>	<b>129.5</b>	<b>100%</b>	<b>1,309.8</b>	<b>100%</b>	<b>2,116,757.9</b>	<b>100%</b>

<sup>1</sup>This area includes two potential well pads and a 20 m wide access road.

<sup>2</sup>This area includes two potential well pads buffered by 1 km on each side and an access road buffer by 50 m on each side.

<sup>3</sup>The regional study area is shown in Figure 1.

<sup>4</sup>For each scale (direct footprint, local, regional), the % of total surface area represents the ratio of caribou habitat affected by the proposed program and the total surface area.

### **Grizzly Bear (*Ursus arctos*)**

Grizzly bear populations in the north are likely limited, in part, by the availability of suitable denning habitat (Harding 1976). Denning primarily occurs within home range areas, to which females, and to a lesser extent males, demonstrate a high degree of fidelity (Nagy et al. 1983). Despite this fidelity, dens are seldom reused in a following season (Slaney 1975, Shideler and Hechtel 2000, McLoughlin et al. 2002). Sites selected for denning include the steep, vegetated banks of lakes, creeks and river channels, and areas of hilly upland Pleistocene deposits that are not subject to regular flooding (Slaney 1975, Harding 1976). Excavations in south-facing slopes take advantage of the insulating snowdrifts formed by prevailing winds (Harding 1976). Dens are typically associated with clumps of vegetation for stability and coverage, with the majority of dens found in areas of shrubby cover from 0.2-0.5 m high (e.g. willows, birch, bearberry) or dense stands of willow and alder 2-3 m high (Nagy et al. 1983). A preference is also shown for specific substrate type, including older, well drained, and consolidated sandy or silty soils (Harding 1976). While snow dens are rarely constructed, their occurrence may indicate a shortage of suitable denning sites (Harding 1976).

These characteristic landforms and soil types are found throughout the uplands of the Richards Island, Tuktoyaktuk Peninsula and Parsons Lake areas, providing suitable grizzly denning habitat (Slaney 1975). Den sightings in the immediate Parsons Lake area have ranged from few (Nagy et al. 1983) to none (Slaney 1975). Den sightings in the immediate Parsons Lake area have ranged from few (Nagy et al. 1983) to none (Slaney 1975). This may be due to fewer and less pronounced lake and channel banks in the Parsons Lake area than elsewhere (Slaney 1975).

The life history timeline of grizzly bear in comparison to program timing is shown in Table 12. General patterns of entrance and emergence remain similar from year to year (Nagy et al. 1983).

Grizzly bears occur within the region in low densities compared to other areas in North America, ranging from 3.8 to 4.7 bears per 1000 km<sup>2</sup> (Nagy et al. 1983). The grizzly bear population of Richards Island and the Tuktoyaktuk Peninsula is considered secure (Nagy et al. 1983, GNWT 2000), and elders in Aklavik and Inuvik feel that the bear population in the Mackenzie Delta region is currently increasing (IEG 2002). Despite this positive trend, the grizzly bear population as a whole in the Northwest Territories has been designated as "Special Concern" as a result of moderate threats to population, distribution and habitat due to expanding development (COSEWIC 2001). It is worth noting the Richards Island/Tuktoyaktuk Peninsula population is not discrete, but is thought to be contiguous with other coastal and interior populations to the east, west and south (Slaney 1975, Nagy et al. 1983), although the degree of continuity is limited (McLoughlin et al. 2002).

### **Muskrat (*Ondatra zibethicus*)**

In the ISR, muskrats occur in particular concentrations in the Mackenzie Delta and coastal Beaufort region (Dome et al. 1982, TCCP 2000). An intermediate number of muskrat pushups on upland lakes near the Parsons Lake area and on Richards Island have been recorded (Slaney 1974a), muskrat habitat in areas west of the Delta region is considered poor or insignificant (Dennington et al. 1973). Similarly, Richards Island and surrounding uplands habitat is classed as less suitable habitat, although, an intermediate number of muskrat pushups on Richards Island have been recorded (Slaney 1974a).

Muskrats burrow into the banks of lakes and streams in areas where aquatic plants are accessible for food and building materials (Dome et al. 1982, Jelinski 1989). While muskrats are not migratory animals, seasonal differences in habitat use do occur. In the spring and summer virtually all suitable waterbodies are occupied (Westworth 1977). Prior to the onset of winter, muskrats relocate to areas of deeper water, and burrow in higher, steeper banks (Jelinski 1989). This shift appears to maintain the accessibility of food, and allows muskrat to forage on high-energy roots and rhizomes of submerged aquatic vegetation, thereby increasing overwinter survival. The optimum depth of water required to support muskrat in winter is between 1.2 m and 3 m (Hawley 1974). The winter range is often extended by the construction of pushups, which are small mounds of vegetation built over holes in the ice that afford cover for feeding (Dome et al. 1982, Martell et al. 1984). During the spring muskrats are highly mobile, feeding on submergent aquatic vegetation (Jelinski 1989).

Muskrat numbers fluctuate widely in the Mackenzie Delta region, possibly exhibiting a cyclical pattern in response to factors such as food availability, suitability of denning sites, the freezing of shallow lakes, and predator abundance (Martell et al. 1984). A recent study detected a four-year cycle of muskrat population highs and low in subarctic-arctic ecozones, which is hypothesized to result from the cyclical nature of predator populations, particularly that of the red fox (Erb et al. 2000). While muskrat in the ISR are abundant at this time, local trappers believe the health of the muskrat population is declining (TCCP 2000).

### **Red fox (*Vulpes vulpes*)**

The red fox is widely distributed in northern latitudes and occurs throughout the mainland Northwest Territories (Banfield 1974). They are most abundant below treeline (IICCP 2000), with population

densities typically greater in forest and forest-tundra transition zones than on the tundra (Dome et al. 1982). However, red fox are currently expanding their range northward (Macpherson 1964, Sklepkovych and Montevecchi 1996).

Within their range, red fox occupy a variety of habitats, including forest areas, natural clearings, river valleys, and tundra. In the uplands region east of the Mackenzie Delta, Slaney (1974b) observed red fox denning and hunting in areas surrounding Parsons Lake, Swimming Point and extending to Big Lake in the Kendall Island Bird Sanctuary. Red fox were frequently seen hunting ptarmigan in dwarf-shrub heath and lowland willow sedge-herb habitat (Slaney 1974b). Red fox tend to den in areas with dense shrub cover on well drained, usually south facing slopes of river banks, ridges, sandy eskers, and moraines in close association with waterbodies (Slaney 1974b, Martell et al. 1984, St. Georges et al. 1995). The versatile diet of the red fox has been a main contributor to their wide distribution, allowing them to encroach on arctic fox terrain (Smits et al. 1989).

Population estimates are not available for the red fox in the region although the population tends to be variable year to year (TCCP 2000) and is considered secure in the NWT (GNWT 2000).

#### **Wolf (*Canis lupus*)**

Caribou are the main prey of wolves in the Inuvialuit Settlement Region (ISR) (Clarkson and Liepins 1991, Heard and Williams 1992), and their availability largely influences wolf movement and distribution patterns. Wolves within the ISR either remain resident to a relatively small area all year long, or cover extensive areas with migratory movements that follow caribou migrations (Clarkson and Liepins 1989, 1991, Walton et al. 2001). During the winter, packs often hunt over long distances along ridges, trails, seismic lines, lakeshores, and frozen lakes and rivers (Mech 1970, Peters and Mech 1975). Wolves ranging south and west of the Husky Lakes are known as the Husky Lakes pack, as designated by Clarkson and Liepins (1991). Packs that travel to areas of high winter caribou concentration in February to May will later abandon those areas and travel to traditional denning areas (Clarkson and Liepins 1991), primarily located east of Husky Lakes (Clarkson and Liepins 1989) and within 50 km of the treeline (Heard and Williams 1992). Denning near treeline likely maximizes caribou availability throughout the denning season (Heard and Williams 1992, Walton et al. 2001). The proposed program is not anticipated to coincide with wolf denning habitat, however overlap may occur with the activities of wolves associated with caribou wintering in the program vicinity.

#### **Wolverine (*Gulo gulo*)**

The distribution of wolverines is circumpolar in tundra and tundra-taiga zones (Landa et al. 1998). In the ISR, wolverines occur at low population densities throughout the tundra, boreal forest, and mountainous regions (Martell et al. 1984, Banci and Harestad 1990, Wilson et al. 2000). Wolverines are also found throughout the year in the forests of the Mackenzie Delta region (Martell et al. 1984) and along the Mackenzie Valley (Dome et al. 1982). Based on traditional harvesting of the wolverine, the winter range is known to extend northeast from Parsons Lake to the Smoke River, encompassing all of the Husky Lakes area (TCCP 2000).

Wolverine dens range in complexity, from temporary rest beds to natal dens with extensive tunnel systems (Lee and Niptanatiak 1996). Natal dens on the tundra are often associated with rocky scree slopes and large snowdrifts (Lee and Niptanatiak 1996, Landa et al. 1998), habitat that is abundant throughout the ISR. Caves, rock crevices, fallen logs, holes in the snow, and burrows are also used for shelter (TCCP 2000). At least 1 metre of snow must be present by February for wolverines to successfully make a den (Magoun and Copeland 1998).

Wolverines have a varied diet that includes small mammals, roots and berries (Banci and Harestad 1988, 1990, TCCP 2000). The wolverine will scavenge carrion from kills of wolves and bears (Clarkson and Liepins 1993), ungulate carcasses being the principal food item especially in winter (TCCP 2000, Petersen 1997).

The wolverine was issued a designation of 'special concern' by COSEWIC in 1989 (COSEWIC 2001). Population estimates and densities within the region are not available. However densities of wolverines in southwestern Yukon indicate one wolverine per 177 km<sup>2</sup> (Banci and Harestad 1990).




### 11.7.2 Birds/Waterfowl

#### Waterfowl/Shorebirds

The upland tundra lakes and riparian areas of the Mackenzie Delta region are host to a wide variety of waterfowl and to a lesser extent shorebirds. The vast majority migrate into, or through, the area to nest, raise young, moult and accumulate fat reserves before returning south in the fall to overwinter in other regions (Martell et al. 1984). Migrating species are not likely to be found in the program area when activities are occurring, as they move south for winter by early September and do not arrive in spring until mid May (Johnson and Herter 1989). Common species found within the vicinity of the proposed program during spring and fall migration are identified in Table 18 at the end of this section. Table 14 identifies important habitat characteristics and program timing compared to important waterfowl and shorebird life history characteristics.

**TABLE 14**  
**MIGRATORY BIRD GROUPS OF SIGNIFICANCE FOUND IN THE VICINITY OF THE**  
**PROPOSED PROGRAM WITH LIFE HISTORY AND PROGRAM OVERLAP**

		Time											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Species	Habitat	PROPOSED PROGRAM											
		October 2002						April 2003					
Waterfowl	Wet lowland areas, which are marshy, vegetated by sedges, grasses, and horsetails.	Fall Migration	Wintering in Southerly Locations						Staging, Nesting, Moulting, Feeding				
Shorebirds	Wet sedge, patterned ground, moist/wet tundra near water.	Fall Migration	Wintering in Southerly Locations						Staging, Nesting, Fledging, Feeding				

 — Important/Sensitive life history event occurring within habitat the program is within or may impact  
 — Life history event occurring within habitat the program is within or may impact  
 — Life history event occurring outside habitat the program is within or may impact

### *Important Habitat Areas and Types*

The upland lakes east of the Caribou Hills and on Richards Island provide abundant habitat for staging and nesting waterfowl and to a lesser extent shorebirds. Areas including the Tuktoyaktuk Peninsula, the Husky Lakes and Liverpool Bay are important moulting and staging areas and comprise a large area of the Tuktoyaktuk spring goose hunt (Martell 1984, TCCP 2000). Haszard (2001) surveyed delta lakes and upland lakes south of Inuvik and found that scoter (*Melanitta spp.*, known locally as black ducks) pairs are more abundant on upland lakes and preferred large wetlands to smaller wetlands. Most notably tundra swans (*Cygnus columbianus*) are found in high densities east of East Channel Mackenzie River in the upland tundra lakes extending to the Anderson River (Slaney 1974a, Dome et al. 1982). Similarly, short grass prairie Canada geese (*Branta canadensis*), greater white-fronted geese (*Anser albifrons*) and black brant (*Branta bernicla nigricans*) utilize the Tuktoyaktuk Peninsula and areas south of the Husky Lakes (Wiebe and Hines 1998, Hines et al. 2000). Slaney (1974a) surveyed areas in the Parsons Lake region and found large concentrations of diving ducks (arctic loon (*Gavia arctica*), greater scaup (*Aythya marila*), old squaw (*Clangula hyemalis*), white-winged scoters (*Melanitta fusca*) and few dabbling ducks (wigeon (*Anas americana*), mallard (*Anas platyrhynchos*), pintail (*Anas acuta*)).

Studies by Gratto-Trevor (1996), found that shorebird pairs are least abundant on high terrain dry upland tundra plots. However, low terrain wetter uplands held low densities of semipalmated sandpipers (*Calidris pusilla*) and lesser golden plovers (*Pluvialis dominica*). A few species preferred dry upland tundra areas characterized by mosses and lichens (lesser golden plover (*Pluvialis dominica*), stilt sandpiper (*Calidris himantopus*)), and one preferred clearings in forests near water (lesser yellowlegs (*Tringa flavipes*)) (Johnson and Herter 1989). Slaney (1974a) found whimbrel (*Numenius phaeopus*) in conjunction with dwarf shrub-heath habitat in the Parsons Lake region and common snipe (*Gallinago gallinago*) and red-necked phalarope (*Phalaropus lobatus*) in upland marshy areas of Richards Island. Gravel pads and beaches also support breeding pairs of semipalmated plovers (Gratto-Trevor 1996).

### *Population Status*

Population estimates for most species of waterfowl and shorebirds occurring within the vicinity of the program indicate that populations are meeting targeted numbers for the Mackenzie Delta Region (CWSWC 2001, Morrison et al. 2001, NAWMP 1998). However, some species have been declining, and other population estimates, due to insufficient data, cannot be determined. Elders from Inuvik, Aklavik, Tsiigehtchic and Fort McPherson have noticed declines in white winged scoters and surf scoters. Surveys in Western Boreal Canada indicate that scoters have declined significantly, although reasons for the decline are unknown (CWSWC 2001). Other waterfowl species that frequent the uplands, such as the greater scaup and lesser scaup (*Aythya marila*), have also shown decreasing trends. Due to difficulties in distinguishing the two species, population estimates need to be clarified (CWSWC 2001). Although census data is not available for the delta region, Northern pintail and mallard ducks in Western Boreal populations have declined significantly. The pintail in the region is at half its NAWMP objective of 407,000 birds. Similarly, mallards declined to the second lowest population level recorded in Western Boreal Canada (1.6 million birds compared to NAWMP goal of 2.36 million) (CWSWC 2001). In the delta region, tundra swan (eastern population) productivity was very low in 2001, and further declines are expected to occur as an estimated one third of the eastern population nests in the delta region (CWSWC

2001). However, the 2001 eastern tundra swan population estimate was 98,200; considerably higher than the North American Waterfowl Management Plan (NAWMP) objective of 80,000 (NAWMP 1998). The greater white-fronted goose (mid continent population) has shown a 33% decrease from 2000, although the current population estimate of 712,000 is still considerably higher than the NAWMP objective of 600,000 (CWSWC 2001, NAWMP 1998). White-fronted geese have low survival rates in the ISR and are currently of special management concern to the Wildlife Management Advisory Council (WMAC) and Inuvialuit Game Council (IGC) (WMAC and CWS 1999).

Morrison et al. (2001) provided estimates of shorebird populations in Canada and North America. Most species supported by the uplands were listed as either "Common" or "Regular" and populations were greater than 50,000 (lower limit of population estimate) in Canada. Although, the whimbrel (*Numenius phaeopus*) had population estimates below 50,000 (lower limit of population estimate). Given the large breeding range of this species and the uncertainties associated with the surveys, estimates are considered conservative (Morrison et al. 2001). Only one shorebird in the delta region is under a COSEWIC designation, the 'endangered' Eskimo curlew (*Numenius borealis*). Nesting pairs have not been observed since 1866, and only 7 possible sightings have occurred since 1975 (Gratto-Trevor 2001).

### Raptors




There are nineteen raptor species residing in the Northwest Territories. However, only five species of raptors, the gyrfalcon (*Falco rusticolus*), bald eagle (*Haliaeetus leucocephalus*), tundra peregrine falcon (*Falco peregrinus tundrius*), snowy owl (*Nyctea scandiaca*) and the short-eared owl (*Asio flammeus*), are considered common residents in the Mackenzie Delta region (Johnson and Herter 1989, Fleck 1981). Of these five, the gyrfalcon and the snowy owl are year-round residents, although they may migrate to more southerly areas of their breeding range depending on prey availability (Parmalee 1972, IICCP 2000). Common prey items of raptors include small mammals and birds such as lemmings, voles, hares, ptarmigan, ducks, shorebirds and songbirds (Armstrong 1980).

### Important Areas and Habitat Types

Raptors in the delta utilize three main habitat types for nesting; elevated surface formations, open tundra and forested areas. Given that the uplands region of the delta is primarily shrubby and herbaceous and characterized by rolling, hilly terrain, it is anticipated that raptor species utilizing elevated cliffs and forested areas would be rare to uncommon in the region. Species that nest on the open tundra include the snowy owl, and the short-eared owl. Nest sites are typically on well-drained hummocks or beneath small shrubs or grass clumps (Johnson and Herter 1989). Refer to Table 15 for timing of snowy owl and short-eared owl life history characteristics.

**TABLE 15**  
**RAPTOR SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROGRAM**  
**WITH LIFE HISTORY AND PROGRAM**

		Time											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Species	Habitat	PROPOSED PROGRAM											
		October 2002						April 2003					
Snowy Owl ( <i>Nyctea scandiaca</i> )	Coastal and tundra regions of the Mackenzie Delta on well drained hummocks or beneath small shrubs or grass clumps.	Feeding in Local or Southerly Area of Range Depending on Prey Availability										Nesting, Fledging, Feeding	
Short-eared Owl ( <i>Asio flammeus</i> )	Coastal and tundra regions of the Mackenzie Delta on well drained hummocks or beneath small shrubs or grass clumps.	Fall Migration	Feeding in Southern Canada or United States									Nesting, Fledging, Feeding	

 — Important/Sensitive life history event occurring within habitat the program is within or may impact  
 — Life history event occurring within habitat the program is within or may impact  
 — Life history event occurring outside habitat the program is within or may impact

### Population Status




Because of the large distribution and breeding ranges of raptors, population estimates are based on a variety of surveys from different parts of North America (Kirk and Hyslop 1998). Specific estimates for the Mackenzie Delta region are difficult to obtain. The snowy owl population estimate ranges between 10,000 – 30,000 individuals in Canada and the population is estimated to be stable across Canada (Kirk et al. 1994). It has held the COSEWIC designation “Not at Risk” since 1995 (COSEWIC 2001). In the delta, populations are estimated to be high in some years and low in others, primarily because of fluctuations in the lemming population (IICCP 2000, Johnson and Herter 1989). COSEWIC (2001) lists the short-eared owl as ‘Special Concern’. The short-eared owl has experienced long term declines, however this may be due to variability in prey populations and limited data (Kirk and Hyslop 1998).

### Rock and Willow Ptarmigan (*Lagopus* spp.)

Willow ptarmigan (*Lagopus lagopus*) and rock ptarmigan (*L. mutus*) are common in the uplands east of the Mackenzie Delta, and are widely distributed throughout both forest and tundra habitats. Within their range willow ptarmigan use muskeg areas and sheltered valleys with abundant willow (*Salix* spp.) growth (IICCP 2000). Rock ptarmigan tend to rely primarily upon birch (*Betula* spp.) buds and catkins (Martell et al. 1984). During the summer, willow ptarmigan are found primarily on dry shrub and polygon tundra, in association with willow-sedge meadows (Hannon and Barry 1986, Schaefer et al. 1996). Rock ptarmigan are found in open tundra and coastal areas during the same time period. Following nesting and chick fledging, ptarmigan form flocks in late summer, and by late fall groups of males will separate from the larger flocks as the ptarmigan move to local wintering areas or forested areas in the south (Martell et al. 1984). Table 16 overviews habitat and life history characteristics of both species in relation to the program timing.

**TABLE 16**  
**PTARMIGAN SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROPOSED**  
**PROGRAM WITH LIFE HISTORY AND PROGRAM OVERLAP**

		Time											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Species	Habitat	PROPOSED PROGRAM											
		October 2002						April 2003					
Willow Ptarmigan ( <i>Lagopus lagopus</i> )	Muskeg areas and sheltered valleys with abundant willow growth, dry shrub and polygon tundra. May migrate to forest habitat in winter or utilize tall willows.	Burrowing, Feeding in Local or Southerly Area of Range Depending on Willow Availability and Snow Depth								Mating, Nesting, Fledging, Feeding			
Rock Ptarmigan ( <i>Lagopus mutus</i> )	Open tundra and coastal areas with abundant birch growth. May migrate to forest habitat in winter or utilize tall birch.	Burrowing, Feeding in Local or Southerly Area of Range Depending on Birch Availability and Snow Depth								Mating, Nesting, Fledging, Feeding			

 — Important/Sensitive life history event occurring within habitat the program is within or may impact  
 — Life history event occurring within habitat the program is within or may impact  
 — Life history event occurring outside habitat the program is within or may impact

The availability of a winter food supply appears to be a crucial limiting factor associated with ptarmigan life history (Johnson and Herter 1989, St-Georges et al. 1995). Highly suitable habitat for both species extends from Richards Island to the Tuktoyaktuk Peninsula and areas surrounding the Husky Lakes (IEG 2002). However, snow cover of forage plants must also be considered because shorter forage plants (e.g., dwarf willow and dwarf birch) will be snow covered for most of the winter season in the outer delta and thus unavailable as a food source to ptarmigan unless exposed by foraging caribou (Johnsgard 1973a). In late April and early May, willow ptarmigan move from tall willow wintering areas to upland shrub tundra where they feed on a wide variety of plants in the summer (Martell et al. 1984). Within the direct program footprint, 106 ha of ptarmigan habitat are available, with 937.2 ha and 1,643,602.4 ha of ptarmigan habitat available within the local program area and regional area, respectively (Table 17).

There have been no long-term studies of ptarmigan population dynamics in the Mackenzie Delta region (Martell et al. 1984). However, Hannon and Barry (1986) studied willow ptarmigan in the Anderson River Delta and found that the population oscillates over a period of 8-13 yrs. Male densities were estimated to fluctuate between 11 – 43 males/km<sup>2</sup>. A density of 106 pairs/km<sup>2</sup> in coastal areas of the delta was observed in the spring of 1969 (Martell et al. 1984).

**TABLE 17**  
**AVAILABLE PTARMIGAN HABITAT WITHIN THE DIRECT PROJECT FOOTPRINT,**  
**LOCAL PROJECT AREA, AND REGIONAL STUDY AREA**

Habitat	Program footprint <sup>1</sup>		Local Project Area <sup>2</sup>		Regional Study Area <sup>3</sup>	
	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>	Total Surface Area (ha)	% of Total Surface Area <sup>4</sup>
Ptarmigan Habitat	106.0	81.9%	937.2	71.6%	1,643,602.4	77.6%
Non-Ptarmigan Habitat	23.5	18.1%	372.6	28.4%	473,155.4	22.4%
<b>Total</b>	<b>129.5</b>	<b>100%</b>	<b>1,309.8</b>	<b>100%</b>	<b>2,116,757.9</b>	<b>100%</b>

<sup>1</sup>This area includes two potential well pads and a 20 m wide access road.

<sup>2</sup>This area includes two potential well pads buffered by 1 km on each side and an access road buffer by 50 m on each side.

<sup>3</sup>The regional study area is shown in Figure 1.

<sup>4</sup>For each scale (direct footprint, local, regional), the % of total surface area represents the ratio of ptarmigan habitat affected by the proposed program and the total surface area.

**TABLE 18**  
**BIRDS POTENTIALLY FOUND IN THE VICINITY OF THE PROPOSED PROGRAM**

Common Name	Scientific Name	Common Name	Scientific Name	Common Name	Scientific Name
WATERFOWL		Tundra Swan	<i>Cygnus columbianus columbianus</i>	Lesser Yellowlegs	<i>Tringa flavipes</i>
Arctic Loon	<i>Gavia arctica</i>	White-fronted goose	<i>Anser albifrons frontalis</i>	Red-necked Phalarope	<i>Phalaropus lobatus</i>
American Wigeon	<i>Anas americana</i>	SEA BIRDS		Semipalmated Plover	<i>Charadrius semipalmatus</i>
Brant	<i>Branta bernicla nigricans</i>	Old Squaw	<i>Clangula hyemalis</i>	Semipalmated Sandpiper	<i>Calidris pusilla</i>
Canada Goose	<i>Branta canadensis</i>	Red Breasted Merganser	<i>Mergus serrator</i>	Stilt Sandpiper	<i>Calidris himantopus</i>
Common Loon <sup>2</sup>	<i>Gavia immer</i>	Surf Scoter	<i>Melanitta perspicillata</i>	Whimbrel	<i>Numenius phaeopus</i>
Greater Scaup	<i>Aythya mirila</i>	White-winged Scoter	<i>Melanitta fusca</i>	RAPTORS	
Green-winged Teal	<i>Anas crecca</i>	SHOREBIRDS		Snowy Owl <sup>2</sup>	<i>Nyctea scandiaca</i>
Lesser Scaup	<i>Aythya affinis</i>	Common Snipe	<i>Gallinago gallinago</i>	Short-eared Owl	<i>Asio flammeus</i>
Mallard	<i>Anas platyrhynchos</i>	Eskimo curlew <sup>1</sup>	<i>Numenius borealis</i>	OTHER	
Northern Pintail	<i>Anas acuta</i>	Hudsonian Godwit	<i>Limosa haemastica</i>	Willow Ptarmigan	<i>Lagopus lagopus</i>
Red-throated loon	<i>Gavia stellata</i>	Lesser Golden Plover	<i>Pluvialis dominica</i>	Rock Ptarmigan	<i>Lagopus mutus</i>

List includes common species, which may nest, stage or moult in the vicinity of the program. Infrequent and uncommon species are not listed unless a COSEWIC status has been designated. For a complete listing consult IICCP (2000) or Johnson and Herter (1989).

COSEWIC Designation: <sup>1</sup>Endangered - A species facing imminent extirpation or extinction. <sup>2</sup>Not at Risk - A species that has been evaluated and found to be not at risk. (COSEWIC 2001)

### 11.7.3 Fish

A large number of fish species occur within the freshwater and marine environments of the western Arctic. The Husky Lakes estuary and surrounding lakes provide important fish habitat and is utilized for subsistence harvesting (TCCP 2000). COSEWIC candidate species are identified and recognized as species that are suspected of being in some COSEWIC category of risk of extinction or extirpation at the national level, before being examined through the status assessment process (COSEWIC 2002). Fish species that are of concern because of their sensitivity or importance for subsistence are listed in Table 19, if they are potentially found in the vicinity of the proposed program area.

**TABLE 19**  
**FISH SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROPOSED**  
**PROGRAM WITH LIFE HISTORY AND PROGRAM OVERLAP**

		Time											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Species	Habitat	<div style="display: flex; justify-content: space-between; width: 100%;"> <span>October 2002</span> <span>PROPOSED PROGRAM</span> <span>April 2003</span> </div>											
Arctic Grayling <sup>1</sup> ( <i>Thymallus arcticus</i> )	Overwintering in lakes. Feeding and spawning in clear water streams.	Feeding	Overwintering/feeding in lakes								Spawning in streams	Feeding	
Broad Whitefish ( <i>Coregonus nasus</i> )	Overwintering, feeding, and spawning in lakes. Migration and spawning upstream.	Migration and spawning	Overwintering/feeding in lakes								Feeding in lakes	Migration and spawning	
Burbot ( <i>Lota lota</i> )	Feeding, spawning, and overwintering in lakes and channels of the Mackenzie Delta.		Overwintering in lakes		Spawning in lakes		Overwintering/migration to deeper water				Feeding in lakes		
Inconnu ( <i>Stenodus leucichthys</i> )	Feeding and overwintering in lakes. Spawning in upstream tributaries.	Spawning in streams	Overwintering/feeding in lakes								Migration to spawning areas		
Lake Trout ( <i>Salvelinus namaycush</i> )	Feeding, spawning, and overwintering in lakes and Husky Lakes estuary.	Spawning in lakes	Overwintering/feeding in lakes								Feeding in lakes		
Lake Whitefish ( <i>Coregonus clupeaformis</i> )	Spawning, feeding, and overwintering in lakes and channels.	Spawning	Overwintering/feeding in lakes								Feeding in lakes		
Least Cisco <sup>1</sup> ( <i>Coregonus sardinella</i> )	Feeding and overwintering in lakes, and channels. Spawning in streams.	Spawning in streams	Overwintering/feeding in lakes								Feeding in lakes		
Northern Pike ( <i>Esox lucius</i> )	Feeding, overwintering and spawning in calm, inland waterbodies.	Feeding	Overwintering/feeding lakes and channels						Spawning		Feeding in lakes		
Pacific Herring ( <i>Clupea harengus</i> )	Spawning, overwintering, and feeding in nearshore areas. Feeding in offshore marine areas.	Feeding	Overwintering/feeding in estuary							Spawning		Feeding	

COSEWIC Designation: <sup>1</sup>Intermediate Priority Candidate- A species suspected of being in some category of risk of extinction or extirpation at the national level, before being examined through the status assessment process (COSEWIC 2002).

- Important/Sensitive life history event occurring within habitat the program may impact
- Life history event occurring within habitat the program may impact
- Life history event occurring outside habitat the program may impact

The Husky Lakes estuary and surrounding lakes provide important fish habitat for various species, with identified overwintering habitat in Hans Bay and surrounding lakes of sufficient depth (Sekerak et al. 1992). Many of the waterbodies in the region are too shallow to support fish species throughout the winter. Migration of fish from or to lakes of the Tuktoyaktuk Peninsula relies on the seasonal thaw and

flow of ephemeral streams. Restricted overwintering habitat and constrained migratory routes limit fish populations in the region.

#### **Arctic Grayling (*Thymallus arcticus*)**

Freshwater populations of arctic grayling occur within the tundra upland and Husky Lakes region, preferring clear water of small to medium-sized streams (TCCP 2000) and overwintering in lakes (Sekerak et al. 1992). Spawning occurs in spring over gravels of clear, flowing water (TCCP 2000). Arctic grayling has been identified as an intermediate priority candidate by COSEWIC (2002).

#### **Broad Whitefish (*Coregonus nasus*)**

Broad whitefish populations occur in interior upland lakes including isolated lakes that satisfy all life-history requirements (Sekerak et al. 1992). Other populations utilize gravels in stream tributaries for spawning in October and migrate to suitable lakes for overwintering (Dome et al. 1982, TCCP 2000).

#### **Burbot or Loche (*Lota lota*)**

Burbot are a unique fish that occur in lakes throughout the tundra uplands, spawning in lakes and channels with water less than 3 m deep from January to March (TCCP 2000) and overwintering in lakes of sufficient depth. The Arctic Borderlands Ecological Knowledge Co-op has initiated a study investigating the occurrence of contamination and other abnormalities in burbot livers with the potential to provide information on the occurrence and distribution of contaminants in the lower Mackenzie drainage (ABEKC 2000).

#### **Inconnu or Coney (*Stenodus leucichthys*)**

Freshwater inconnu occur within large lakes of the tundra upland with identified overwintering in Sitidgi Lake (Sekerak et al. 1992). Spawning occurs in various sized gravel of streams during September through early October (DFO 1998, Howland et al. 2000, TCCP 2000). Inconnu are highly migratory, with spawning areas in excess of 1000 km from summer feeding areas (DFO 1998). Recent evaluations of Inconnu stocks in the Mackenzie River indicate that stocks are healthy and not currently under risk from fisheries or subsistence harvesting (DFO 1998).

#### **Lake Trout (*Salvelinus namaycush*)**

Lake trout are most common in large, deep lakes and may be found in estuarine habitats such as the Husky Lakes estuary (Sekerak et al. 1992). Spawning occurs in early September primarily over clean, rocky substrate of lakes and less frequently in rivers (TCCP 2000). As a result of low temperatures and low food supply in Arctic lakes, as well as their position as top fish predators, lake trout are commonly near their physiological limits for survival and may be particularly sensitive to disturbance (McDonald et al. 1996). Lake trout has been identified as a lower priority candidate by COSEWIC (2002).

#### **Lake Whitefish or Humpback Whitefish (*Coregonus clupeaformis*)**

Lake whitefish are common in lakes and estuarine habitat throughout the Tuktoyaktuk Peninsula with migration between areas (Sekerak et al. 1992). Overwintering occurs in lakes and bays of the Husky

Lakes (Sekerak et al. 1992). Lake whitefish spawn in late September through early October (TCCP 2000).

#### **Least Cisco (*Coregonus sardinella*)**

Least cisco are dispersed across many habitat types, with identified overwintering habitat in the Husky Lakes estuary and surrounding lakes (Sekerak et al. 1992, TCCP 2000). Spawning occurs in streams over gravel or sand substrate from mid-September to after freeze-up (Martell et al. 1984, TCCP 2000). Least cisco has been identified as an important prey species of predacious fish, mammals, and birds (TCCP 2000). Least cisco has been identified as an intermediate priority candidate by COSEWIC (2002).

#### **Northern Pike or Jackfish (*Esox lucius*)**

Important northern pike habitat includes inland fresh water bodies, with overwintering habitat in lakes of the upland tundra surrounding the Husky Lakes Estuary (Sekerak et al. 1992). Calm water is preferred, with spawning occurring over aquatic vegetation in early spring (TCCP 2000).

#### **Pacific or Blue Herring (*Clupea harengus*)**

Pacific Herring is a marine species, which spawns in brackish waters of coastal bays and river mouths, particularly areas with macrophyte growth, in June and July (Bond and Erickson 1993, TCCP 2000). The Husky Lakes estuary has been identified as important Pacific herring habitat (TCCP 2000) with identified overwintering habitat in Hans Bay (Sekerak et al. 1992).

### **11.7.4 Cultural and Historic Resources**

Heritage sites recognized by federal agencies include: archaeological sites, historic structure sites, traditional trails, campsites, berry picking areas, sacred or medicinal plant picking areas, burial sites, ceremonial sites, traditional hunting grounds, and places associated with traditional names or legends.

#### ***Known Archaeological and Cultural Resources***

The area proposed for the Petro-Canada Winter Drilling Program offers limited potential for encountering heritage resources. Past archaeological reconnaissance of this area has resulted in low site densities. This was further corroborated by the extensive aerial survey and ground reconnaissance conducted by IEG in the summer and fall of 2001 (IEG 2002). The closest recorded archaeological site recorded to date is NhTp-1 located approximately 8 km to the northeast of the proposed Nuna # 1 well site. Under the direction of ILA, additional reconnaissance within the vicinity the proposed well locations and access routes will be undertaken.

The access route does not have any known heritage sites within 10 km of the program area. Even though the west side of the newly proposed east west access route for this program offers moderate to high potential for encountering heritage resources, the closest heritage site to this route (NgTt-9) is located approximately 2.5 km to the southwest.

## 12.0 PROPOSED MITIGATION AND ANTICIPATED ENVIRONMENTAL IMPACTS

Petro-Canada's wellsite locations have been selected to minimize impacts on the environment and land users. However, without adequate mitigation, the potential exists for environmental impacts to occur during construction, drilling, and completion phases of the program. Potential environmental impacts were identified through public consultation, a review of existing literature and maps, and a field reconnaissance of the project area.

Potential environmental impacts resulting from the construction of the well site and access roads may include: damage to permafrost; minor drawdown of water bodies; and temporary alteration of vegetation and therefore wildlife habitat.

The following section and Table 21 identify how potential environmental and socio-economic impacts could arise during the drilling program; recommended measures to avoid or mitigate the potential impacts; and the significance of the residual impacts. The assessment criteria and definitions used in assessing the significance of each potential impact are provided below (Table 20).

General drilling activities will follow INAC's *Environmental Operating Guidelines: Hydrocarbon Wellsites in Northern Canada* and best management practices that have been adopted by the drilling industry since the time of this publication. The proposed drilling program is localized and will be conducted during the winter months. It is predicted that the use of proposed mitigative measures by Petro-Canada and their contractors, and completion of the program during winter will result in no significant residual impacts.

**TABLE 20**  
**SIGNIFICANCE CRITERIA**

### AERIAL EXTENT

Local:	Impacts are limited to the drilling lease and rights-of-way.
Subregional:	Impacts may extend beyond the limits of the drilling lease and rights-of-way, but are limited to within 1 to 50 km of the rights-of-way and camp.
Regional:	Impacts may extend beyond 50 km from the drilling lease and rights-of-way to the entire region.

### MAGNITUDE

Negligible:	No discernible impact.
Low:	Impacts would be restricted to a few individuals or only slightly affect the resource or parties involved; factors related to species' population levels would not be affected.
Moderate:	Impacts would affect many individuals or noticeably affect the resource or parties involved; factors related to a species' population levels would be affected to a degree that a change within natural limits of variability will occur; impacts would be socially tolerated.
High:	Impacts would affect numerous individuals or affect the resources or parties involved in a significant manner; factors affecting species' population levels would be altered to a degree that a change would measurably reduce the viability of the population.

### **DURATION**

Immediate:	Impact duration is limited to less than two days.
Short-term:	Impact duration is longer than two days but less than one year.
Medium-term:	Impact duration is one year or longer but less than ten years.
Long-term:	Impact duration extends ten years or longer.

### **FREQUENCY OF OCCURRENCE**

Isolated:	Occurrence confined to specified period.
Accidental:	Occurs rarely over assessment period ( <i>i.e.</i> , life of the project).
Occasional:	Occurs intermittently and sporadically over assessment period.
Periodic:	Occurs intermittently but repeatedly over assessment period.
Continuous:	Occurs continually over assessment period.

### **PROBABILITY OF OCCURRENCE**

Low:	Unlikely.
High:	Likely.

### **LEVEL OF CONFIDENCE**

Low:	Based on incomplete understanding of cause-effect relationships and incomplete data pertinent to project area.
Moderate:	Based on good understanding of cause-effect relationships using data from elsewhere or incompletely understood cause-effect relationships using data pertinent to project area.
High:	Based on good understanding of cause-effect relationships and data pertinent to project area.

### **PERMANENCE OR REVERSABILITY**

Reversible in short-term:	Impact can be reversed in less than one year.
Reversible in medium-term:	Impact can be reversed in 1 year or more, but less than 10 years.
Reversible in long-term:	Impact can be reversed in 10 years or more.
Irreversible:	Impact is permanent.

### **RESIDUAL IMPACT BALANCE**

Positive:	Net benefit or gain to the resource or affected party.
Neutral:	Neither a positive nor negative impact; or positive and negative impacts are balanced.
Negative:	Net loss to the resource or detriment to the affected party.

### **RESIDUAL IMPACT SIGNIFICANCE**

Significant Adverse Effect:	High probability of permanent or long-term residual effect of high magnitude on ecological, social, or economic sustainability that cannot be technically or economically mitigated or compensated.
Significant Positive Effect:	High probability of permanent or long-term positive residual effect of high magnitude on ecological, biological, social, or economic sustainability.
Unknown:	Potential significance cannot be defined with existing information or knowledge.
Not Significant Adverse Effect:	All other negative effects.
Not Significant Positive Effect:	All other positive effects.

## **12.1 Implementation of Mitigation Measures**

The goal of this section is to facilitate implementation of required and suggested environmental mitigation measures. It is important that Petro-Canada, their drilling subcontractor, Akita Equitak, and other contracted field crew adhere to the mitigation measures outlined in the project description.

### ***12.1.1 Communication, Responsibility, and Environmental Monitoring***

Identification and communication of sensitive areas, assigning responsibility for ensuring that mitigative measures are implemented or adhered to, and environmental monitoring are key components in ensuring the program is carried out in an environmentally responsible manner. Suggested measures to achieving compliance with the measures outlined in this project description and in permits are as follows:

- Prior to the commencement of construction activities, a project kick-off meeting will be held with Petro-Canada representatives and appropriate operations personnel
- Appropriate personnel and the Drill Crew Supervisor will be required to read the entire project description.
- Responsible parties will ensure that the crews (drilling, road construction crew) understand the components of Table 21 directly related to tasks they will be performing.
- Meetings will be held to focus on environmental concerns that may be encountered during upcoming tasks and should also address areas where improvement can be made.
- The Crew Manager and other supervisors will meet with the Environmental Monitor prior to startup to explain the operations and discuss environmental concerns associated with the program.
- The Monitor will take an active role in meetings, providing guidance and inspiring an environmentally responsible work ethic. Daily meetings can provide an opportunity for the environmental monitor to communicate concerns about observations in the field and to provide positive feedback about practices that are successful in mitigating impacts.
- The program supervisor will be in daily contact with the Environmental Monitor to ensure that the Monitor is aware of the status of operations and to assist the Monitor in acquiring knowledge about all phases of drilling operations. An established relationship between the Monitor and operational staff will facilitate communications in the event of an environmental incident.
- Maps/diagrams indicating areas of environmental concern should be posted in a visible and accessible location.

### ***12.1.2 Communication with Other Land Users***

With authorization from the trapper, warning signs may be posted where traplines are present. All hunters and trappers will be notified of the proposed project and its progress by communication with the local Hunter and Trappers Committee.

### ***12.1.3 Role of the Environmental Monitor/Wildlife Monitor***

A qualified Inuvialuit Environmental Monitor and a qualified Inuvialuit Wildlife monitor will be employed at the start of the program to ensure that mitigation measures are implemented and that environmental and wildlife concerns are addressed as they are encountered. The Monitor will have appropriate training, experience, and knowledge of the local area to successfully fill this role. It is

important that the roles and responsibilities of the Monitor be clearly understood by all crew members. The Monitor will prioritize her/his activities according to which tasks may have a higher potential to cause adverse environmental impact. It will also be the Monitor's responsibility to document relevant information for the ILA, INAC, and Petro-Canada. Based on community comments during the consultation process, periodic relay of information back to the communities should also be conducted, in a manner to be determined with the ILA.

An Inuvialuit Wildlife Monitor will be employed for the duration of the program to mitigate impacts to wildlife in the vicinity of the program and to handle interactions between wildlife and crews or equipment. The Wildlife Monitor will have knowledge of the local area and experience handling firearms. The Wildlife Monitor should attend daily meetings and should communicate wildlife sightings or environmental concerns to the Environmental Monitor.

#### ***12.1.4 Identification of Workspace Boundaries and Areas of Environmental Concern***

To ensure that ground disturbance does not occur in areas outside of the lease and access right-of-way (ROW) boundaries, it is crucial to identify the boundaries.

- Lease and ROW boundaries will be clearly identified by signage.
- Petro-Canada, with assistance from the Monitor, will flag areas where environmental concerns warrant avoidance. The flagging will be a colour other than that used for lease and ROW boundaries, and will be made known to all crew members during startup meetings and subsequent meetings.
- Areas where heritage resources have been identified will be staked or flagged if located in close proximity to the project area.
- Warning signs will be posted as indicated in Table 21. Petro-Canada will notify trappers of the proposed project via the HTC.

**TABLE 21**  
**POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS, MITIGATION AND RESIDUAL IMPACTS**

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
1. <u>Permafrost</u>										
1.1 Disturbance of permafrost	<p>.1 Surface area utilized will be minimized to avoid disturbance of permafrost outside the lease area and/or off the 20 m wide access road.</p> <p>.2 Except during sump construction, permafrost areas will not be disturbed.</p> <p>.3 Equipment or vehicles will be confined to the surveyed area, will not be moved under thaw or soft ground conditions and will not be moved unless the surface is capable of supporting the equipment or vehicles without rutting or gouging the ground. If rutting occurs, vehicle movement will be suspended.</p> <p>.4 Electronic and physical ice profiling will be used throughout the program to ensure ice conditions are suitable for travel of equipment and vehicles.</p> <p>.5 Overland access road will be flooded with water to create an ice layer to insulate and protect the permafrost. Lease site will be flooded with water to create a 40cm ice layer to insulate the permafrost and protect it from degradation.</p> <p>.6 Equipment mobilization / demobilization and drilling operations will occur during winter to mitigate soil disturbance and permafrost degradation.</p> <p>.7 The annulus surrounding the conductor pipe will be insulated or refrigerated to minimize deterioration of the ground surface due to thermal disturbance.</p> <p>.8 An Environmental Monitor will be present to identify sensitive areas and advise on mitigation</p>	Local	Low	Short term	Isolated	Low	High	Reversible in short term	Neutral	Not significant
1.2 Pingos	.1 All pingos will be avoided by a minimum of 150 m.	Local	Low	N/A	N/A	N/A	High	N/A	Neutral	Not significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
2. Terrain and Soils										
2.1 Disturbance to the soil profile (i.e. soil loss, compaction, admixing)	<p>1 Clearing of the site will be completed under frozen ground conditions limiting soil disturbance caused by uprooting.</p> <p>2 Access roads will not be constructed until the active layer of the soil is frozen.</p> <p>3 Any inadvertent surface disturbance will be repaired immediately.</p> <p>4 Any soil or organic material displaced during operations will be replaced and compacted.</p>	Local	Low	Short term	Isolated	Low	High	Reversible in short term	Neutral	Not significant
2.2 Disturbance to erosion prone banks and slopes	<p>1 Snow/ice ramps will be constructed on lakebank slopes to prevent disturbance and erosion resulting from equipment.</p> <p>2 Equipment operators will be instructed to not disturb the organic mat, and all access will be clearly marked to reduce the possibility of inadvertent surface disturbance.</p> <p>3 If surfaces are disturbed in an area where drainage or erosion is a possibility, such as channels or lakes, erosion control measures will be implemented.</p>	Local	Low	Short-term	Isolated	Low	High	Reversible in short-term	Neutral	Not significant
2.3 Disturbance to drainage	<p>1 The well sites will not be located within a drainage feature.</p> <p>2 Snow bridges or ice roads will be constructed across drainages or waterbodies. Only clean snow and/or ice will be used for drainage crossings.</p> <p>3 Drainages will be left free of debris.</p> <p>4 Any clearings will be re-contoured to restore natural cross drainages</p> <p>5 Surface drainage ditches will be reclaimed to original condition. V-notching of snow bridges will be performed upon completion.</p>	Local	Low	Short term	Low	Low	High	Reversible in short term	Neutral	Not significant
3. Vegetation										
3.1 Loss of vegetation communities	1 Mobilization and demobilization will take place in winter and utilize an ice access, therefore minimizing effects to existing vegetation.	Local	Low	Medium-long term	Occasional	Low	Moderate	Reversible in long term	Neutral	Not significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
	<p>2 Cut material will be spread evenly over the site and frozen in place through the flooding procedure to protect root systems.</p> <p>3 The access road will be developed primarily along frozen lakes to minimize the footprint.</p> <p>4 Disturbed areas will be stabilized to promote natural revegetation</p> <p>5 Building of overland access will entail compacting snow and building an ice layer. Roads will be restricted to a 20 m width</p> <p>6 Should any clearing of riparian vegetation be required, the removed vegetation tops will be spread evenly on the site to further protect the ground.</p>									
3.2 Potential disturbance to rare, sensitive or unique plant species or vegetation communities	<p>1 Natural revegetation of rights-of way will be promoted by avoiding disturbance of root zone</p>	Local	Low	Medium Term	Accidental	Low	High	Reversible in medium term	Neutral	Not significant
4. Wildlife										
4.1 Disturbance to wildlife	<p>1 Daily incineration of camp wastes will prevent the attraction of nuisance wildlife.</p> <p>2 A wildlife component will be included in the orientation, including a bear awareness program.</p> <p>3 Regular (daily) garbage patrols will be undertaken to remove materials (i.e. metals, plastics) that may be potentially harmful to wildlife.</p> <p>4 Inuvialuit Wildlife Monitors will be employed to assess potential wildlife conflicts in the area of operations. Environmental monitors may also assist in this role.</p> <p>5 All activities will be restricted to lease area, camps and roads.</p>	Local	Low	Immediate to Short term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
4.2 Disturbance of wildlife migration	.6 During summer reconnaissance and subsequent clean-up overflights, aircraft will maintain a ceiling of over 650 m over areas likely to have birds and a ceiling of over 1100 m over areas where birds are known to concentrate (sanctuaries, colonies, molting areas). Detours will be made around major bird concentrations maintaining a minimum 1.5 km buffer around flocks; spring goose harvesting areas will be skirted. .1 Drilling operations will be completed prior to the arrival (mid May) of the majority of migratory bird species. .2 Drilling operations will be completed expeditiously to minimize impacts to resident wildlife. .3 Inuvialuit Environmental/Wildlife Monitors will be employed to assess potential wildlife conflicts in the area of operations	Sub-Regional	Low	Immediate to Short term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
4.3 Attraction of nuisance animals	.1 Kitchen and camp wastes will be incinerated daily. .2 Wildlife will not be harassed or fed.	Local	Low	Immediate to Short term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
4.4 Encroachment on endangered species or important wildlife habitats	.1 Environmental/Wildlife Monitors will scout ahead of equipment in order to avoid potential conflicts with denning bears, where possible. Local RWED biologists and officers will be notified if a bear is encountered.	Local	Low	Immediate to Short term	Accidental	Low	High	Reversible in short-term	Neutral	Not significant
5. Aquatic Resources										
5.1 Erosion of stream banks and destabilization of slopes	.1 Snow ramps will be designed to minimize erosion and/or destabilization of slopes. .2 Tracked units and dozers equipped with mushroom shoes will be used to reduce the possibility of surface disturbance. .3 A 100 m buffer of undisturbed ground between the well site boundary and watercourses or waterbodies will be maintained.	Local	Low	Short-medium term	Isolated	Low	High	Reversible in medium term	Neutral	Not Significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
	<p>.4 If necessary, clean ice bridges will be constructed if ice thickness tests reveal that ice cannot support equipment loads.</p> <p>.5 If the surface is disturbed in an area where drainage alteration or erosion is a possibility, control measures may include earth breaks cross ditches, or as otherwise directed by the land use inspector.</p> <p>.6 Channel crossings will be made at a level location wherever possible. Crossings will be scouted in advance and will be constructed at right angles (90°).</p>									
5.2 Possible damage to fish habitat and spawning sites	<p>.1 Excavated fill, waste material, or debris will not be disposed of in waterways.</p> <p>.2 Water intake from waterbodies will utilize mesh screens on intake hoses to prevent disturbance to stream or lake bottoms and to prevent the entrainment of fish.</p> <p>.3 Water will be withdrawn from the identified lakes and channels where water sources and fisheries will not be affected by drawdown.</p> <p>.4 Disturbance to creek banks will be minimized. The right-of-way width may be decreased at stream crossings to preserve riparian habitat.</p>	Local	Low	Immediate	Accidental	Low	High	Reversible in short term	Neutral	Not significant
5.3 Introduction of oil, fuel or other pollutant to waterbody	<p>.1 The campsite and associated facilities (i.e. kitchen, sanitary waste sumps, solid waste site) will be located a minimum of 100 m from the ordinary high water mark of any permanent waterbody or watercourse.</p> <p>.2 Liquid fuels and oils will be stored in a closed system during transportation.</p> <p>.3 Liquid fuel will be contained in a closed and properly vented container and will be located at least 25 m from the well.</p> <p>.4 All fuel storage will have secondary containment with the volume of containment being 110% greater than the capacity of the largest fuel container.</p> <p>.5 Drilling units will be equipped with a system capable of collecting any waste oil from the oil surps on the unit.</p>	Regional	Moderate	Immediate - medium term	Isolated	Low	High	Reversible in medium-term	Neutral	Not significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
5.4 Disposal of drilling waste in sumps	.6 Fuels or hazardous materials will not be stored within 100 m of a waterbody.	Local	Low	Short term	Accidental	Low	High	Reversible in medium term	Neutral	Not Significant
	.7 Hydraulic hoses and couplings, fuel tanks, and other potential sources of contamination will be inspected prior to working on-site.									
	.8 Any mobile equipment will be refueled and serviced a minimum of 100 m away from waterbodies, where feasible.									
	.9 Any equipment which is to remain stationary for more than 8 consecutive hours will have drip pans placed underneath.									
	.10 The well-head will be equipped with a blow-out preventer system and be installed in accordance with the Canada Oil and Gas Drilling Regulations.									
	.13 Spill areas will be treated in-situ where appropriate.									
	.15 Any deleterious material that accidentally falls into a waterbody will be removed.									
	.16 In the event of a spill, the Fuel Spill Contingency Plan will be followed.									
	.17 Maintenance procedures and vehicle refueling will be carried out in a manner so as to prevent the entry of any deleterious substance into waterbodies.									
	.1 Drilling fluid sumps will be located a minimum of 100 m from the ordinary high water mark of any permanent water body or stream, where feasible.									
	.2 Drilling fluid levels will be maintained a minimum of 1.2 m below the active layer.									
	.3 Records will be kept of the quantities and types of mud additives used, in case post-abandonment leakage problems occur.									
	.4 Well site personnel will be familiar with the properties of the mud types available and only use drilling additives of chemically known composition.									

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
	<p>.5 Sumps will be monitored regularly so that any required corrective measures can be immediately implemented.</p> <p>.6 A snow fence will be used one side of the sump and will be bermed on the remaining 3 sides to prevent snow from accumulating in the sump and to prevent wildlife or personnel from falling in.</p> <p>.7 Sumps will be properly abandoned at the end of the operating season.</p> <p>.8 In the event of sump problems leading to potential release of untreated toxic material into the environment the following options will be considered:</p> <ul style="list-style-type: none"> <li>• Drilling will be suspended;</li> <li>• Supplementary sumps will be constructed immediately adjacent to the existing sump with a wall separating the two.</li> </ul>									
5.5 Disposal of other associated waste	<p>.1 Combustibles and non-combustibles will be segregated.</p> <p>.2 Camp wastes will be incinerated daily.</p> <p>.3 Incinerator residue will be disposed of at an approved facility.</p> <p>.4 Non-combustible materials will hauled to an appropriate waste receiver.</p> <p>.5 Solid wastes will not be disposed of in the drilling fluid sump.</p> <p>.6 All waste fuel, oil or lubricant will be collected in a closed system separately and will be transported and properly disposed off-site.</p>	Local	Low	Short term	Accidental	Low	High	Reversible in medium term	Neutral	Not significant
6. <u>Interference with Other Land Uses</u>										
6.1 Possible conflict with wildlife harvesting in the area	<p>.1 Public consultation with all local communities has been undertaken and is ongoing to notify communities of drilling operations and timing.</p> <p>.2 Construction warning signs will be placed on access routes.</p>	Local	Low	Short term	Isolated	Low	High	Reversible in short term	Neutral	Not Significant

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
6.2 Trapline Operators	.1 Local trappers will be notified of drilling operations and timing via the HTC.	Local	Low	Short term	Isolated	Low	High	N/A	Neutral	Not significant
6.3 Traffic accident on winter access	.1 Only identified access routes will be used and traffic safety measures will be implemented.	Local	Low	Short term	Isolated	Low	High	N/A	Neutral	Not significant
6.4 Disturbance to snowmobile trails	.1 When an access route crosses snowmobile trails utilized by community members, the trail will be left clean and open.	Local	Low	Short term	Accidental	Low	High	N/A	Neutral	Not significant
6.5 Loss or damage to existing cabins and camps	.1 The operator will discuss appropriate site-specific mitigation measures with cabin owners and camp occupants in the vicinity.	Local	N/A	Short term	Isolated	Low	High	N/A	Neutral	Not significant
7. Archaeological, Historical or Palaeontological Sites										
	.1 A 100 m buffer between camp facilities, including roads, and culturally important sites will be maintained when operating on Inuvialuit-owned lands. A 30 m buffer will be maintained when operating on federal lands. .2 Should any archaeological or palaeontological sites be discovered during construction or operations, work will be suspended in the vicinity of such discoveries and the NEB, (when operating on federal lands) or ILA (when operating on Inuvialuit lands), the Prince of Wales Northern Heritage Centre and other appropriate Inuvialuit organizations will be notified. Operations will be suspended in the immediate area until all regulating bodies grant written clearance.	Local	Low	Short term	Accidental	Low	High	N/A	Neutral	Not significant
8. Health or Environmentally Threatening Emergency										
	.1 In the event of an emergency, the Emergency Response Plan will be implemented.	N/A	N/A	N/A	Isolated	Low	High	N/A	Neutral	N/A

Table 22 Cont'd

Concern/Impact	Mitigative Measures	Aerial Extent	Magnitude	Duration	Frequency	Probability	Confidence	Reversibility	Residual Impact Balance	Residual Impact Significance
9. Abandonment and Restoration	<p>.1 Non-combustible solid wastes will be removed from the site.</p> <p>.2 Drilling sump fluids will be disposed of using the total containment method.</p> <p>.3 Before backfilling the sump, the frozen fluids will be tested to ensure they are sufficiently frozen to support the weight of the backfill material without rupturing.</p> <p>.4 A 2 m compacted cap of soil material will be placed over the sump. The cap will overlap the sump edges.</p> <p>.6 Material excavated during sump construction will be used as the cap material and contoured to promote vegetation growth and allow natural migration of permafrost on to the site.</p> <p>.7 After sump abandonment, snow shall be removed from the sump surface to ensure timely freezing and to facilitate long-term site stability.</p> <p>.8 All equipment and materials will be removed from the area immediately following project completion. After the snow has melted, a reconnaissance of the area will be conducted and any residual materials related to the project, which may have been obscured by snow, will be removed.</p>	Local	Low	Short term	Isolated	Low	High	Reversible in short term	Neutral	Not significant

## **12.2 Potential Impacts and Mitigation**

### **12.2.1 Permafrost and Soils**

In order to minimize impact to permafrost and soils, the dimensions of the surface lease will be limited to what is required to accommodate equipment and ensure safe working conditions (lease, camp, sump, and access dimensions are detailed in Section 4.0). Access route construction on overland portions (Section 4.0), and a 40 cm thick ice pad under the drilling rig will minimize disturbance by heavy equipment to the underlying soil and permafrost.

The drilling process could create temperatures that cause the permafrost to thaw. A KCL drilling mud system and mud cooler will be used to prevent permafrost degradation during drilling. These systems allow drilling to occur at near freezing temperatures (refer to Section 4.0).

Road and pad construction will take place only under frozen ground conditions in order to limit soil disturbance that may otherwise result from uprooting.

Soils will not be disturbed with the exception of sump excavation. Adequate ground thermal conditions for sump containment will be investigated by augering and testing prior to sump construction. Snow accumulation will be taken into account effects on thermal conditions. Sites with high ground ice content will be avoided. Drilling fluid levels will be contained at 1 m depth in the sump, with 2.4 m freeboard to ensure that the fluids are kept a minimum of 1.2 m below the active layer, and an additional 2 depth as contingency.

With application of these mitigative measures, residual effects on soil, terrain and permafrost are concluded to be low in magnitude, local in extent, and short to medium-term in duration.

### **12.2.2 Aquatic Resources**

Potential impacts to waterbodies and fish populations include the removal of aquatic habitat due to water drawdown in lakes, the erosion of streambanks and the destabilization of slopes, direct impacts due to operational activities, and the introduction of sediments and/or pollutants to waterbodies. All waterbodies will be assumed to be fish bearing unless demonstrated otherwise.

Petro-Canada will require water for the construction of roads and the drill pad, as well as for drilling operations (section 4.2.4).

Although numerous lakes occur throughout the Tuktoyaktuk Peninsula, many are too shallow to support overwintering fish populations. Lake #34 (Figure 1 and Section 4.2.4) was assessed in the Fall of 2001 (Aquatics Draft 2002). This study indicates the occurrence of significant depth and lake volume, capable of supporting overwintering fish populations, but of large enough volume such that quantities and rates

of withdrawal utilized for program activities will not significantly result in water drawdown or impact overwintering fish populations. Petro-Canada has been in communication with DFO regarding the use of identified waterbodies as water sources. By removing an insignificant proportion of water from any lake the potential impacts of water withdrawal on overwintering fish populations is considered negligible.

Access to water bodies for the removal of water, as well as travel near or over waterbodies and stream banks or lake shores, may contribute to erosion, introducing sediments to associated water bodies and altering drainage patterns. The following guidelines for mitigating impacts on permafrost and soils will minimize erosion. Snow ramps at waterbody boundaries will be designed to minimize erosion and/or the destabilization of slopes. To protect aquatic wildlife, all intake lines will be fitted with screens of sufficient size to prevent impingement or entrainment of fish.

The introduction of sediments or other deleterious materials to waterbodies may significantly impact aquatic wildlife and habitat. Materials may be introduced directly to waterbodies or through groundwater drainage. Oil, fuel, or other fluids are toxic or may carry material that is toxic to aquatic organisms or may significantly alter chemical or physical processes necessary for ecosystem function. Fuel storage will be managed to minimize the potential for accidental releases to waterbodies. The use secondary containment of storage tanks will reduce the potential for spills. Sump construction will occur on flat or gently sloping terrain in areas that promote surface drainage. The sump will be located 100 m from any permanent waterbody and away from any identifiable ephemeral drainages.

The potential release of deleterious substances due to program activities is very low and given emergency response measures (Appendix E) any spills will be mitigated and impacts to waterbodies will be negligible.

### **12.2.3 Vegetation**

The timing, location, and equipment used for this project (see Section 4.0 Development Summary) will ensure that clearing, compression or destruction of the peat layer, or the exposure of mineral soil will be minimized. The project will be conducted in winter when the soil is completely frozen, thereby minimizing compaction of root systems and disturbance to seed banks along access routes. Most understory species will be covered by a protective layer of snow during construction activities. If machine clearing is necessary on access routes or drilling pads, appropriate equipment will be used to minimize disturbance to the ground surface.

Regrowth of any cleared vegetation will largely be vegetative (Bell and Bliss 1980, Hobbie and Chapin 1998). Shrubs such as willow are quite resilient, and will sometimes show increased vigour following disturbance (de Grosbois et al. 1991).

The proposed drilling program is localized and will be conducted during the winter months. The most significant impact of the program relates to the development of 10 km of new overland ice roads. Ice roads and ice pads help minimize impacts on the tundra. Effects cannot be mitigated entirely but will be

minor since Petro-Canada seeks to minimize new, overland road length as much as possible while avoiding slopes vulnerable to erosion, known archaeological sites and other ecologically sensitive areas.

Calculations of the effects of the proposed project on vegetation communities were based on the parameters outlined in Section 6.3.2. One or two drilling pads will be constructed. Both pads and access roads will be considered together when assessing potential impacts to landcover classes. To minimize terrestrial impacts, the access routes move between waterbodies, limiting the amount of overland roads.

Impacts are calculated based on the direct footprint of vegetation beneath drill pad sites and roads. However, changes to habitat are often short-term and reversible.

'Ice, Water & Aquatic Vegetation' is the main landcover class potentially affected within the direct footprint of the proposed project, and in the local study area (Table 22). Since drilling is localized and roads will be used only in winter, impacts to this landcover class are not anticipated.

**TABLE 22**  
**POTENTIAL EFFECTS OF THE PROPOSED PROJECT ON LANDCOVER CLASSES AT**  
**DIRECT PROJECT FOOTPRINT AND LOCAL PROJECT AREA SCALES**

Landcover Class	Proposed Program			
	Direct Project Footprint (Lease Area & Road)		% of Respective Landcover Classes Affected	
	Area (ha) Affected	% of Area Affected	% Local Area Affected <sup>1</sup>	% Regional Area Affected <sup>2</sup>
Graminoid	0.5	0.4%	14.0%	0.001%
Sedge	7.8	6.0%	6.0%	0.005%
Tussock Tundra	3.3	2.6%	10.8%	0.002%
Low Birch / Dwarf Shrub	7.9	6.1%	5.9%	0.004%
Low Willow Alder	22.4	17.3%	6.3%	0.006%
Tall Willow Alder	0.1	0.0%	10.0%	<0.001%
Conifer Woodland	0.6	0.4%	4.9%	0.001%
Conifer Forest	0.0	0.0%	0.0%	<0.001%
Other Terrestrial	1.2	0.9%	4.6%	0.002%
Ice, Water & Aquatic Vegetation	85.8	66.2%	13.9%	0.010%
<b>TOTAL</b>	<b>129.5</b>	<b>100.0%</b>	<b>9.9%<sup>3</sup></b>	<b>0.006%<sup>3</sup></b>

<sup>1</sup> The local project area includes a 1 km buffer around the well lease and access road. The buffer provides a representative view of habitat and landcover classes within the immediate vicinity of the project area.

<sup>2</sup> The regional study area is shown in Figure 2.

<sup>3</sup> The percentages presented in these columns represent the proportion of the respective landcover classes at the local and regional scales; hence, totals would not be representative of the total area affected.

In terms of terrestrial vegetation, the majority of the area affected by the direct footprint occurs in the 'Low Willow Alder' landcover class (17.3%), followed by 'Low Birch / Dwarf Shrub' (6.1%), and 'Sedge' (6.0%) classes. On a local project area scale, the class potentially affected the most is 'Graminoid' (14.0%) followed by 'Tussock Tundra' (10.8%) and 'Tall Willow / Alder' (10.0%) classes. Potential impacts to the local study area are limited, with the program footprint located primarily on areas of low vegetation cover, requiring minimal vegetation clearing and effective protection provided by constructed ice roads. Impacts to landcover classes at a regional scale will be negligible, with all landcover classes being potentially impacted at less than 0.01%.

#### 12.2.4 Wildlife

Direct effects on wildlife are expected to be limited to temporary habitat alteration and sensory disturbance due to noise. Increased traffic may have the potential to raise mortality due to collisions with wildlife. Petro-Canada and their contractors will abide by speed limits set for the program access. Attraction of nuisance wildlife to camp locations will be mitigated by daily incineration of camp wastes.

Habitat alteration and loss could result in medium-term effects on wildlife. Impact on habitat quality will be species specific, depending on several considerations including range size and specific habitat requirements. Additionally, vegetation removal may reduce preferred forage. Alternately, the removal of vegetation may result in habitat enhancement by stimulating new growth (e.g. Emers et al. 1995) and providing movement corridors. Wildlife habitat will be protected by following guidelines for mitigating impacts on vegetation, soils, and terrain (Table 20).

Project timing avoids wildlife interaction during critical periods, such as migration and the breeding season. Environmental and wildlife monitors will identify any environmental and wildlife concerns during program operation and ensure that mitigation measures are implemented.

##### **Arctic Fox (*Alopex lagopus*)**

Arctic fox denning and reproductive activities will not coincide or overlap with the proposed program.

The proposed program has a footprint relevant to arctic fox of approximately 14.97 km<sup>2</sup>. This program footprint includes the major access route, assumes that two wells will be drilled and includes a 200 m zone of influence surrounding the drilling locations and access routes. Based on a density ranging from 0.086 to 0.386 foxes/km<sup>2</sup> in the Northwest Territories (GNWT 2000), an estimated 1.29 to 5.78 arctic foxes would coincide with the program footprint. For a more detailed description of arctic fox density model calculations refer to Appendix D.

A wildlife monitor will alert work crews to the presence of dens if encountered or arctic foxes in the vicinity of the proposed program area, and ensure that mitigation measures are implemented. Vehicle travel along access roads will abide by speed restrictions to minimize mortality or injury due to collisions. Combustible refuse will be incinerated to avoid the attraction of animals. Any spills of equipment fluids or drilling mud will be contained and cleaned up immediately following detection to prevent ingestion by wildlife and contamination of the environment.

Because arctic fox are highly tolerant of human activity, and in some cases may even be attracted by it, the project has the potential to increase population density of foxes. While this may have a positive effect on the fox population, the fox in turn may negatively affect their prey populations including shorebirds (Burgess 2000). The proponent should therefore ensure that staff is aware that the feeding of wildlife, including foxes, is avoided. This includes direct handouts and indirectly supplying foxes with food through improper garbage disposal. Dense aggregations of arctic foxes have been observed at superabundant food sources (such as garbage dumps) during winter.

Given the implementation of mitigation measures impacts of the proposed project are expected to be negligible to low in magnitude and be restricted to periods of program operation.

#### **Caribou (*Rangifer tarandus*)**

The effects of hydrocarbon exploration activities on the Cape Bathurst and Bluenose West caribou are currently not documented. An ongoing satellite-tracking study conducted by RWED (1999) will provide information on seasonal caribou locations to better understand habitat use and facilitate the assessment of effects of exploration activities on the herds. Combined with forthcoming updated body condition, productivity and recruitment data, this information will aid in setting threshold values for a sustainable caribou population, against which impact from human activity can be measured. In the interim, parallels can be drawn using studies from Alaskan oilfields.

While research in Alaskan oil fields suggests that caribou are capable of habituating to some levels of development, high intensities or frequencies of disturbance could place sufficient stress on caribou or displace them from traditional habitat areas such that population-level effects could potentially occur (Murphy and Lawhead 2000). However, the opinions of researchers differ widely regarding the potential for impacts at the herd, or population, level. While some authors believe that caribou herd productivity may be reduced by oil field interaction (e.g. Cameron et al. 1992, Nellemann and Cameron 1996, 1998) others state the potential for herd-level impacts is confounded by added environmental factors, making it difficult to attribute changes to anthropogenic activities (e.g. Cronin et al. 1997, 1998a). A third, and more recent opinion states that few or no herd-level impacts are observed following interaction with oil field facilities (e.g. Cronin et al. 1998b, 2000). Bergerud (2000) elaborates that the energetic costs of caribou responding to human-induced stimuli are small compared to response to the natural occurrences of predation and insect harassment.

The overlap of the proposed program with the winter range of the Cape Bathurst/Bluenose West herds presents the potential for direct interaction, sensory disturbance, and indirect effects of temporary habitat removal or alteration.

While a linear feature (i.e. access road) itself could disturb caribou, the use of a linear feature through intermittent human and vehicle presence is more likely to affect wildlife. Disturbance of this nature may lead to avoidance behaviour, and therefore industrial development may result in habitat loss greater than the area directly disturbed (James and Stuart-Smith 2000). Disturbances that displace caribou from preferred winter range may increase their risk of natural mortality (Simpson et al. 1996). As well, the body condition of adult females is linked to herd productivity and calf survival (Nagy et al. draft 2001) and, therefore, impacts to forage availability have the potential to affect caribou at the population level.

Wolfe et al. (2000) reported that infrequently traveled transportation corridors, as is anticipated to be the case for access roads associated with the proposed program, resulted in low numbers of road-kills, did not deter road crossing by caribou, and had no observable effect on traditional migration routes, annual distribution or energetic costs. This supports Bergurud's (2000) conclusion of limited effects on caribou by human induced effects.

The drilling program may utilize a helicopter for support; daylight and weather conditions permitting. The response of caribou to aircraft overflights or nearby landing depends on many factors. In general, the strongest reactions are elicited during calving, post-calving and winter periods (Wolfe et al. 2000). Caribou may habituate and become less reactive to aircraft over time (Wolfe et al. 2000) depending on the frequency and predictability of overflights.

The occurrence of such impacts is anticipated to be low to negligible, as only 0.008% of caribou habitat would be affected on a regional basis by the propose program (Table 23), and only a small portion of the herd would be affected given the localized and short-term nature of the program operations. A qualified wildlife monitor will be on-site. No deliberate attempts will be made to force or control caribou movement.

**TABLE 23**  
**POTENTIAL EFFECTS TO WINTER CARIBOU HABITAT BY THE DIRECT FOOTPRINT**  
**OF THE PROPOSED PROJECT**

Habitat Type	Proposed Program			
	Project Footprint (Drilling Pad & Access) (ha)		% of Area Affected	
	Area (ha) Affected	% of Area Affected	Local Project Area	Regional Study Area*
Winter Caribou Habitat	95.2	73.5%	12.3%	0.008%
Non-Winter Caribou Habitat	34.3	26.5%	6.4%	0.004%
<b>Total</b>	<b>129.5</b>	<b>100.5</b>	<b>9.9%</b>	<b>0.006%</b>

\*This value represents the percentage of the regional study area directly affected by the footprint of the proposed project.

**Grizzly Bear (*Ursus arctos*)**

Grizzly bears are vulnerable to disturbances that increase mortality, due to their low reproductive rates and slow recovery times (Pasitschniak-Arts and Messier 2000). Grizzly bears in the uplands of the Mackenzie Delta generally enter dens between late September and early November, and emerge from late April to late May (Harding 1976, Nagy et al. 1983). Road building activities scheduled to commence in October may coincide with individual grizzly bears still active outside of their dens. Given the low density of dens located by past telemetry studies (Nagy et al. 1983) in the program vicinity, interactions resulting in direct mortality and resultant population-level effects are anticipated to be low and accidental. No human-bear interaction is anticipated during the operations phase of the drilling program, as no grizzly bears have been documented as occurring outside of their dens in winter over the last several years of activity in the Mackenzie Delta region (John Nagy pers. comm.).

Aside from mortality, disturbance effects on grizzly bear populations are difficult to confirm and quantify (Jalkotzy et al. 1997). Given the suitable grizzly bear denning habitat in the vicinity of the proposed program, bears within their dens may be disturbed by program operations and activities associated with program access routes. If disturbed, a bear may incur energetic costs due to stress, or abandon its den and cubs (Jalkotzy et al. 1997).

The proposed program has a footprint relevant to denning grizzly bear habitat of approximately 49.60 km<sup>2</sup>. The program footprint includes the access route, assumes that two wells will be drilled and includes a 500 m zone of influence surrounding the drilling locations and access routes. Given the low density of bears in the region (i.e. an average of 4.25 bears per 1000 km<sup>2</sup>) (Nagy et al. 1983) and the conservative program footprint estimation, the probability of encountering a single den within the program footprint is relatively low at 21.1%. For a more detailed description of grizzly bear density model calculations refer to Appendix D.

Known dens identified by radio-telemetry will be avoided by a 50 m setback at all times, and any additional requirements for a buffer will be discussed with RWED. If a bear is disturbed out of its den when operating in an area, a 300 m to 500 m pullback of construction activities will occur to allow the bear to return to its den. This pullback will be according to terrain and will be determined by the Wildlife Monitor.

Potential effects of sensory disturbance on denning bears from access road activities are expected to be low to negligible. To ensure the potential for impacts is minimized, travel frequency will be limited to the extent possible. Vehicles will travel below posted speed limits to reduce the potential of accidents, which may inadvertently cause injury or damage to grizzly bears or dens respectively.

**Muskrat (*Ondatra zibethicus*)**

Muskrat populations in the vicinity of the project may be subject to habitat loss through the direct effects of vegetation removal and pushup destruction. Indirectly, habitat could be lost or degraded via water drawdown, erosion, and pollution to waterbodies.

Erosion and pollution is not expected to occur, given the proposed mitigation measures in Table 21. Visible muskrat pushups will be avoided whenever possible to minimize disturbance.

Water drawdown on lakes could alter muskrat habitat, particularly emergent vegetation, an important food resource during summer (Jelinski 1989). Muskrats prefer a winter water depth of 1.2 - 3 metres (Dome et al. 1982). Drawdown below that level could result in inaccessible food sources, muskrat displacement and increased exposure to predation (Thurber et al. 1991). Mitigation measures outlined in section 12.3.2 and Table 21 will minimize the effects of water drawdown, resulting in a negligible effect to muskrat as a result of water drawdown.

### **Red fox (*Vulpes vulpes*)**

Throughout the duration of the program, red fox may potentially be impacted via den interference, prey disturbance, road kill, attraction to camp garbage, and direct contact with spills or sump fluids.

To ensure dens are not disturbed during program activities, all dens identified by the wildlife monitor will be avoided. Also, the slopes of river banks, ridges, eskers and moraines, which are generally preferred denning habitat for foxes (Slaney 1974b), will be protected by following guidelines for mitigating impacts on soils and terrain (Refer to Table 21). Prey species such as ptarmigan may be impacted through vegetation removal, although impacts are expected to be negligible (Refer to ptarmigan section below). Furthermore, mitigation efforts such as access road speed limits, proper garbage disposal and incineration, sump enclosure and spill contingency plans will limit the impact of the program on the red fox (Refer to Table 21). Therefore, potential program impacts are expected to be negligible.

### **Wolf (*Canis lupus*)**

While the proposed program is not anticipated to affect denning habitat, human activities that alter the distribution or timing of caribou movements may have negative effects on the reproductive success of wolves (Walton et al. 2001). Mitigation measures that will be implemented to minimize program effects on caribou are discussed earlier in this section. Because impacts on the main prey base of wolves (i.e. caribou) is expected to be low to negligible, the effects on wolf productivity are expected to be low to negligible as well.

The proposed program could potentially impact wolves through the effects of direct mortality, injury, harassment or sensory disturbance. The elusive nature and low density of wolves in the region makes the occurrence of population-level impacts from localized development unlikely. The proposed program has a footprint relevant to wolves of approximately 14.97 km<sup>2</sup>. The program footprint includes major access routes, assumes that two wells will be drilled and includes a 200 m zone of influence surrounding the drilling locations and access routes. Based on a density of 1 wolf per 944 km<sup>2</sup> (van Zyll de Jong and Carbyn 1998), an estimated 0.016 wolves would coincide with the program footprint (i.e. a probability of 1.6% of encountering a wolf). For a more detailed description of wolf density model calculations refer to Appendix D.

**Wolverine (*Gulo gulo*)**

The wolverine has a large range and sparse distribution within the NWT (Refer to Section 11) and typically avoids human activities (Magoun and Copeland 1998). The solitary and secretive nature of wolverines will minimize encounters during program activities, however the possibility of mortality on ice roads and during construction and drilling operations does exist. Wildlife monitors will identify all dens and ensure dens are avoided during development (Refer to Section 11 for den site characteristics). The increased activity associated with the development may cause wolverines to move away from the development area, limiting their range and traditional habitat use (Petersen 1997). Given the temporary nature of the program and the anticipated negligible impacts on habitat and prey, population level disturbance is not anticipated.

**Migratory Birds**

Impacts to migratory birds as a result of the program are limited. Due to the fact that most birds migrate out of the area prior to the program beginning and migrate into the area after the program has been completed, interference will be negligible. However, potential impacts do exist, such as habitat loss due to clearing of vegetation, contamination or reduction of food supply and attraction of predators (Dickson 1992, Truett et al. 1997, Axys 2001).

Given that vegetation will be protected under a minimum of 20 cm of snow cover, waterfowl habitat will not be affected. Clearing of woody vegetation will be limited to low willow patches, which, given the protection of the root base, will not be fully removed. The effectiveness of the vegetation mitigation measures has been acknowledged by elders in Tuktoyaktuk (IEG 2002). Environmental monitors will be instructed to ensure that sufficient snowcover is maintained to protect the vegetation. Refer to Section 12.3.4 and Table 21 for a full discussion of vegetation removal mitigation measures.

Indirectly, oil and gas activities may attract predators (Arctic fox, glaucous gulls, grizzly bear) to bird colonies and nesting areas in their vicinity, which may result in reduced nesting success and mortality due to predation. However, all camp refuse will be incinerated and developments will be free of garbage upon completion in April, prior to nesting.

Temporary ice roads are not expected to have an impact on migratory birds. Fuel spills and chemicals released onto the tundra may degrade or destroy migratory bird habitat. However, oil field acreage encompassed by all accidental spills in the Prudhoe Bay Oil Field region has been a small fraction of 1%, and less than 10% of these spills reach the tundra. Most are contained on snow and ice in winter, so that they can be removed prior to reaching the substrate (Truett et. al. 1997). Given that activities will be occurring in the winter, spills will be scraped from the snow. In the case of an emergency, fuel spill contingency plans will be in place.

Given the mitigation measures for this program, impacts on migratory birds are expected to be negligible.

### Ptarmigan (*Lagopus* spp.)

Although ptarmigan are common throughout most of the Mackenzie Delta region, local community conservation measures include the identification and protection of important habitat types from disruptive land uses (AICCP, IICCP, and TCCP 2000).

IEG (2002) developed a habitat suitability model for willow ptarmigan. Using this, direct footprint impacts were calculated for ptarmigan habitat (IEG 2002). Table 24, summarizes this information. For the proposed project, approximately 11.3% of potential ptarmigan habitat in the local project area could potentially be disturbed while at the regional level, 0.006% of potential ptarmigan habitat could be affected.

**TABLE 24**  
**POTENTIAL EFFECTS TO PTARMIGAN HABITAT BY THE DIRECT FOOTPRINT OF THE PROPOSED PROJECT**

Habitat Type	Proposed Program			
	Project Footprint (Drilling Pad & Access) (ha)		% of Area Affected	
	Area (ha) Affected	% of Area Affected	Local Project Area	Regional Study Area*
Ptarmigan Habitat	106.0	81.9%	11.3%	0.006%
Non-ptarmigan Habitat	23.5	18.1%	6.3%	0.005%
<b>Total</b>	<b>129.5</b>	<b>100%</b>	<b>9.9%</b>	<b>0.006%</b>

\*This value represents the percentage of the regional study area directly affected by the footprint of the proposed project

Willow ptarmigan could be negatively impacted by the removal of critical winter food supplies such as willow (*Salix* spp.). Extensive sensory disturbance during winter could result in the expenditure of critical winter energy reserves, limiting survival. When ptarmigan are forced out of their burrows, they must increase their energy losses to compensate for thermoregulation and such movements as flight, walking and browsing (Andreev 1991). The project area is relatively small and impacts are expected to be negligible.

#### 12.2.5 Cultural Resources

Mitigative measures for archaeological sites are determined by their viability in the context of the development project (*Prince of Wales Northern Heritage Centre 2001: 3*). Mitigation strategies consist mainly of avoidance of impact through maintaining a minimum 30 m buffer zone. With the proposed well site locations for the Nuna Winter Drilling Program being located in an area of low potential for heritage resources, it is predicted that no heritage resources will be impacted with well site development. However, should a heritage site be discovered during development, all operations will be suspended in the vicinity of the discovery until permitted by the appropriate authorities to resume (the NEB conservation

officer; INAC engineer/inspector; the Prince of Wales Northern Heritage Centre, and other appropriate Inuvialuit organizations).

### 12.3 Accidents and Malfunctions

Accidents and malfunctions may affect safety and productivity on a drilling program, and may also negatively impact the environment. Strict adherence to environmental, health and safety policies reduces the likelihood of an accident. Operators in the Delta have strict safety policies and are working with local companies to develop regional safety policies, which can be adhered to by all subcontractors on the program.

Should an accident occur, guidelines in the emergency response plan and/or fuel and oil spill contingency plan will be followed. All incidents are reported and each incident report is reviewed and consideration given for implementing measures to avoid future similar incidents.

Some of the accidents and malfunctions that may occur are described below, along with an indication of the likelihood of occurrence and the techniques used to minimize the effects of an accident:

#### i. *Hydraulic Oil Leak*

The drilling rig accumulator unit, which functions with the Blow Out Preventors, uses hydraulic oil to run the system. On occasion a hose or fitting may crack or leak causing a loss of fluid. Operational error may also result in leaving the recirculating pump on a "manual bypass" in which case the pump, if left unattended, can overheat resulting in a leak in the pump casing and loss of hydraulic fluid. The lost fluid would predominantly collect on the floor of the manifold building. Depending on the amount of hydraulic fluid lost and how long it is left unnoticed, the fluid can leak from the manifold building to the rig floor matting to the plastic liner to ice pad. The possible occurrence of this incident is considered rare, and is generally avoidable given the implementation of mitigative strategies.

Petro-Canada proposes to mitigate for a spill of this nature by implementing regular and structured procedural checks of the accumulator unit by a designated member of the rig crew to ensure proper functioning of the unit. Diligent maintenance of the accumulator unit and associated hoses, fittings and packing will verify the system integrity and identify components with the potential to leak.

In the event that a leak does occur, Petro-Canada has devised contingencies for clean up. The hydraulic oil will be contained with adsorbant materials from the Spill Kit and placed in a plastic lined bin or sea can along with any contaminated snow or ice for transport out of the wellsite area to the base camp area, where it will be safely stored until transported by truck or barge to an appropriate facility for disposal. The spill will be reported to the NWT 24-Hour Spill Report Line and the NEB.

## ii. *Glycol Spill*

The use of a mud cooler will be required to keep drilling muds at temperatures close to freezing, in order to minimize any downhole conditions that may cause permafrost damage or initiate hydrate development. The mud cooler exchanger element contains glycol to act in part as the heat transfer agent, and to prevent freezing of the unit when not in use. Mechanical failure of the mud cooler and improper handling of the glycol during transfer may potentially result in a glycol spill. Impacts to the environment may occur if such a spill reached the ice pad and tundra, as glycol does not freeze. The possible occurrence of this incident is also considered rare, and is generally avoidable given the implementation of mitigative strategies.

Petro-Canada proposes several mitigation strategies for a spill of this nature. The improvement of mud cooler design by adding a glycol reservoir storage component as an integral part of the unit will reduce the need to manually fill the unit with glycol on site. Additionally, a "false floor" built in to the mud cooler design would contain any errant fluids should a leak occur. The use of a new mud cooler unit and the implementation of a diligent maintenance program should virtually eliminate the possibility of a glycol leak. Strict operational procedures will be followed and any manual glycol transfer will be completely supervised.

In the event that a leak does occur, Petro-Canada has devised contingencies for clean up. The glycol will be contained with adsorbant materials from the Spill Kit and placed in a plastic lined bin or sea can along with any contaminated snow or ice for transport out of the wellsite area to the base camp area, where it will be safely stored until transported by truck or barge to an appropriate facility for disposal. The spill will be reported to the NWT 24-Hour Spill Report Line and the NEB.

## iii. *Fuel/Fluid Leaks or Spills*

Fuel and other deleterious substances may be introduced into the water should a vehicle fall through the ice on a lake or channel. To avoid an accident, both mechanical and electronic ice thickness profiling will be conducted throughout the program and maximum load size restrictions, compliant with transportation guidelines, will be strictly followed. With these mitigative measures in place, accidents are unlikely.

All tanks will have secondary containment, built with 110% of the capacity of each tank. The likelihood of any spill exceeding the capacity of the secondary containment structure is unlikely.

## iv. *Well Kicks and Blowouts*

Substances such as drilling fluids, sand or sediment, and gaseous or liquid hydrocarbon may be released to the flare stack or surface in the event of a well kick. A loss of well control, if allowed to proceed unchecked, could result in a blowout, and could include the uncontrolled release of drilling fluid and hydrocarbon from the well, potentially at high volumes. The released substances would impact the surface environment in the immediate radius of the accident, and may ultimately enter subsurface and aquatic environments.

Well kicks are infrequent and blowouts are extremely rare, especially with the high degree of control exercised in Arctic activity. Well kicks and blowouts are primarily managed through prevention. An elevated level of well control is exercised in the Mackenzie Delta through premium technology, equipment, and key personnel. This includes techniques that will be standard in Petro-Canada's operations, including measuring dissolved gas in drilling mud to maintain constant hydrostatic well balance; the use of a quadruple redundant blowout preventor; and an automatic well choking technology. In the event of a well kick, flaring can be carried out using standard equipment with minimal impact to the environment. Well blowout risk is further mitigated through conservative management.

v. *Wastewater*

Should any malfunctions occur with the wastewater treatment system, wastewater will be disposed of to a sump. It will only be trucked to and disposed of in the nearest municipal wastewater treatment system in case the sump is unavailable. A Municipal Services Agreement would be secured in such a case prior to disposal. To avoid malfunctions, a single individual will be responsible for conducting regular testing of all equipment and discharged water to ensure compliance with NWT guidelines. Having a single person responsible for the system will make it more likely for any accidents or malfunctions to be identified quickly and responded to appropriately.

## **12.4 Mitigation of Potential Impacts of the Environment on the Project**

In planning the proposed Petro-Canada winter drilling program, extensive consideration was given to potential effects the environment may have on the program. A series of mitigative measures and strategies to address any such potential effects has been developed.

### **12.4.1 Ice Formation**

Warmer than average weather in late fall and early winter could delay ice formation. Warm weather coupled with an early or unusually heavy snowfall can also contribute to the slow formation of ice. Slow ice formation can delay the project start-date and requires strict adherence to safety measures in order to avoid accidents. Petro-Canada is committed to implementing the following mitigation measures to address the potential effects of the environment on the project:

- Electronic and physical ice profiling will be used throughout the program to ensure ice conditions are safe for travel and equipment.
- If thickening of ice on access routes or airstrips is required, flooding will be carried out.

### **12.4.2 Sensitive Terrain**

Areas of environmental sensitivity in the program area are features of the environment that will impact activities and have been considered during program planning. The following measures will be employed to ensure a safe working environment and to avoid the disturbance of sensitive areas:

- Access routes were selected where slopes are gentle. Where slopes are steep and high banks (> 1 m) hamper access, snow and/or ice ramps made of clean snow and water will be constructed to prevent erosion and disturbance by equipment.
- Detailed and extensive planning in the program area was conducted. All known areas of sensitivity, including archaeological sites, camps and cabins have been located and identified during past field reconnaissance.
- Known archaeological sites will be avoided by a minimum of 30 m on Crown lands and will normally be avoided, where feasible, by at least 100 m and on ILA lands. Similarly, steep slopes will be avoided. Known grizzly dens will be avoided by a minimum of 50 m.

### **12.4.3 Deep Snow**

Areas of deep perennial snow accumulation or snow banks require downhill drainage that should not be blocked by the program area. The well site selection will avoid locations downhill from perennial snow accumulation areas or snow banks.

### **12.4.4 Little or No Snow**

During years of low precipitation, snow may not accumulate to typical depths. Portions of the lease site may also be more exposed to wind due to variation in topography, resulting in shearing off of the snow cover. Inadequate snow cover can delay project operations and result in impacts to vegetation and terrain. The following mitigation measures will be employed:

- Prior to surface preparation, low ground-pressure tracked vehicles compact the snow to protect underlying vegetation. The use of snow fences and/or the hauling of snow from lake surfaces may be used.
- Machinery will be strictly confined to the surveyed area to minimize terrain disturbance.
- The construction of ice pads will minimize effects to vegetation.

### **12.4.5 Blowing or Drifting Snow**

Blowing and drifting snow during program operations make it very difficult to ensure no garbage is left within the program area. To ensure all debris is removed from the program area, the following mitigative measures will be employed:

- All equipment and materials will be removed immediately following project completion.
- After the snow has melted, an aerial survey of the program area will be conducted to ensure no debris has been left around the camp or well site. Any waste will be picked-up and disposed in an approved landfill site.

#### **12.4.6 Early Ice Breakup**

The program is designed to be completed before break-up. However, should ice conditions deteriorate earlier than expected, the rig would be demobilized and testing completed the following season.

### **12.5 Follow-up Programs and Monitoring**

#### **12.5.1 Concurrent with Program Operations**

- Petro-Canada performs regular inspections of its programs during their operations and upon completion.
- An Inuvialuit Wildlife Monitor assigned by the local Hunters and Trappers Committee at the start of the program. The monitor observes wildlife in the program area, attempts to prevent wildlife interactions, and provides security for the crew. The monitor reports to its HTC, which reports to the Inuvialuit Game Council (IGC).
- An Inuvialuit Environmental Monitor is assigned by the Inuvialuit Land Administration for both Crown and Inuvialuit Private lands. The monitor will be provided with a copy of the Project Description and the permits and licenses assigned to the program. The monitor watches all aspects of the operation to ensure that mitigative measures are employed and adhered to, and will provide daily and weekly reports to INAC, and communicate with Petro-Canada to ensure that any issues are resolved to the satisfaction of the monitor and INAC.
- During operations, regulators conduct inspections and communication is maintained with Petro-Canada to address any issues which may arise.
- Petro-Canada is supporting research being conducted by RWED to monitor movements of the Bluenose West/Cape Bathurst caribou herd. The focus of the study to assess the effect of exploration activities on caribou movement and distribution and the results of the study will contribute to continuing program planning.
- Support has also been given to a grizzly bear denning survey being conducted by RWED. The focus of the study is to collect data on grizzly bear denning sites and assess the effect of exploration activities on denning location and denning success, the results of which will contribute to ongoing program planning.
- All wastewater discharges are regularly monitored to ensure compliance with NWT guidelines.

#### **12.5.2 Post Program**

Upon completion of program operations, the well site and access road will be left to melt and the drill rig will be moved off site. Any equipment will be removed from the site and debris will be disposed of in an appropriate off site facility.

Regulators will conduct an inspection of the program area, after the activities are complete. Prior to inspection by the regulators, Petro-Canada will conduct an inspection with particular attention focused on:

- Removal of debris from access roads, camp and well site area;
- Survey of water crossings to ensure no vegetation has been left in watercourses;
- Survey and documentation of camp and well site disturbance. Any disturbance will be reported to regulators and reclamation efforts will be initiated if warranted;
- Documentation of apparent travel outside of designated routes;
- Removal of remaining signage from access; and
- Inspection of the sump to ensure that slumping is not occurring. At a minimum, an electromagnetic survey of the sump will be conducted in Summer 2004 to ensure the sump contents have not migrated.

Post-project inspection by the regulators will also include a survey of the above items. Petro-Canada will accompany the regulator on the survey. A post-inspection meeting will be attended to outline and confirm plans for remedial action, where warranted. Once remedial actions have been completed, regulators and community members may be taken on a reconnaissance flight of the area.

## 12.6 Remediation

### i. *Remediation of effects identified through program monitoring or post-program inspection:*

- Effects related to deposit of debris would be immediately rectified.
- Effects related to surface disturbance would be discussed with INAC and ILA to determine appropriate action. Where in-house expertise is not available, a specialist would be contracted to determine an appropriate solution.
- The regulator and Petro-Canada would agree to an acceptable endpoint of remediation.
- Remediation would take place within the growing season and the success of the remediation evaluated at agreed upon intervals (e.g. Inspection during the following growing season. If not acceptable, further remedial actions and inspection at intervals until a satisfactory result is achieved).

### ii. *Remediation of effects identified through wildlife monitoring or harvest studies:*

- Remediation of effects would be discussed with RWED, DFO, IGC and other interested parties.
- Modification of mitigative measures to respond to concerns.
- Modification of operational practices to address concerns.
- Petro-Canada is working with local HTC's and the IGC to establish Harvest Compensation Agreements.

## 12.7 Notification

### *Notification of INAC and ILA*

Regulators are notified by Petro-Canada through the inspection process and provision of final reporting (as built reports).

### *Notification of the Water Board*

Results of the treated discharge monitoring reports are provided the NWT Water Board. Results will also be copied to the INAC Water Resources Division.

### *Notification of the NEB*

NEB receives notification and summary of all incidents. Petro-Canada provides a final report of their activities.

## 13.0 EMERGENCY RESPONSE PLANS

In the event of an emergency, Petro-Canada's Emergency Response Plan will be followed, and the NEB and INAC and/or ILA will be contacted immediately. In the event of a spill, the Fuel and Oil Spill Contingency Plan will be followed and INAC, NEB and NWT Emergency Spill Response Line will be notified immediately as outlined in Table 21. A copy of the Emergency Response Plan has been provided to all regulators and review parties, and additional copies are available upon request.

## 14.0 CLEANUP, RECLAMATION, DISPOSAL, AND/OR DECOMMISSIONING PLAN

Upon completion of the drilling program, the well(s) will be capped and temporarily or permanently abandoned, and the wellsite, campsite, and fuel storage facilities will have the surface scraped to pick up all contaminated or stained ice & snow. This scraped material will be hauled by gravel truck or sealed container to Swimming Point for consolidation. All equipment will be removed from the site, and survey stakes and construction debris associated with the operations will be disposed of in the Inuvik landfill upon completion of drilling. As a minimum, an electromagnetic survey will be completed the summer following sump closure (summer 2004) to ensure the contents of the sump have not migrated. The only permanent facility planned is the well. Petro-Canada and their contractors will adhere to all applicable regulations and guidelines.

## 15.0 OTHER ENVIRONMENTAL ASSESSMENT

Previous environmental assessments prepared by IEG (formerly Inuvialuit Environmental Inc.) for projects within the vicinity of the proposed program include the Petro-Canada Nuna 2001/2002 3D Seismic Program and the Conoco Parsons Lake Winter 2001/2002 3D Seismic Program. These Project Descriptions are on file with the EISC and NEB. Several assessments written for past developments

within the vicinity of the project area were previously approved, and a number of environmental assessments for proposed projects within the vicinity of the project area will be submitted for approval.

## 16.0 COMMUNITY CONSULTATION

Petro-Canada initiated public consultation with the communities and regional organizations potentially affected by the proposed drilling program in June 2002. Government representatives were also informed of the proposed project; access route selection; selection and data calculations of lakes to be used as a source for water withdrawal; development schedule; and where warranted, technical details of the drilling program. This consultation has provided an opportunity for Petro-Canada to present the proposed program to various groups, obtain information on the area from local residents, and hear concerns raised regarding the planned project.

Representatives of Petro-Canada held meetings July 15-18, 2002 in the communities of Inuvik, Tuktoyaktuk and Aklavik to discuss issues of concern and mitigative measures to be adhered to during the project. A second meeting with the Tuktoyaktuk HTC as a focus group was conducted in Tuk on July 19, 2002. At the meetings, project information was presented to various individuals and groups and an information sheet with associated colour maps of the proposed projects were provided as handouts. Following the presentation, community members were invited to raise issues, concerns and questions. A schedule of meetings is provided in Table 25. Issues raised during the community consultation meetings are provided as Table 26.

**TABLE 25**  
**COMMUNITY/STAKEHOLDER/GOVERNMENT MEETINGS**

Consultation Group	Date	Location
Tuk Community Corporation; Tuk Hunters and Trappers Committee; Tuk public	July 15, 2002	Tuk Inn, Tuktoyaktuk
Inuvik Community Corporation; Inuvik HTC; Inuvik public	July 15, 2002	Ingamo Hall, Inuvik
Aklavik Community Corporation, Aklavik HTC, Aklavik public	July 18, 2002	Council Chambers, Aklavik
Indian and Northern Affairs Canada	July 18, 2002	Inuvik
Department of Fisheries and Oceans	July 18, 2002	Inuvik
Peter Clarkson, Mayor of Inuvik	July 18, 2002	Inuvik
Inuvialuit Regional Corporation – Nellie Courmoyea, Roger Connelly	July 19, 2002	IRC Building, Inuvik
Tuktoyaktuk HTC	July 19, 2002	Tuktoyaktuk government office

**TABLE 26**  
**COMMUNITY CONSULTATION ISSUES AND RESPONSES**

<b>Community</b>	<b>Proponent</b>
Where was the Nuna seismic camp located last year?	Close to the Nuna #1 drilling prospect area.
Are you certain that 40 – 50 km of access will be located on frozen lakes? It doesn't seem likely.	Petro-Canada has checked the route, and had Mardy Semmler of the ILA out with us on Friday (July 12). The distance was measured off the map, so we are confident with the route.
Has this access route been used before?	A portion of it has been. This is a safer route.
When you say people (Petro-Canada personnel) have to make decisions, what is it with respect to? Why are we sitting down to talk if the decisions have been made?	Decisions still need to be made on whether Petro-Canada will drill one or two wells, and whether we will use one or two rigs to accomplish that.
Has the application been submitted yet?	No, it will be submitted in August for review at the EISC meeting in September.
There is an established road from Tuk. It is a shorter route.	Swimming Point is our operations base. Petro-Canada has put considerable effort into the route selection. The preferred access route saves 10 km of access on land alone as opposed to the Pete's Creek access.
What about the access route? Will this leave another footprint on the ground?	The access route is approximately 50 km long, of which only about 10 km is on land. The rest of the access is on frozen lakes.
The access road to Nuna that was used last year allows for an earlier start, is a shorter distance, and has higher terrain.	Petro-Canada has asked INAC to stage some equipment on a sand bar located on the river to allow for an early start.
INAC granted permission? Is that not ILA land?	Not the first portion of the river. It is Crown land.
The Community Corporation did not see any correspondence from INAC in this regard.	Noted.
Are operations at the Boss Camp being moved to Swimming Point?	The Boss Camp is operated by Devon, and they operate out of Tuk. Petro-Canada operates out of Swimming Point.
We heard the Boss Camp was going to close and move to Swimming Point.	Devon is Petro-Canada's partner, but we do not share their operations.
Will there be a loss of job opportunities in Tuk if the operations are out of Swimming Point?	We don't know what Devon's plans are. We cannot take all the people from the Boss Camp and put them at Swimming Point.
People will suffer if this is the case.	Petro-Canada operates out of Swimming Point, and there are opportunities there.
Petro-Canada is partners with Devon. There are a lot of people from Aklavik and Inuvik, and Tuk Residents get mistreated when they go over.	<i>Petro-Canada reply:</i> Mistreated in what way? <i>Resident reply:</i> That we are not there to work. <i>Note:</i> John Hunt of Petro-Canada has followed up with the individual who raised this concern through a private conversation. It was determined that the antagonism from northern workers in the workplace was occurring in the absence of authority figures. This concern has been noted by Petro-Canada and workers are asked to come forward in such an instance. Action will be taken should this occur again.
The timing and location of these meetings influences the turnout. Some people are busy working. This is a bad location (Tuk Inn) to discuss the program when there are a lot of questions.	The Tuk Inn and lunchtime meeting was selected because the other venues were booked. Petro-Canada is here with both Shell and Conoco in response to community comments that you would prefer we schedule one meeting jointly to go over a number of items, as opposed to several meetings conducted individually. The Community Corporation the meeting time and place, and scheduling was thus arranged.
There is a big difference this year over last year in terms of the influence on Tuk. It's not the same	There will be opportunities available. Petro-Canada is committed to capacity building.

TABLE 26 Cont'd

operations and we are trying to build capacity.	
People are upset that Tuk will lose if the work is based out of elsewhere when it makes the most sense to based out of here.	We hear your concerns.
You are working at Petro-Canada's convenience, not Tuk's.	We hear your concerns.
We have been trying to set up a meeting for a couple of weeks and have been unsuccessful, and then you come here and say things are definite.	We are willing to come to Tuk to meet with you at any time and have been in Tuk several times this past Winter and Spring.
You based the Nuna seismic program out of Tuk last year, so why not the Nuna drilling program this year? It made sense to operate out of Tuk last year, equipment and staging will be out of Tuk, and it's the same decision making process, so why is the decision different this year?	The Nuna seismic program was based out of 3 camps last year. Everything has been scaled back this year. Last year was a high point for operations, but it is now being scaled back with seismic and drilling. Akita Rig #60 is based at Swimming Point, so it is logical that we would operate from there.
We realize that there is less work being done this year, which is why it is all the more important to start work from Tuk.	Noted.
We have only seen plans from Chevron other than Petro-Canada and Shell.	Part of why we are here is to get input on the environmental aspects of the program to put the Project Description together.
We heard that Rig #60 is going south and Rig #63 is being shipped from Tuk to Swimming Point.	The decisions are still being made in this regard.
We have made commitments on equipment.	We don't usually need specific pieces of equipment for a long time. If the equipment is already here, we would rather use it here that contract because it is short-term. The long-term type of equipment that is needed are graders, loaders, gravel trucks, and we don't want to see people lose any equipment.
Does that mean that significant opportunity for work in Tuk will go outside of the community.	We don't know at this point.
You had a big meeting 2 years ago, we had a vote and you people had made a commitment to training. My experience is that a lot of people made commitments to meeting your needs (buying equipment etc. and based out of Tuk) and going on false hopes. We gave you support, and now we know it was a boom then bust.	Petro-Canada has exploration agreements on these lands.
You gave commitments for jobs, training, etc.	Yes, we did, and I think we have lived up to that. Has there not been a lot of employment? <i>Community member response:</i> Yes, but you should have some say with Devon as your partner. Tuk will suffer.
The decision to consolidate Petro-Canada and Devon's operations is now a big factor in the discussion.	Noted.
	<i>Petro-Canada Comment:</i> What about land use in this area? Are there any concerns with respect to the operations themselves that we need to take into consideration?
We need to look at long-term compensation with respect to caribou. The caribou don't come around as much over the last few years, and go on the other side of Urqhart Lake, which is a long way for the older people to go. Caribou used to come right up to the pingos and now they don't.	Noted.
Now they are saying we hunt too many geese. We need to look at subsistence hunting closely along with industry.	Noted.
In the Spring the geese do not come through this area since the start of the activity. The only way to successfully hunt geese is to go as far as the Kendall Island Bird Sanctuary.	We will shut down our operations by April 15 before the migratory birds are back in the area.

TABLE 26 Cont'd

We have seen a change in migratory birds in the last 3 years. Maybe it's because of global warming.	We will shut down our operations by April 15 before the migratory birds are back in the area.
Caribou hunting coincides with operations.	We will put provisions in place to address this.
We still see the scars from seismic 40 years ago. We want to keep the scars from access down to a minimum.	There is quite a bit of existing seismic from the 50s and 60s. With the new technology and low impact seismic techniques we expect the impact to be minimized.
IRC, regulators and industry should be considering the social impacts and well being, but they're not. We should sit down and look at the effects on the people including drugs.	Noted.
Why can't the IRC look after everyone? It's too bad Nellie isn't present to hear what the concerns are.	Noted.
What kind of assurances can you make that Tuk will get jobs if the operations are based out of Swimming Point?	This is a short operating window and it is fair to say that we are newcomers to the area, and what we do depends on how successful we are. I try to be very honest about what Petro-Canada is doing in exploration modes of operation. WesternGeco and Akita need a lot of people, but the work is short-term and seasonal. Exploration is uncertain and can be short-lived. We have always emphasized that.
If the business goes to the closest community, then Tuk is affected the most.	Noted.
Do you have sole-sourced contracting?	No. You see who we are working with. About 80% of what we spent is going to Inuvialuit businesses.
There is a discrepancy with the \$80 million spent.	That includes long-term contracts with Akita and WesternGeco. Other numbers are on a per year basis. That probably wasn't explained well. You have made valid points and we know there are some business issues that need to be resolved, but we can discuss that later. Are there any concerns about the proposed programs on the environmental side?
Where did all the concession dollars go?	This is an internal IRC issue.
In regards to the footprint from the access, how long will we see the scars?	Many of the scars are from the early seismic. That's why the regulators are here. We took Mardy Semmler of the ILA out to see the access route. We will comply with the regulations. We want to operate appropriately.
The small guys can't compete with the big companies and contracts. We can't compete and we need to look after the businesses and people. We can't compete with Grubens and big prime contractors.	Noted.
There are social problems within the communities.	I don't disagree with you. The dropout rate is also something to think about. We have been thinking about how to help keep kids in school. <i>Community member comment:</i> it is our responsibility too, not just industry. It is time we sit down and do that.
Payment of contracts should be faster. Petro-Canada and Shell are the best.	We will keep trying to improve.
All the decisions have been made. You have a hard time coming down to the community level.	We have a lot of places to spend our money. We like to think that we hear what you have to say. We might not always respond with the answer you want, but we take your concerns seriously. At the same time, we tried to be clear from day one that while jobs are important, we can't give jobs to everyone. We are involved with education programs within the community; we are involved with the Beaufort Sea Education Council; and we have donated computers as part of the donation program.
We appreciate the jobs and opportunities we have, we just want a continued commitment.	Noted.
If the weather prevents you from starting the program when you planned, are downtime costs also included	We put out tenders as soon as we know we are doing the work. When we award the contract, it is usually based on a minimum

TABLE 26 Cont'd

in the contracts?	number of days, but the start-up date is left flexible to allow for ice conditions. There is a certain amount of guaranteed days, which we have to pay the contractor.
There were concerns raised about deals being made where you know in advance who's getting what.	Contracting is a standard process that we comply with. In the past, some bidders had been bluffing others about the status of the contract to confuse the other bidders competing for the work ( <i>Shell Response</i> ).  We should be made aware of any accusations of early information being given. That is not something that we would tolerate ( <i>Petro-Canada Response</i> ).
There are no guarantees on who gets the contracts?	I tell the people that phone me the same thing I tell the communities. They have no more information than you do. We hope people do not buy equipment on speculation, because the projects are not guaranteed to go ahead until the AFE is signed. ( <i>Shell Canada Response</i> )  All tenders are sent on the same day. ( <i>WesternGeco Response</i> )
Will the concerns raised and documented in past meetings be taken into consideration this year as well?	Yes. We remember the issues raised in past meetings, and continually try to improve by incorporating those concerns into future planning.
Will you be enforcing a drug and alcohol policy this year?	We're not sure at this time, given the Supreme Court ruling. Our attempts to standardize the requirements are being resolved.
This winter there were concerns over sewage and wastewater going to some of the communities.	The operators need a water licence to dispose of their waste. We are now being requested by the regulators to submit a Municipal Services Agreement (MSA) allowing for waste disposal in the particular community at the time of submitting the application.
If we said you could not haul your waste here, then what would you do?	These programs have sewage treatment systems to treat the waste. Last year there were some problems meeting the criteria for discharge. The ideal solution is that the treatment systems will meet spec and hauling will not be required. We don't want to overload the community systems. We are trying to improve our waste treatment systems instead.
Getting an MSA may slow down your application if it gets held up at the community level. You may have to submit the information as soon as possible to catch the community meetings. This could create problems if we have to review a number of them. We have not heard anything about this requirement at the community level.	We will request that INAC send a letter to the communities advising of this, as it is their new requirement.
In terms of the way community consultation is conducted, it would be useful if the regulators were at the community meetings. They have the scientific knowledge and expertise about the programs and impacts that would be useful for the communities to know during the planning stages.	That is a very valid comment. We will include your suggestion in the project description. Both industry and the regulators are continually looking to improve the consultation process, and we can discuss this further with them.
The Environmental Monitor reports completed for the programs should be forwarded on to the HTC of the affected community for their reference and to know what is happening in the field instead of at the end of the program.	It would also give us comfort to know that the communities know how things are going in the field. The reports also contain a fair bit of positive response, which would also be good for the communities to know what we are doing right. Your suggestion will be included in the project description. We can discuss this further with the ILA.
The communities should be circulated on the inspection reports completed for the programs.	Noted. This is another suggestion that will be discussed with the regulators.
Research work should be done first on programs to ensure that the correct decisions are made.	The way the work is being done this year is not necessarily the way it was done last year. DFO is making new recommendations for this year's work following their review of last year's research.

TABLE 26 Cont'd

Is this [green line on map] going to be the road?	No, that is last year's access road for Weatherhaven camp. This yellow line will be next year's access road for Nuna drilling.
How big is the well?	The actual drill hole is quite small (several inches in diameter), but the well structures and drill pad will be quite large.
What is the approximate date that you will start building the road?	We will start preparing the road on November 1 or so, then hope to start drilling around January 1. It is estimated that there will be 55 days of drilling for each well, as they will be about 3600 m deep.
Who will be flagging the trail on the new route?	The route has already been inspected by ILA. Mardy Semmler flew it with Wray on Friday, July 12. ILA seems pleased with the routing and the work we have put into the design.
But who will be flagging the route? Usually it is someone, a local contractor. There is a list of eligible businesses on the Inuvialuit business list.	We will be hiring someone to do the surveying and to mark out the route in the fall.
[Comment] There were environmental people here before (in the 1960's and 1970's), and you can still see the damage from the work they did. Anyways, Gordon Anaviak is as good as an environmentalist.	The way operations are conducted now and the technology that is used creates much less impact on the environment than in the past.
[Comment] In the 1970's, there was lots of damage at Husky Lakes from the seismic work they did. They just walked through and damaged the land.	Noted.
The caribou come through in the end of October; they always come through that part, where the road is planned to be. It would be good to have a wildlife monitor to watch for caribou and be aware of caribou sightings.	Noted. A qualified wildlife monitor will be employed at the very start of the project to oversee access route construction at this time.
You should hire someone just to keep track of where the herds are, and what way they are going.	A qualified wildlife monitor will be on site.
Maybe you could ask the wildlife monitor for more definite information than just usually they kind of keep track of whether there are animals or bears or whatever around where the activity is happening. Maybe the wildlife monitor could keep track of the numbers of caribou, the directions they are moving, dates, and whether they cross or parallel the road. You should watch that in November, mainly just for the first couple weeks of the migration. The leaders choose the route each year, and once that is established, the other ones follow the same way.	A qualified wildlife monitor will be on site.
No, you don't have to stop the activity, just keep track.	Noted.
[Comment] The caribou cross from Middle Husky Lakes to Richards Island, north of Pete's Creek. Sometimes they go down south, along the East Channel.	Noted.
Every year, the caribou go through this part [where the road and Nuna drilling will take place].	Noted. A qualified wildlife monitor will be on site.
[Comment] The first bunch is the one to watch. If the first bunch turns off, that's where the rest will be too. You can't stop them. You just want to avoid problems.	Noted. A qualified wildlife monitor will be on site.
[Comment] One problem with the Porcupine Caribou Herd was that the young people were hunting on the Dempster Highway, and they were killing the first ones, the leaders, when they went through. So the elders said that they should let the first caribou just pass through before they started hunting during the migration. So they shut down the hunting for the first two weeks of the migration each year.	Noted.
[Comment] I noticed that the caribou moved away	Noted.

TABLE 26 Cont'd

faster this year. Usually they come really close to Tuk and stay around for a while.	
It's hard to say why the caribou moved away further this year. It could be the activity, but it could also be all the hunting pressure. There are a lot of hunters from other communities in this area, so maybe there's just too much hunting. There are also some local hunters who are selling lots of caribou to other communities. So it may be the pressure of hunting that is moving them away. But hard to say how much is that and how much is other effects.	Noted.
You could increase the number of monitors for the month of November.	Noted.
[Comment] The demarcation between Inuvik and Tuk's hunting area is Holmes Creek. Holmes Creek is mostly just the trapping demarcation. Inuvik people can hunt here too.	Noted.
Last year, we had complaints of meat wastage along the Pete's Creek access road, but people were still hunting by skidoos, not with trucks. I think what discourages people from using the access road to drive on is that it is a private road, and you are at your own risk if you use it.	So they are not really using the access road for hunting?
[Comment] I used to have a trapline in there, and there are lots of fish in lakes 14 and 15 (on last year's access route) and the creeks in between. There are big white fish in there.	Noted.
[Comment] I used to set traps for foxes and hunt wolves in the Parsons Lake area. Now there are no wolves, because the wolves shy away from any kind of activity. They used to come in packs, and I could get lots of wolves, for their skins. Last year, they kind of stayed on the other side of Husky Lakes. The foxes and wolverines don't mind.	Noted.
I used to get about 20 wolves in one winter.	Noted.
Did you change the route from last year because it is cheaper?	Primarily because it is a safer route. It's also shorter and has less distance on land.
[Comment] In this lake [Lake 6, next to proposed Nuna 3 drill], there are all kinds of fish in there.	Noted.
There are moose at Holmes Creek. Probably in that little bit of moose pasture, there may be 2-3 moose, but it's still good to avoid the area.	When we did a fly-over of the proposed access route, we identified possible moose habitat, so we have re-routed the access road to avoid the moose habitat. A wildlife monitor will be in place.
For when the caribou come through, you don't have to stop activity, just watch where the caribou are going, and report on that.	Noted.
You should double up on wildlife monitors.	Noted.
It's mainly the young guys who feel they're being prejudiced about, from people down south.  We won't be able to do anything about that, unless they can go to someone in town to talk about this, because they won't go to the big bosses in the camps.  It probably goes both ways, between the communities, and if people from other communities say bad things to Tuk people, probably Tuk people are saying bad things to those other people too.	Noted. This matter will be brought forward to senior management at Petro-Canada to determine an action for this matter.

TABLE 26 Cont'd

<p>It would only work to fix this if there is someone who can get the reports of discrimination from the workers.</p> <p>It would be good if they could bring someone in to the camps who could be like a school counsellor, so if people have problems, they can go and talk to someone and get help.</p> <p>It should be someone local, someone aboriginal, so people feel comfortable going to them.</p> <p>You should hire a local employment person in town, who people can go to. You need a native resource person in Tuk. Like a resource person that local people can go to.</p> <p>You should have an Inuit [Inuvialuit] resource person who can answer for these things.</p>	
At those drilling camps [Nuna], they won't have those sewage sumps anymore?	No. We used pump outs. Last year we had ongoing problems with sewage. Each of the camps has a sewage treatment system, but we have had problems getting them working effectively, so have been pumping them out and taking the sewage to the communities to be dumped.
There are incinerator toilets available.	Yes, some of the camps used these last year.
Will we be seeing this proposal for work again at our meeting?	Yes, when the project description is finished, we will be sending it to you for your review. This meeting is to get information from you, the users of the land, so that we can do a better job on the Project Description.
When industry came through in the 1970's, you just destroyed everything, even our traplines.	The technology we use on our programs today are different than in the past. We also conduct consultation for our programs.
You should treat every like as if it has fish in it, and clean up everything from the industrial activity. If there is a spill, you should clean it up; if you leave something on the land, you should go pick it up.	We certainly intend to have minimized impact and leave nothing behind.
Is there going to be someone going into the area when it first freezes up, when the ice gets its first 4-6" of ice? This area is really good bear denning area. Not sure if anyone will be going in and looking at that?	John Nagy has a project ongoing where RWED is looking at bear denning, with the companies. We will also use a wildlife monitor to scout ahead.
Both Lennie and Henry really know that area.	Noted.
John Nagy is working on locating all the dens in the area, looking at where the bears are in fall and spring. Lugga and Emmanuel were supposed to go out this last year to work on that project, but neither was available at that time.	Noted.

\* All comments were made by Petro-Canada personnel unless otherwise noted.

## 17.0 PERSONAL COMMUNICATIONS

Inuvialuit Environmental & Geotechnical Inc. wishes to acknowledge the following people for their assistance in supplying information and comments incorporated into this report:

John Nagy. April 12, 2002. Wildlife Management Officer. DRWED, Government of the Northwest Territories, Inuvik, NT.

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## APPENDIX A

### LAKE VOLUME CALCULATIONS OF LAKES IDENTIFIED FOR WITHDRAWAL

Lake	Average Depth (m)	Surface Area (m <sup>2</sup> )	Total Volume (m <sup>3</sup> )	Total Ice Volume (m <sup>3</sup> )	Total Usable Water Volume (m <sup>3</sup> )	Volume for 1% Withdrawal (m <sup>3</sup> )	Required Withdrawal (m <sup>3</sup> )	% of Total Volume
1	1.5	398,827	598,241	598,241	598,241	5,982	210	0.035
2	1.5	73,940	110,909	110,909	110,909	1,109	510	0.460
3	2.4	535,550	1,285,319	1,071,100	214,220	2,142	500	0.233
4	2.4	1,021,559	2,451,742	2,043,119	408,624	4,086	350	0.086
5	1.8	282,387	494,176	494,176	494,176	4,942	280	0.057
6	2.4	562,371	1,349,691	1,124,743	224,949	2,249	320	0.142
7	2.4	208,175	499,619	416,349	83,270	833	600	0.721
8	1.5	50,415	75,622	75,622	75,622	756	540	0.714
9	1.5	1,905,622	2,858,432	2,858,432	2,858,432	28,584	360	0.013
10	2.8	2,642,094	7,397,863	5,284,188	2,113,675	21,137	460	0.022
11	2.1	1,923,611	4,039,584	3,847,222	192,361	1,924		
12	2.5	3,740,710	9,351,776	7,481,421	1,870,355	18,704		
13	1.5	175,894	263,840	263,840	263,840	2,638		
14	2.8	2,186,809	6,123,066	4,373,619	1,749,448	17,494		
15	2.2	1,464,598	3,222,115	2,929,195	292,920	2,929		
16	2.3	5,903,087	13,577,100	11,806,174	1,770,926	17,709		
17	1.5	754,858	1,132,286	1,509,715	-377,429	-3,774		
18	3.5	3,831,067	13,408,735	7,662,134	5,746,601	57,466		
19	3.8	63,438,181	241,065,088	126,876,362	114,188,726	1,141,887		
20	7.0	1,059,198	7,414,389	2,118,397	5,295,992	52,960		
21	6.6	538,227	3,552,296	1,076,453	2,475,843	24,758		
22	4.3	439,006	1,887,725	878,012	1,009,714	10,097		
23	8.0	3,095,144	24,761,151	6,190,288	18,570,863	185,709		
24	12.4	2,291,530	28,414,969	4,583,060	23,831,910	238,319		
25	8.0	471,968	3,775,744	943,936	2,831,808	28,318		
26	2.4	5,386,489	12,927,574	10,772,979	2,154,596	21,546	460	0.021
27	2.0	734,058	2,080,780	2,080,780	2,080,780	20,808	690	0.033
28	3.2	5,245,136	16,784,436	10,490,272	6,294,163	62,942	360	0.006
29	3.1	617,117	1,913,063	1,234,234	678,829	6,788	560	0.082
30	4.0	2,978,948	11,915,794	5,957,897	5,957,897	59,579	450	0.008
31	4.6	1,198,384	5,512,568	2,396,769	3,115,799	31,158	630	0.020
32	2.5	1,063,767	2,659,417	2,127,534	531,883	5,319	550	0.103
33	4.4	1,874,471	8,247,673	3,748,942	4,498,731	44,987	360	0.008
34	6.5	8,080,273	52,521,775	16,160,546	36,361,229	363,612	470	0.001
35	6.5	352,994	2,294,461	705,988	1,588,473	15,885		
36	6.5	2,530,869	16,450,650	5,061,739	11,388,912	113,889		
37	3.7	546,021	2,020,280	1,092,043	928,237	9,282	240	0.026
38	2.0	1,436,358	2,872,715	2,872,715	2,872,715	28,727	360	0.013
39	2.6	396,160	1,030,016	792,320	237,696	2,377	190	0.080
40	6.5	980,077	6,370,500	1,960,154	4,410,346	44,103		
41	1.7	860,887	1,463,508	1,721,775	-258,266	-2,583		
42	2.0	2,711,806	5,423,612	5,423,612	5,423,612	54,236		
43	2.6	1,658,134	4,311,149	3,316,268	994,881	9,949		

Lake	Average Depth (m)	Surface Area (m <sup>2</sup> )	Total Volume (m <sup>3</sup> )	Total Ice Volume (m <sup>3</sup> )	Total Usable Water Volume (m <sup>3</sup> )	Volume for 1% Withdrawal (m <sup>3</sup> )	Required Withdrawal (m <sup>3</sup> )	% of Total Volume
44	2.7	7,336,528	19,808,625	14,673,056	5,135,570	51,356		
45	2.4	239,612	575,068	479,223	95,845	958		
46	2.9	1,828,453	5,302,515	3,656,907	1,645,608	16,456		
47	2.5	1,729,525	4,323,813	3,459,050	864,763	8,648		
48	2.4	92,290	221,496	184,580	36,916	369		
49	2.2	296,956	653,303	593,912	59,391	594		
50	2.4	519,569	1,246,967	1,039,139	207,828	2,078		
51	4.0	1,286,793	5,147,174	2,573,587	2,573,587	25,736		
52	1.8	4,638,719	8,349,694	9,277,438	-927,744	-9,277		
53	2.1	937,010	1,967,720	1,874,019	93,701	937		
54	5.2	6,995,464	36,376,414	13,990,929	22,385,486	223,855		
55	4.5	526,397	2,368,787	1,052,794	1,315,993	13,160		
56	2.4	2,109,643	5,063,142	4,219,285	843,857	8,439		
57	2.1	3,170,091	6,657,191	6,340,182	317,009	3,170		
58	2.6	1,371,679	3,566,367	2,743,359	823,008	8,230		
59	4.6	4,254,594	19,571,133	8,509,188	11,061,945	110,619		
60	6.5	1,795,805	11,672,733	3,591,610	8,081,123	80,811		
64	2.3		2,815,198	2,447,998	367,200	3,672	850	0.231
65	3.0	569,104	1,707,312	1,138,208	569,104	5,691	400	0.070
66	2.8		4,187,011	2,990,722	1,196,289	11,963	500	0.042
Mackenzie River							500	
TOTAL							11,700	

Red – Lakes frozen to bottom during sampling

Blue – Lakes sampled during winter

Black – Lakes sampled during summer

**APPENDIX B**

**CHEMICALS LIST**

# INVENTORY April 09/01

MATERIAL CODE	PRODUCT NAME	ORIGINAL		UNIT SIZE	TOTAL UNIT QTY	Swimming Point	Rig
		QTY	UoM			BALANCE ON HAND	BALANCE ON HAND
0	NO ITEM						
1	ALCOMER 74P	1	C-CAN	15 KG	40	0	40
2	BARITE - BULK BOXED - 1.36 MT	742	C-CAN	1.36 MT	742	584	37
3	BARITE - SACKED	68	C-CAN	40 KG	5100	160	3225
4	BICARB	1	C-CAN	22.68	75	0	70
5	CALCIUM CARBONATE SUPERCAL	1	C-CAN	25 KG	80	80	
6	CALCIUM CARBONATE O (MEDIUM)	2	C-CAN	25 KG	160	160	
7	CALCIUM CARBONATE 325 (FINE)	1	C-CAN	25 KG	80	80	
8	CAUSTIC SODA	4	C-CAN	22.68 KG	240	180	58
9	CELLOPHANE / CELLOFLAKE	4	C-CAN	11.34 KG	200	150	50
10	CI-40	5	TOTE	1000 L	5	0	1
10-A	CI-40	48	PAIL	20 LT	48	0	27
11	CITRIC ACID	1	C-CAN	25 KG	50	0	34
12	DEFOAM-X	2	TOTE	1000 L	2	1	0.5
12-A	DEFOAM - X	45	PAIL	18.93 LT	45	45	
13	DESCO CF	2	C-CAN	11.34 KG	160	160	34
14	DRILL-XT	4	TOTE	1040 L	4	2	1
15	IDCAP D	5	C-CAN	25 KG	250	0	10
16	IDLUBE XL	9	TOTE	1000 L	9	9	
17 *	KELZAN XCD	3	C-CAN	25 KG	105	0	165
18	LIGNITE	3	C-CAN	22.68 KG	200	150	50
19	LIME	1	C-CAN	20 KG	36	35	
20	MIX II FINE	4	C-CAN	11.34 KG	144	144	36
21	MULTI SEAL	1	C-CAN	18.14 KG	30	30	
22	PRIMASEAL COARSE	1	C-CAN	18.14 KG	30	0	30
23	KWIKSEAL FINE	1	C-CAN	18.14 KG	30	0	30
24	PIPELAX W	4	TOTE	1040 L	4	4	
25	POLY PLUS DRY	2	C-CAN	22.68 KG	80	80	
26	POLYPAC REG	1	C-CAN	22.68 KG	40	140	43
27	POLYPAC UL	2	C-CAN	22.68 KG	80	0	37
28	POTASH	26	C-CAN	25 KG	1664	504	210
29	SAPP	1	C-CAN	22.68 KG	80	60	
30	SAWDUST	7	C-CAN	18.6 KG	350	200	90
31	SODA ASH	1	C-CAN	22.68 KG	40	0	17
32	STARPAK / THERMPAK D	8	C-CAN	22.68 KG	400	150	20
33	UNTREATED BENTONITE (GEL)	12	C-CAN	40 KG	420	70	86
34	WALNUT FINE	1	C-CAN	22.68 KG	35	0	35
35	WALNUT MEDIUM	1	C-CAN	22.68 KG	40	40	
36	X-CIDE 207	1	C-CAN	2.72 KG	102	60	52

\* 160 Kelzan shipped to rig

## APPENDIX C

### LICENCE APPLICATIONS

## APPLICATION FOR LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE

3. **Location of Undertaking** (describe and attach a map, indicating watercourses and location of any proposed waste deposits)

Petro-Canada is proposing to drill one or two new exploratory wells, selected from three potential locations within the Nuna area, during the winter of 2002/2003. The potential wellsite locations are within EL 406, and depending on the final sites selected, the wells may be drilled on Crown and/or Inuvialuit 7(1)(b) land. The wellsite locations will be finalized in October when interpretation of last year's Nuna 3D seismic data is complete.

Please refer to the map in the map pocket of the attached project description.

Longitude 133° 17' to 134° 20'W

Petro-Canada is applying to conduct a winter 2003 drilling program in the Mackenzie Delta Region of the Northwest Territories. The proposed project is in the Inuvialuit Settlement Region (ISR) and involves three (3) proposed drill locations, one or two of which will be drilled. A north location will be drilled first, and pending seismic interpretation, one of two south locations may be drilled. The proposed drill locations are situated on tundra uplands over 20 km to the northwest of the Husky Lakes estuary with each drill pad and associated facilities expected to occupy approximately 3.6 ha. Akita-Equtak will be the drilling contractor and Akita-Equtak Rig #60 and/or Rig #63 will be used for drilling operations on the program. The program will begin with ice access and lease construction in October and the wells will be drilled between January to April.

8. Miscellaneous (describe)

Other (describe) \_\_\_\_\_

---

SCHEDULE III – *Concluded*APPLICATION FOR LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE - *Concluded*

---

## 7. Quantity of Water Involved (litres per second, litres per day or cubic metres per year, including both quantity to be used and quality to be returned to source)

Water will be withdrawn from various lakes and the Mackenzie River with a maximum withdrawal of 1000 m<sup>3</sup>/day from different sources (Mackenzie River and lakes) during access and wellsite construction, and likely from either lake #42 and/or #34 for drilling (please refer to the map in the map pocket of the attached project description for an identification of lakes). Petro-Canada has completed volumetric calculations for each of the lakes identified for potential withdrawal and numbered each for reference (please refer to Table 5, Section 4.2.5 of the attached project description for volumetric information).

Lake volume sampling was completed by sectioning the lake based on area (one sample for every 10 to 20 ha, based on lake size), and then sampling by section. Smaller lakes were sampled at a frequency of 1 sample per 10 ha, with a minimum of 3 samples per lake. The sampling frequency on larger lakes was reduced to 1 sample per 20 ha.

Petro-Canada has engaged in early discussions with DFO regarding source lake volumes. Water intake hoses will be fitted with screens of such size to prevent impingement or entrainment of fish.

## 8. Waste Deposited (quantity, quality, treatment and disposal)

Drilling wastes will be disposed in a sump. For a complete description of sump location, construction, testing and monitoring please refer to Section 4.2.6 of the attached project description.

Wastewater from the rig camp will be treated using a treatment system to achieve water licence criteria for land. As a contingency, a camp sump will be dug to contain the waste and backfilled at the completion of operations. If wastewater is not meeting criteria, chlorination will be used for treatment and subsequent dechlorination of the treated wastewater will be conducted before disposing to land.

## 9. Other Persons or Properties Affected By This Undertaking (give name, mailing address and location; attach list if necessary)

N/A

## 10. Predicted Environmental Impacts of Undertaking and Proposed Mitigation

Please refer to *Section 12.0 Proposed Mitigation and Anticipated Environmental Impacts* of the attached project description.

## 11. Contractor and Sub-Contractors (names, addresses and functions)

Drilling Contractor:

Akita Equetak

Inuvik, NT

Environmental Consultant:

Inuvialuit Environmental & Geotechnical Inc.

Inuvik, NT

Other subcontractors are yet to be determined.

**12. Studies Undertaken to Date (attach list if necessary)**

Previous environmental assessments prepared by IEG (formerly Inuvialuit Environmental Inc.) for projects within the vicinity of the proposed program include the Petro-Canada Nuna 2001/2002 3D Seismic Program and the Conoco Parsons Lake Winter 2001/2002 3D Seismic Program. Sixth Lake (identified as Lake #34 on the map in the map pocket of the attached project description) was assessed in the fall of 2001 (Aquatics Environmental Services. Draft. 2002. Aquatic Lakes Assessment of Langley Lake, Riverbend Lake, and Sixth Lake. Prepared for Petro-Canada.)

In the Mackenzie Delta region, Petro Canada has contributed to caribou and grizzly bear collaring studies conducted by Resources, Wildlife and Economic Development, as well as the following projects:

IEG. 2002. Vegetation Classification and Wildlife Habitat Suitability Modeling in the Mackenzie Delta Region. Prepared for the Operators and the Wildlife Management Advisory Council in the Mackenzie Delta Region, NWT. 66 pp. + appendices.

IEG. 2002. Heritage Resource Survey – Mackenzie Delta: Summary Report. Prepared for the Operators in the Mackenzie Delta Region.

Petro Canada is also currently participating in the Environmental Studies Research Fund Technical Advisory Group, examining current best practices for sump construction.

**13. Proposed Time Schedule**

Project Activity	Estimated Time Frame
Planning	Ongoing
Ice Access and Lease Construction	October – December 2002
Mobilization to First Drilling Location	December 2002
Camp Set-up	December 2002
Well Drilling	January – February 2003
Move to Second Drilling Location (pending results of first drill)	February 2003
Well Drilling	February – April 2003
Final Cleanup	Dependant upon whether one or two wells are drilled, and ice conditions. Well #1 – March 2003 Well #2 – April 2003

Time lines given in the above table are approximate and subject to change depending upon variables such as weather or ice thickness.

Start date October 2002 Completion date September 2007

NAME

TITLE

SIGNATURE

DATE

FOR OFFICE USE ONLY

APPLICATION FEE

Amount: \$ 30.00

Receipt No.: \_\_\_\_\_

WATER USE DEPOSIT

Amount: \$ \_\_\_\_\_

Receipt No.: \_\_\_\_\_

# INUVIALUIT LAND ADMINISTRATION APPLICATION FORM

All rights applied for are subject to the IFA, ILA Rules and Procedures and the laws of General Application.

## LOCATION NAME/LOCAL NAME

Coordinates 69° 05' to 69° 09' N 133° 17' to 134° 20' W

UTM N E

If a heading does not apply to your application, please indicate N/A. If insufficient space, please attach a separate sheet(s).

**1. Name and mailing address of Head Office of Applicant:**

Petro-Canada  
150 - 6<sup>th</sup> Avenue SW  
Calgary, AB T2P 3E3

**Responsible officer or manager of Applicant:**

John Kerkhoven, Supervisor, Surface Land

**Telephone and Fax:**

Phone (403) 296-6345

Fax (403) 296-3032

2. **Type of Right(s) applied for: (Note: If a Right-of-Way forms part of the general activity applied for, make a separate application for the Right-of-Way.)**

## Land Use Permit

**3. Type of Operation(s) to be carried out:**

Petro-Canada is proposing to drill one or two new exploratory wells, selected from three potential locations within the Nuna area, during the winter of 2002/2003. The potential wellsite locations are within EL 406, and depending on the final sites selected, the wells may be drilled on Crown and/or Inuvialuit 7(1)(b) land. The wellsite locations will be finalized in October when interpretation of last year's Nuna 3D seismic data is complete.

<i>Preliminary Wellsite Locations</i>	<i>Location</i>
Nuna 1	Lat/Long: 69°09.57'N – 133°20.91'W
Nuna 2	Lat/Long: 69°05.28'N – 133°20.42' W
Nuna 3	Lat/Long: 69°07.33' N – 133°17.71' W

The access to the wellsites will begin at Swimming Point (logistics base), utilize the access east of the Mackenzie River, and then follow a direct route to the wellsite that will be constructed over large lakes, with limited overland sections. Akita-Equtak will be the drilling contractor and Akita-Equtak Rig #60 and/or Rig #63 will be used for drilling operations on the program. The program will begin with ice access and lease construction in October and the wells will be drilled between January to April.

**4. Planned duration of activities:**

Project Activity	Estimated Time Frame
Planning	Ongoing
Ice Access and Lease Construction	October – December 2002
Mobilization to First Drilling Location	December 2002
Camp Set-up	December 2002
Well Drilling	January – February 2003
Move to Second Drilling Location (pending results of first drill)	February 2003
Well Drilling	February – April 2003
Final Cleanup	Dependant upon whether one or two wells are drilled, and ice conditions. Well #1 – March 2003 Well #2 – April 2003

**5. Total Number of Personnel / Manpower requirements:**

Approximately 45 personnel will be required for the program during both the construction and drilling phases. This will consist of five (5) Petro-Canada and contractor supervisors, and up to 40 operators.

**6. Total Number of Inuvialuit employed:**

To be determined.

**7. Names, addresses and functions of Inuvialuit contractors and sub-contractors:**

Drilling Contractor:  
Akita Equetak  
Inuvik, NT

Environmental Consultant:  
Inuvialuit Environmental & Geotechnical Inc.  
Inuvik, NT

Other subcontractors are yet to be determined.

**8. Names, addresses and functions of non-Inuvialuit contractors and sub-contractors:**

**9. Attach a concluded or proposed Participation Agreement or Access Agreement.**

Please see attached.

**10. Planned surface requirements for land use / occupancy in hectares (ha):**

To be determined when the final well site location is selected.

**Attach a 1:50,000 NTS map showing the location and a preliminary plan showing area, measurements and location of all buildings, work areas, etc.**

Please refer to the maps and figures in the attached project description.

**11. Planned length of Right-of Way in kilometers (km):**

ROUTE	DISTANCE (km)			AREA (ha) based on route widths of 50 m on water and 20 m on land		
	Land	Water	Total	Land	Water	Total
North Nuna Route	10.0	35.2	45.7	20.0	176.0	196.0

**12. Waste and/or drilling fluid disposal arrangement (fuel fired forced air incinerator or specify other method):**

Drilling wastes will be disposed in an on-site sump. Please refer to Section 4.2.6 of the attached project description.

**Garbage:**

The rig camp will be equipped with an incinerator. Solid refuse will be incinerated daily to prevent the attraction of nuisance animals. Camp waste ash will be transported to Inuvik for proper disposal at the landfill site.

**Sewage (Sanitary & Grey Water):**

Wastewater from the rig camp will be treated using a treatment system to achieve water licence criteria for land. As a contingency, a camp sump will be dug to contain the waste and backfilled at the completion of operations. If wastewater is not meeting criteria, chlorination will be used for treatment and subsequent dechlorination of the treated wastewater will be conducted before disposing to land.

**13. Equipment, vehicles, and facilities to be used (type, number, size, purpose, weight, etc.):**

Construction		Equipment to be Staged	
1	Hovercraft	2	Bombardier Snow Cats
4	Snow machines	2	Delta Three's
2	Bombardier snow cats	1	D6M Crawler
2	Crawler tractors (D7R, D6M)	2	Water Trucks
2	Delta Three's	1	1000 US gallon enviro-fuel tank
4	Plow/auger trucks	2	Light towers
2	Plow trucks	1	1000 gal water tank
2	Motor Graders		
2	Loaders c/w accessories such as blade, bucket, snow blower		
6	Water trucks		
1	Excavator		

**14. Fuels to be used (type, number of containers, capacity, etc.):*****Diesel:***

**Rig Site**  
4 diesel tanks 63595 litres (16800 gallons)

**Construction**  
1 Enviro-Tank 3785 litres (1000 gallons)

***Gasoline:******Aviation Fuel:******Propane:*****15. Method of emptying and filling fuel containers:**

Liquid fuels and oils will be stored in a closed system during transportation. All fuel storage will have secondary containment with the volume of containment being 110% greater than the capacity of the largest fuel container. Any mobile equipment will be refueled and serviced a minimum of 100 m away from waterbodies, where feasible. Maintenance procedures and vehicle refueling will be carried out in a manner so as to prevent the entry of any deleterious substance into waterbodies.

**16. Please attach FUEL/OIL SPILL CONTINGENCY PLAN.**

Please see attached.

**17. Radio Equipment to be utilized with identification #:**

To be determined.

**18. Emergency First Aid Facilities:**

Medic will be on site.

**19. Potable Water Requirements:**

Water will likely be withdrawn from either lake #42 and/or #34 for drilling and camp purposes (please see the map pocket for lake identification). A maximum of 1000 m<sup>3</sup>/day will be used for the program.

**20. Attach a detailed project description expanding on the information given above and including any additional relevant information.**

Please refer to the attached project description for a detailed description and assessment of the proposed activities.

**21 Where the applicant applies for a Right pursuant to Subsection 7(18) of the Agreement, attach copy of the right or interest granted by Canada on the basis of which this application is being made.**

**22. Fee calculations (based on ha and/or km as per current ILA Fee Schedules(s):**

A cheque from Petro Canada will be mailed within 30 days of receipt of an invoice from the ILA

\_\_\_\_\_  
Name of Representative and Title

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Signature of Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Land Administrator

\_\_\_\_\_  
Date

\_\_\_\_\_  
Location

Issuing ILA Office: Inuvialuit Land Administration  
P.O. Box 290  
Tuktoyaktuk, NT  
X0E 1C0  
Telephone: (867) 977-2202 or (867) 977-2466  
Fax: (867) 977-2467

## Office use only

Application fee	Land use fee	General receipt no.	Date	Class	Permit no.
-----------------	--------------	---------------------	------	-------	------------

To be completed by all applicants

☒ New Application ☐ Amendment

## 1. Applicant's name and mailing address (full name, no initials)

Petro-Canada  
150 – 6<sup>th</sup> Avenue S.W.  
Calgary, Alberta T2P 3E3  
John Kerkhoven, Supervisor Surface Land

Telephone no. 403.296.6345  
Fax no. 403.296.3032

## 2. Head office address

As above

Telephone no.  
Fax no.

## 3. Field Supervisor

Radio telephone.

Telephone no.

## 4. Other personnel (Subcontractor, contractors, company staff, etc.)

Don Thompson  
Logistics Superintendent, Drilling  
Phone: (403) 296-6799

## 5. Qualifications

Refer to Section 21 – Territorial Land Use Regulations.

A (i) ☐ a(ii) ☒ a(iii) ☐ b ☐ c ☐

## 6. (a) Summary of operation (Describe purpose, nature and location of all activities – refer to Section 22 (2) (b) – Territorial Land Use Regulations. (Use last page of form if additional room is required).

Petro-Canada is proposing to drill one or two new exploratory wells, selected from three potential locations within the Nuna area, during the winter of 2002/2003. The potential wellsite locations are within EL 406, and depending on the final sites selected, the wells may be drilled on Crown and/or Inuvialuit 7(1)(b) land. The wellsite locations will be finalized in October when interpretation of last year's Nuna 3D seismic data is complete.

Preliminary Wellsite Locations	Location
Nuna 1	Lat/Long: 69°09.57'N – 133°20.91'W
Nuna 2	Lat/Long: 69°05.28'N – 133°20.42' W
Nuna 3	Lat/Long: 69°07.33' N – 133°17.71' W

The access to the wellsites will begin at Swimming Point (logistics base), utilize the access east of the Mackenzie River, and then follow a direct route to the wellsite that will be constructed over large lakes, with limited overland sections. Akita-Equtak will be the drilling contractor and Akita-Equtak Rig #60 and/or Rig #63 will be used for drilling operations on the program. Begin ice access and lease construction in October. Drill Well 1 January-February, Well 2 February to April.

## (b) Please indicate if a camp is to be set up (Use last page to provide details)

Petro-Canada will utilize the 60-80 person Arctic class Akita camp that is paired with Akita-Equtak rigs (both Rig #60 and Rig #63) (please refer to Drawing 1 of the attached project description). The logistics and construction activities base for the drilling operation is located at Swimming Point and utilizes the existing camp facilities.

## 7. Summary of potential environmental and resource impacts (Describe the effects of the proposed program on land, water, flora &amp; fauna and related socio-economic areas. (Use separate pages if necessary).

Please refer to Section 12.0 of the attached project description.

## 8. Proposed restoration plans (please use last page if required).

Please refer to Section 4.2.6 of the attached project description for an explanation of drilling sump construction, restoration and monitoring. Also please refer to Section 14.0, Clean-up, Reclamation, Disposal and/or Decommissioning Plan in the attached project description for additional information.

- 9 Other rights, licences or permits related to this permit application (mineral claims, timber permits, water licences, etc.)  
Application has been made to the NWT Water Board for a Type B Water Licence. An Authorization to Drill a Well from the National Energy Board will be applied for 21 days prior to well-spud.

Roads: ☐ Is this to be a pioneered road? ☒ Has the route been laid out or ground truthed? ☐ Has funding been applied for (i.e. RTAP)?

The program will use winter access routes only. Please refer to Section 4.2.1 and 4.2.2 of the attached project description for additional information on access location and construction.

10. Proposed disposal methods

*Drilling Waste Disposal*

Drilling wastes will be disposed in an on-site sump. Please refer to Section 4.2.6 of the attached project description.

*Solid Waste Management*

The rig camp will be equipped with an incinerator. Solid refuse will be incinerated daily to prevent the attraction of nuisance animals. Camp waste ash will be transported to Inuvik for proper disposal at the landfill site.

*Wastewater Treatment*

Wastewater from the rig camp will be treated using a treatment system to achieve water licence criteria for land. As a contingency, a camp sump will be dug to contain the waste and backfilled at the completion of operations. If wastewater is not meeting criteria, chlorination will be used for treatment and subsequent dechlorination of the treated wastewater will be conducted before disposing to land.

11. Equipment (includes drills, pumps, etc.) (Please use last page if required)

**Construction**

1	Hovercraft
4	Snow machines
2	Bombardier snow cats
2	Crawler tractors (D7R, D6M)
2	Delta Three's
4	Plow/auger trucks
2	Plow trucks
2	Motor Graders
2	Loaders c/w accessories such as blade, bucket, snow blower
6	Water trucks
1	Excavator

**Equipment to be Staged**

2	Bombardier Snow Cats
2	Delta Three's
1	D6M Crawler
2	Water Trucks
1	1000 US gallon enviro-fuel tank
2	Light towers
1	1000 gal water tank

12. Fuels - Combustibles	(✓)	Number of Containers	Capacity of Containers
• Diesel (All fuel will be stored at the Swimming Point tank farm)	✓	<b>Rig Site</b> 4 diesel tanks	63595 litres (16800 gallons)
		<b>Construction</b> 1 Enviro-Tank	3785 litres (1000 gallons)
• Gasoline			
• Aviation Fuel			
• Propane			
• Other			

13. Containment fuel spill contingency plans (Please attach separate contingency plan if necessary)  
Please see the attached plan.

14. Methods of fuel transfer (To other tanks, vehicles, etc.)

Specific individuals will be tasked with re-fuelling during the construction and drilling operations in order to minimize access to fuel and prevent spills. All vehicles will require a drip pan when being fuelled and when stationary.

15. Period of operation (includes time to cover all phases of project work applied for, including restoration)

Project Activity	Estimated Time Frame
Planning	Ongoing
Ice Access and Lease Construction	October – December 2002
Mobilization to First Drilling Location	December 2002
Camp Set-up	December 2002
Well Drilling	January – February 2003
Move to Second Drilling Location (pending results of first drill)	February 2003
Well Drilling	February – April 2003
Final Cleanup	Dependant upon whether one or two wells are drilled, and ice conditions. Well #1 – March 2003 Well #2 – April 2003

• Time lines given in the above table are approximate and subject to change depending upon variables such as weather or ice thickness.

16. Period of permit (up to two years, with maximum of one year extension)

2 years

Start date	Completion date
October 1, 2002	September 30, 2004

17. Location of activities by map co-ordinates (attached maps and sketches)

MN Lat Deg	Min Lat Min	Max Lat Deg	Max Lat Min
69°	5'	69°	10'
MN Long Deg	MN Long Min	Max Long Deg	Max Long Min
133°	17'	134°	20'

18. Applicant

Print name in full

Signature

Date

19. Fees

☒ Class A \$150.00

☐ Class B \$150.00

Land use fees:

\*Hectare @ \$50.00

Total Application and Land Use Fees

\* Land use fees will be calculated based on the actual site locations selected and the fees will be forwarded under separate cover at that time.

## **APPENDIX D**

### **DESCRIPTION OF VEGETATION LAND COVER CLASSIFICATION AND WILDLIFE DENSITY MODELS**

### Description of Vegetation Classes Identified in the Mackenzie Delta Region (IEG 2002)

GIS software and intensive vegetation sampling was used to conduct a classification of satellite imagery in the Mackenzie Delta region. Twenty distinguishable vegetation classes were identified. Details of the classification and an in-depth discussion of the spatial distribution of the classes throughout the Mackenzie Delta region are presented in the report, *Vegetation Classification and Wildlife Habitat Suitability Modeling in the Mackenzie Delta Region* (IEG 2002). The composition of each class is summarized below.

The classification resulted in several spectral classes that corresponded to rock and other highly reflective materials. Based on the spatial relationships of these spectral classes, three categories of rock were identified. 'Rock' primarily corresponds to the most highly exposed rock surfaces at high elevations in the Richardson Mountains, while 'Barren Rock' corresponds to exposed rock surfaces at lower elevations. 'Rock / Urban' often corresponds to small mineral deposits in the mountains, delta, or upland tundra regions, as well as some structures in urban areas.

'Sparse Vegetation' and 'Mountain Tundra' are commonly found in the mountains; 'Sparse Vegetation' at higher elevations and 'Mountain Tundra' at lower elevations. Occasionally, vegetation in the uplands along the eastern edge of the delta is classified as 'Mountain Tundra'.

'Graminoid' is mainly composed of grasses, but sedges are sometimes included within this class. Vegetation classified as 'Graminoid' is most heavily concentrated on Richards Island, but is also found in small patches throughout the Mackenzie Delta region. 'Tussock Tundra', mainly dominated by cotton grass, is located throughout the region outside of the delta, with high concentrations in the mountains, Richards Island, and northern Tuktoyaktuk Peninsula. In contrast to 'Tussock Tundra', 'Sedge' is found within the delta, as well as most of the surrounding areas. As the name implies, most vegetation that corresponds to the 'Sedge' class are members of the sedge genus, *Carex*.

A large patch of sparse vegetation and soil is located in an area southeast of Inuvik that burned during 1997. The spectral class corresponding to this region was labeled 'Burn / Regrowth'.

Shrub is a major component (44%) of the vegetation within the Mackenzie Delta region. Shrub, including various species of *Salix* (willow), *Alnus* (alder), *Betula* (birch), *Ledum* (Labrador Tea), *Vaccinium* (berry), *Arctostaphylos* (blackberry), *Rubus* (cloudberry), and other genera, is found among all habitat types within the study area. Three classes of shrub were distinguishable.

'Tall Willow Alder' represents shrubs > 1.5 m that are predominately *Salix* or *Alnus* species. Although found throughout the Mackenzie Delta region, 'Tall Willow Alder' is most concentrated in the delta. The understorey of this class varies from sparse herbaceous vegetation when the canopy is closed, to low shrubs when the canopy is open.

In contrast, 'Low Willow Alder', shrubs with heights between 0.25 – 1.5 m, have their highest density on the tundra, south of Husky Lakes and on the Tuktoyaktuk Peninsula. In addition to the characteristic

*Salix* and *Alnus* species of 'Low Willow Alder', a sparser cover of dwarf shrub or herbaceous vegetation may also be present

'Low Birch / Dwarf Shrub' is a community either dominated by *Betula* species <0.25 m in height or by other dwarf species < 0.25 m in height, mainly *Ledum* and the berry species, *Vaccinium*, *Arctostaphylos*, and *Rubus*. In addition to these dominant species, the 'Low Birch / Dwarf Shrub' sometimes includes a sparse cover of herbaceous plants. Found throughout the Mackenzie Delta region, 'Low Birch / Dwarf Shrub' has a thin distribution within the delta.

Although found scattered throughout most of the Mackenzie Delta region, except the Tuktoyaktuk Peninsula, 'Woodland Conifer' is most densely spread in the Peel Plain and uplands south of the Husky Lakes. Within this plant community, the dominant tree species, *Picea glauca* (white spruce), is sparsely distributed (< 25% of the total vegetation cover) with various understorey components including reindeer lichen, and low or dwarfed shrub. In some places, the stunted trees have branches with few needles.

The 'Forest Conifer' community consists of tall, open canopy *P. glauca* trees with a dense understorey of tall and low shrubs, and herbaceous flowering plants. Patches of this community are mainly located in the delta and Peel Plain.

Infrequently found within the Mackenzie Delta region, 'Forest Deciduous' is predominated by *Betula* (birch) and *Populus* (poplar and aspen). Small patches of this community are scattered in the Peel Plain, delta and upland hills.

#### **Description of Wildlife Density Models: Calculations and Assumptions**

Density calculations assumed a program footprint which includes 2 drilling locations, each with a 150 m X 150 m drill pad, a 100 m X 80 m campsite, a 70 X 30 m sump, a 30 X 30 m heli-pad, a 50 X 50 m fuel storage area, which was approximated to a 200 X 300 m area for calculations involving buffers. Also included was 45.7 km of access routes with route widths of 20 m.

#### *Arctic Fox (Individuals)*

The following assumptions were made in calculating the number of fox likely encountered within the program area ( $n_{fox}$ ).

- The density ( $d$ ) of arctic fox in the Northwest Territories ranges from 0.029 to 0.13 foxes per  $km^2$  (GNWT 2000).
- A 200 m buffer zone was included around the drill and campsite locations in calculating the program footprint ( $f$ ) and was applied maintaining the proportions of the approximated drill locations (i.e. rectangular) and outwards from both sides of the access routes.

Program footprint for arctic fox utilizing a buffer of 200 m is  $f = 14.97 km^2$ .

$$\begin{aligned}
 n_{\text{fox}} &= (d * f) \\
 &= 0.086 \text{ foxes/km}^2 * 14.97 \text{ km}^2 \\
 &= 0.386 \text{ foxes/km}^2 * 14.97 \text{ km}^2 \\
 &= 1.29 \text{ TO } 5.78 \text{ FOX}
 \end{aligned}$$

#### *Grizzly Bear (individuals)*

The following assumptions were made in calculating the probability of encountering a grizzly bear ( $P_{\text{gb}}$ ) within the program area:

- The density ( $d$ ) of grizzly bear in the Northwest Territories averages 4.25 bear per 1000  $\text{km}^2$  (Nagy et al. 1983).
- A 500 m buffer zone was included around the drill and campsite locations in calculating the program footprint ( $f$ ) and was applied maintaining the proportions of the approximated drill locations (i.e. rectangular) and outwards from both sides of the access routes.

Program footprint for grizzly bear utilizing a buffer of 500 m is  $49.60 \text{ km}^2$ .

$$\begin{aligned}
 P_{\text{gb}} &= (d * f) * 100 \\
 &= (0.00425 \text{ bears/km}^2 * 49.60 \text{ km}^2) * 100 \\
 &= 21.1\%
 \end{aligned}$$

#### *Wolf (Individuals)*

The following assumptions were made in calculating the probability of encountering a wolf ( $P_{\text{wolf}}$ ) within the program area:

- The density ( $d$ ) of wolves is 1 wolf per 944  $\text{km}^2$  (van Zyll de Jong and Carbyn 1998).
- A 200 m buffer zone was included around the drill and campsite locations in calculating the program footprint ( $f$ ) and was applied maintaining the proportions of the approximated drill locations (i.e. rectangular) and outwards from both sides of the access routes.

Program footprint for wolf utilizing a buffer of 200 m is  $14.97 \text{ km}^2$ .

$$\begin{aligned}
 P_{\text{gb}} &= (d * f) * 100 \\
 &= (1.059 \times 10^{-3} \text{ wolves/km}^2 * 14.97 \text{ km}^2) * 100 \\
 &= 1.6\%
 \end{aligned}$$