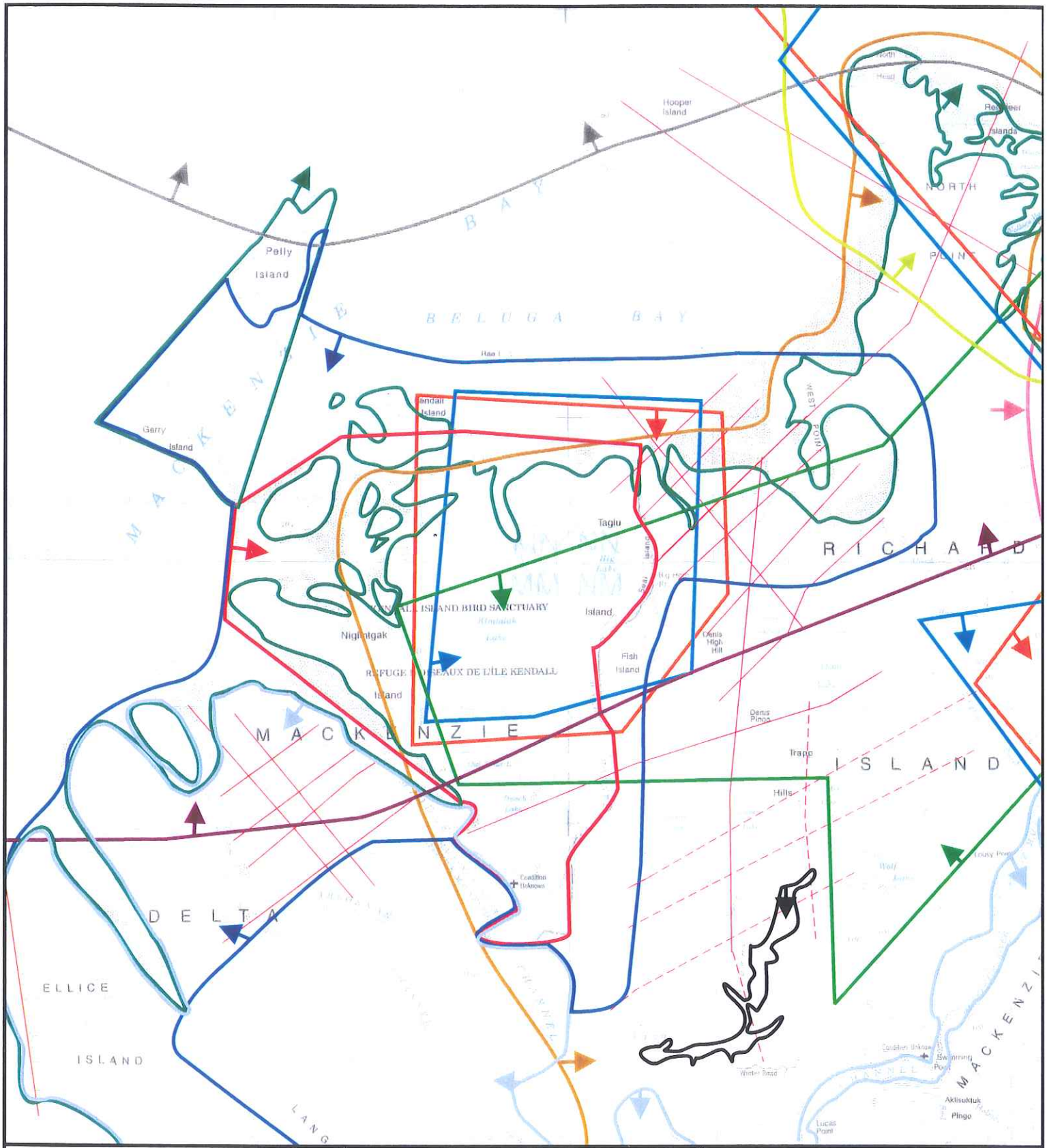

Legend

- Seismic Lines
- 307C
- 310C
- 313C
- 315C
- 316C
- 322C
- 323C
- 704D
- 706D
- 712C
- 714DE
- 715CE
- 718D

Inuvialuit Environmental Inc.

Special Management Areas Within or Near the Vicinity of the Project

Scale 1: 250,000

0 5km

September 2000

698-00

Figure 4

The habitats of many wildlife species harvested by the Inuvialuit are located within the general vicinity of the project, including site No. 307C – Summer Fish Harvesting, No. 310C – Fall Fish Harvesting, No. 313C – Winter Seal and Polar Bear Harvesting, site No. 315C – Winter Caribou Harvesting, site No. 316C – Winter Fish Harvesting, site No. 322C – Grizzly Bear Denning Areas, and site No. 323C - Mainland Coastal Polar Bear Dens. A concern of communities utilizing the project area is that industrial development may have a negative impact on sensitive wildlife habitat that local users have traditionally utilized for subsistence harvesting (IICCP 2000).

Site No. 307C – Summer Fish Harvesting, site No. 310C – Fall Fish Harvesting, and No. 316C – Winter Fish Harvesting are each located on private 7(1)(a) and 7(1)(b) lands and Crown lands within the ISR. These sites are important for subsistence harvesting in the summer, fall, and winter.

Site No. 313C – Winter Seal and Polar Bear Harvesting Area is located offshore, within Crown waters of the ISR. It is an important area for subsistence use by the surrounding communities. Site No. 315C – Bluenose-west Winter Harvesting Range is located on private 7(1)(a) and 7(1)(b) lands and Crown lands within the ISR. This site is important as the caribou herd is relied upon for harvesting by various Inuvialuit communities as well as aboriginal communities outside the ISR boundary. The community of Tuktoyaktuk is concerned that potential oil and gas activities within the ISR and neighbouring settlement areas may cause the herd to change its migration route due to a degradation of habitat (TICCP 2000). The proposed seismic program is on the western edge of the Bluenose-west caribou herd boundaries.

Bear denning areas located in both site No. 322C and No. 323C are found in the northern portion of the proposed program. Site No. 322C – Grizzly Denning Habitat is located on Crown lands within the ISR. Site No. 323C – Mainland Coastal Polar Bear Dens, is located on private 7(1)(a) lands as well as Crown lands within the ISR. Site No. 322C is an important denning area for grizzly bears from October to May. Polar bears will also den in the area identified as site No. 323C from November to April. Both of these sites include many critical areas for denning bears that can be disturbed by industrial activity (IICCP 2000). Wildlife and Environmental Monitors will be present during the entire seismic program and will alert ground crews to potential bear and bear den conflicts.

No. 704D – Fish Lakes and Rivers is located on private 7(1)(a) and 7(1)(b) lands and Crown lands and waters within the ISR. The area contains valuable fish habitat that is important to both communities of Tuktoyaktuk and Inuvik.

Site No. 706D – Kendall Island Bird Sanctuary is on Crown lands within the ISR and is legislatively protected under the *Migratory Birds Convention Act, 1994*. Although migrating birds are only present within the Kendall Island Bird Sanctuary during breeding season (May – August), the wetland habitat is sensitive year round. Shallow Bay and the islands of the outer delta are important staging grounds in the fall, for several shorebird species and for Greater White-fronted geese in the fall. The sanctuary also provides breeding habitat for lesser snow geese as well as tundra swans, white-fronted geese, sandhill cranes, brant geese, and ducks (TICCP 2000).

Site No. 712C – Beluga Management Zone 2 is located in Crown waters within the ISR and is an important site due to its role as a major beluga travel corridor into, out of and amongst the bays of the Mackenzie estuary (TICCP 2000). The beluga population will be wintering in the Bering Sea during the proposed project schedule and will not be affected by the seismic operations.

Site No. 714D - Kugmallit Bay is located on private 7(1)(a) lands and Crown lands within the ISR. This is a high concentration area for beluga whales calving, rearing calves, moulting and socializing. It is also used as a subsistence harvesting area throughout the summer months (TICCP 2000). The beluga population will be wintering in the Bering Sea during the proposed project schedule and will not be affected by the seismic operations.

Site No. 715CE (the E portion being inside the sanctuary) - Key Migratory Bird Habitat is located on private 7(1)(a) lands and Crown lands and waters within the ISR. The site is important nesting and breeding habitat for birds from May to September and subsistence harvesting of waterfowl occurs from June to September (IICCP 2000). Due to the timing of operations, migrating birds will not be affected by the proposed program.

Site No. 718D - Central Mackenzie Estuary is on both private 7(1)(a) lands and Crown lands within the ISR. This site is important for its concentration of Beluga whales, use as an overwintering and nursery area for a variety of fish, extensive use by feeding anadromous coregonids (whitefish), and function as a transition area between Shallow and Kugmallit Bays (IICCP 2000).

Since the Burlington seismic program will be conducted during the winter months, impacts to fish and wildlife populations should be minimal. Burlington has undertaken consultation with local Hunters and Trappers Committees (HTC) to ensure that individuals are aware of ongoing exploration activities in the project area. Communication with HTC's will be ongoing during the course of the program.

9.0 DEVELOPMENT TIMETABLE

The winter 2000/2001 seismic program was initiated during July 2000 beginning with the project planning phase. Burlington and their seismic contractor are proposing to commence groundwork in January 2001. Table 5 provides the proposed schedule for the winter 2000/2001 seismic program.

TABLE 5

DEVELOPMENT SCHEDULE

Project Activity	Estimated Time Frame*
Planning	August – ongoing
Pre-survey Scouting	August – September 2000
Mobilization	November 2000
Mobile Camp Set-up	December 2000 – January 2001
Survey Control	January – February 2001
Survey	January – February 2001
Recording	January – April 2001
Final Clean-up	April – May 2001

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

10.0 NEW TECHNOLOGY

10.1 Sercel 408UL

A Sercel 408UL advanced seismic telemetry data acquisition system will be utilized on this project. The acquisition system consists of geophones, cabled to link the phones to the recording device inside a recording truck or "doghouse". Technical aspects of this new equipment includes Advanced Delta Sigma Technology (ADST) that allows 24 bit extended resolution recording with the highest instantaneous dynamic range and the lowest harmonic distortion of any land seismic system. The system also allows for superior spatial sampling capability, which will accommodate unlimited active channels (geophone groups) and unlimited line (entire lines with groups of geophones) with an additional roll-along capability of 8064 channels.

Significant advances in technology enables this system to operate as a superior recording system having substantial impact on the quality of the data being recorded, while improving the environmental aspects of the project operation. Less travel is required along the seismic lines to service the equipment since power can be pushed down the line and the unit uses a simple battery management system.

Uncomplicated 4-wire cables, fewer components, a new telemetry scheme for superior cable break detection and rerouting of data, expedite and lessen the amount of trouble-shooting required, minimizing travel up and down a seismic line. The physical weight of the system on the ground is considerably lighter than other conventional systems, and therefore transport of equipment results in less ground impact along access routes or less air time when utilizing helicopters to deploy equipment.

10.2 Vehicle Guidance and Tracking System

All vehicles used during the program will be equipped with a Vehicle Guidance Tracking System (VGTS). The VGTS is a remote system that is capable of displaying the locations of all vehicles being utilized on the program at any one time. The VGTS is a navigational aid for equipment drivers and also provides a vehicle monitoring tool for camp managers. The system makes it possible to keep vehicles on course during extreme weather, and reduces the potential for lost vehicles or crew members. The central tracking device will be located in the camp office and each unit will have an individual transmitter. The central tracking device records the data of each vehicle on a daily basis, allowing management to monitor vehicle movement during the operation.

In addition, areas of concern for safety or environmental reasons can be input into the database of the tracking system, thus alerting vehicle operators of the sites during operations. The use of the VGTS will ensure that crew members stay on identified access routes and avoid sensitive areas while operating in the project area.

10.3 Dyna - Nav System

The dyna-nav system is utilized by the helicopter while laying-out lines for seismic recording. This tracking system enables the pilot to fly to a predetermined location to deploy or retrieve equipment. Where weather and daylight permits helicopter support, this system improves efficiency of daily operations while minimizing the vehicle travel required on seismic lines.

10.4 Fuel-Com Fuel System

Veritas DGC Land will be utilizing a "Fuel-Com" fuelling system on all vehicles operating within the proposed seismic program area (Plate 8). The Fuel-Com system was chosen because of the safety it provides when fuelling and/or transporting fuel. The system is built similar to a jet aircraft fuelling system, utilizing interlocking spill-proof nozzles and sealed tanks on the vehicles or other fuel carrying devices. The risk to the environment is greatly minimized or

eliminated in most situations, even in the event of a vehicle roll-over or accidental submerging in water, as the system is designed to prevent spillage. All camp trailers, seismic vehicles and other equipment subcontracted out will be required to have the system installed before arriving on site. The choice to utilize the Fuel-Com system was based on minimizing any risk of environmental damage and to this date Veritas will be the only contractor utilizing and requesting this system on all equipment.

Plate 8: Spill Proof Tank (left) and Hardened Steel Spill Proof Nozzle (right) that requires a Fuel-Com System hose assembly to accept fuel.

11.0 ENVIRONMENTAL OVERVIEW

11.1 Physiography and Bedrock Geology

The proposed project lies within the Tuktoyaktuk Coastal Plain ecoregion of the Southern Arctic ecozone. The Tuktoyaktuk Coastal Plain ecoregion covers the outer Mackenzie River delta and Tuktoyaktuk Peninsula bordering the Beaufort Sea. There are two main landscape types within the Tuktoyaktuk Coastal Plain ecoregion. One is composed of distinctive delta landforms at the mouth of the Mackenzie River. These include wetlands, active alluvial channels, and estuarine deposits. Characteristic wetlands, which cover 25–50% of the area, are lowland polygon fens, both the low- and high-centre varieties.

The second landscape type consists largely of broadly rolling uplands. Discontinuous morainal deposits mantle much of the area, except near the coast where fine-textured marine sediments cover the surface. Occurring less frequently are outwash aprons of crudely-sorted sand and gravel, and raised beach ridges along the shores of preglacial lakes. The resulting undulating terrain is studded with innumerable lakes and ponds (ESWG 1995).

The region is underlain by continuous permafrost with high ice content in the form of ice wedges and pingos. Sensitive terrain areas encountered within the project area include the eroded banks of the Mackenzie River and associated channels, as well as moderate to steep slopes adjacent to lakes. Permafrost slumping is often found adjacent to lakes (Plate 9).

Plate 9: Example of permafrost slumping adjacent to lake near proposed line of seismic program.

11.2 Soils

The dominant soils of the Tuktoyaktuk Coastal Plain ecoregion include Organic and Turbic Cryosols developed on level to rolling organic, morainal, alluvial, fluvioglacial, and marine deposits (ESWG 1995). A continuous layer of permafrost underlies these soils. The organic soils found on the eskers of this ecozone are generally shallow, highly acidic, and nutrient-poor. The mineral soils are also poorly developed and often frozen (ESWG 1995).

11.3 Climate

The ecoregion traversed by the proposed program experiences very cold winters and cool summers. The mean annual temperature is approximately -11.5°C with a mean summer temperature of 4.5°C and a mean winter temperature of -26.5°C (ESWG 1995). Winters in this region tend to be quite long as there is a period of approximately three months during which the sun does not rise above the horizon. During this period very cold conditions prevail and may last for several weeks at a time. When temperatures reach such lows, the ability of the air to contain moisture is limited and very little precipitation falls. The mean annual precipitation ranges from 125 to 200 mm (ESWG 1995).

Snow and freshwater ice persist for six to eight months of the year. When the sun begins to rise above the horizon (late January) the increased amounts of heat dissipate the high-pressure centre and storms prevail. By June most of the snow has melted, although lake ice may persist until July. During the seismic program, temperatures should average between -8°C and –36.4°C (RWED 1999).

11.4 Permafrost

Permafrost occurs continuously throughout the project area. This layer often lies just a few centimetres below the surface and acts as a barrier that stops the downward flow of water. Consequently, even though there is little precipitation here, the soils are often waterlogged or frozen. Vegetation provides thermal protection against permafrost degradation. Vehicle and equipment traffic, and soil disturbance can degrade the permafrost (UMA 1999).

Repeated freezing and thawing of these soils creates features on the surface that include cell-like polygons (Plate 10), bulging hummocks, and bare mud boils where the soil is so active that no plants can take root. Intense frost heaving often splits apart the underlying bedrock and forces large angular "boulders" to the surface.

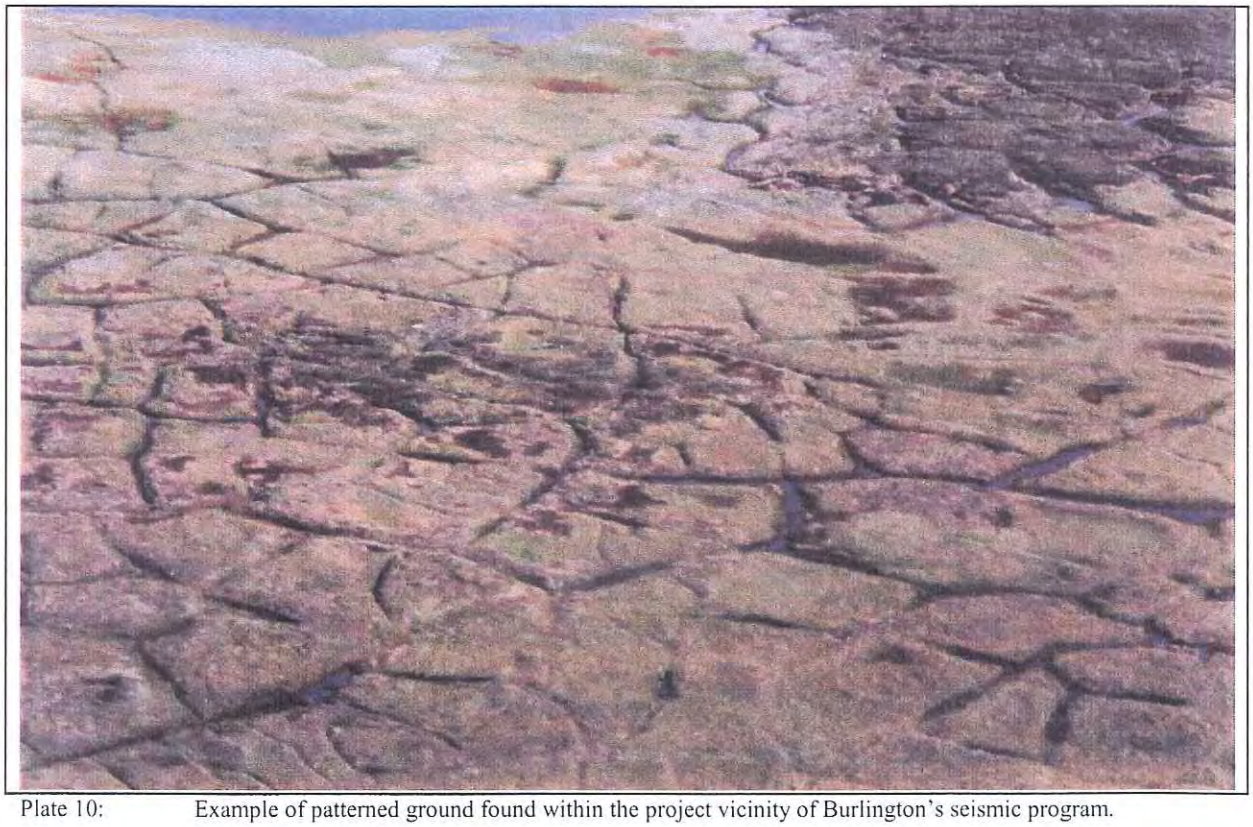

Plate 10: Example of patterned ground found within the project vicinity of Burlington's seismic program.

11.5 Vegetation

Permafrost detracts from soil productivity by chilling the soil and creating waterlogged conditions in the thawed active layer near the soil surface. Plant communities found in the vicinity of the project are relatively simple and are dominated by a few species that are well adapted to poor soil conditions and the harsh climate.

The predominant vegetation in the vicinity of the project consists of a ground cover of dwarf birch, willow, northern Labrador tea and tussocks of sedge (ESWG 1995). Poorly-drained sites usually support sedge and sphagnum moss, while tall dwarf birch, willow and alder up to 1.2 m in height may occur on warm sites (Gill 1971). Wetlands occur on 25–50% of the ecoregion and are lowland polygon fens, both the low- and high-centre varieties (ESWG 1995).

Eleven plant species of national significance are found in the Mackenzie River delta region (McJannet et al. 1995). However, due to the fact that the proposed project takes place in the winter these species will likely not be affected. Plants of national significance that may occur in the area are listed in Table 6.

TABLE 6

VEGETATIVE SPECIES OF SIGNIFICANCE FOUND IN THE VICINITY OF THE PROPOSED SEISMIC PROJECT

Common Name	Latin Name	Phytogeography	Habitat	NCR[1]
Pussytoes	*Antennaria friesiana*	Arctic-alpine	Alpine ridges and snowbeds.	N3T1
Mustard	*Braya pilosa*	Arctic	Sandy seashores.	NX
Fescue	*Festuca lenensis*	Arctic-alpine	Dry tundra.	N1
Junegrass	*Koeleria asiatica*	Arctic-alpine	Shale scree slopes and dry tundra.	N1
Pondweed	*Potamogeton subsibiricus*	Aquatic	Still waters.	N2
Goose grass	*Puccinellia poacea*	Arctic	Riverbanks, flood plains and tidal flats.	N1
Buttercup	*Ranunculus pallasii*	Arctic-alpine	Coasts and estuaries	N2
Buttercup	*Ranunculus turneri*	Arctic-alpine	Subalpine meadows.	N2
Willow	*Salix chamissonis*	Arctic-alpine	Tundra	N2
Willow	*Salix ovalifolia* var. *arctolitoralis*	Arctic	Sand beaches and terraces.	N2T2
Mustard	*Smelowski calycina* var. *media*	Arctic-alpine	Stony slopes and lakeshores.	N3T2

Notes:

1. The Nature Conservancy Ranks
   - Canada Rank (N): national status
   - Taxon Subrank (T): applied if a taxon is a subspecies or variety
   - The degree to which a species is imperiled is rated on a scale of 1 – 5 (from extremely rare to abundant), with X indicating the species is extirpated or extinct.

11.6 Wildlife

The habitats that include and surround the Mackenzie River Delta, support a wide variety of wildlife species including black and grizzly bear, polar bear, caribou, wolf, fox, snowshoe and arctic hare, beaver, muskrat, mink, ermine, arctic ground squirrel, beluga and seal. The proposed seismic exploration lies within grizzly bear denning areas and borders the winter range of the Bluenose-west caribou herd. The project area also borders Beluga Management Zone 2, however this species is not likely to be found in the project area during the time proposed since Beluga winter in the Bering Sea. Inuvialuit Environmental and Wildlife monitors will be present during the program to help manage potential wildlife conflicts as the project progresses.

Grizzly bears reside year round in the project area, although at low density. They have been designated the status of "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) due to their dwindling populations as a result of hunting and habitat degradation (COSEWIC 2000). Between the years of 1973 to 1978 approximately four bears per 1000 km^2 were observed in the Richards Island region (WMAB 1998) and the current population is estimated at 4000-5000 in the Northwest Territories (COSEWIC 2000). Most local grizzly denning occurs on south and west facing lake/channel banks between sea level and 100 m above sea level within the bear's home range. Grizzlies will enter their dens beginning in late September and will remain there until late April/early May (WMAB 1998). RWED will provide information on the potential locations of dens and the Inuvialuit Environmental Monitor will identify any grizzly bear dens found in the vicinity of the project activities.

Polar bears den from late October to late March/early April, along the shore of Kugmallit Bay and along the northern portion of Richards Island, as well as in the mainland coastal region of the Central Mackenzie Estuary. They have also been designated the status of "Special Concern" by COSEWIC due to their dwindling populations as a result of hunting (COSEWIC 2000). The Canadian population totals approximately 15,000 animals of which roughly 1,200 reside in the Beaufort Sea and on the mainland coast from Alaska to the Northwest Territories (Carpenter 1989).

The project area borders the Bluenose-west caribou herd habitat. Various Inuvialuit communities rely upon this herd for subsistence use and it is a common concern that oil and gas activities as well as an increase in tourism might have a negative impact on the herd. The proposed seismic lines are on the western fringe of the Bluenose-west boundaries. Currently the population of the Cape Bathurst/Bluenose-west herd is between 14,000 and 19,000 and can be found on the Tuktoyaktuk Peninsula and on northwestern Richards Island between September and April (TICCP 2000).

A wolf research program was undertaken by RWED in the western arctic from 1987-1993. These studies indicate that wolves may occur throughout the project area, but are more common in the Caribou Hills, southeast of the project area (Clarkson *et. al.* 1992).

Beaver, mink and ermine are found in habitat associated with the streams and lakes found in upland tundra and adjacent delta. Foxes may also occur in the vicinity of the project. Ground squirrels inhabit dry upland ridges, while lemmings and voles occupy more heavily vegetated tundra and delta habitats.

The muskrat is a semi-aquatic rodent whose habitat includes the fresh water marshes, marshy areas of lakes, and slow-moving streams of the Mackenzie River Delta. They winter in lakes between one and two metres deep ensuring that there is adequate supply of submerged aquatic plants available for forage (CWS 2000). Muskrats extend their foraging distance under ice by creating push-ups, which are hollow mounds of vegetation that rise above the surface of the ice

and are subsequently covered by snow. These are used as feeding stations and can be located up to 90 metres away from the muskrat's main burrow (CWS 2000). Muskrat harvesting occurs during the proposed timing of the seismic program.

Common bird species include the common redpoll, gray jay, common raven, red-throated loon, northern shrike, ptarmigan, and fox sparrow. Raptors include the bald eagle, gyrfalcon, peregrine falcon, and osprey. The Mackenzie Valley forms one of North America's most traveled migratory corridors for waterfowl (ducks, geese, and swans) breeding along the Arctic coast. The delta is important as a spring and fall staging area for migrating waterfowl. In spring, the largest concentrations occur along the Middle Channel during mid to late May (TICCP 2000). An area of high use for breeding by geese and other waterfowl during the spring and summer is the Kendall Island Bird Sanctuary. Migrating species are not likely to be found in the project area during the time proposed, as they move south for winter.

A number of species are found in the proposed project vicinity that are important to local subsistence harvesters as well as recreational users. Vertebrate species of concern potentially found in the project area are listed in Table 7.

11.6.1 Marine Mammals

Ringed and Bearded seal species can be found offshore within the proposed project area. Ringed seals in the delta region maintain a highly variable population, with approximately 37,000 animals (Casselman 1984). Each winter a portion of this population remains in the delta and concentrate wherever breathing holes may be maintained near shorefast ice (Casselman 1984). The Ringed seal is an important element of the arctic marine ecosystem, both as a main prey of polar bears and a major consumer of marine fish and invertebrates (TICCP 2000).

The Bearded seal is less populous than the Ringed seal and maintains a population level of approximately 2,000 (Casselman 1984). Within the delta region Bearded seals are associated with shallow waters, winter in areas with open leads and follow seasonal inshore – offshore movements of the ice edge (Casselman 1984).

Ice profiling methods will be utilized during the offshore portion of the program to evaluate the thickness of ice (related to support of the equipment) and to establish whether or not ice is bottom-fast. Hydrographic maps indicate that water depth along offshore line sets should not exceed 3 metres and therefore will likely be frozen to bottom (DFO 1991). Where it is determined that offshore ice is not frozen to bottom, dynamite will be used as the energy source. An Environmental Monitor will move ahead of the program to locate any breathing holes present in the ice, and will notify operations immediately. No explosives will be detonated within 500 m of any breathing holes located.

TABLE 7

VERTEBRATE SPECIES OF CONCERN FOUND IN THE VICINITY OF THE PROPOSED SEISMIC PROJECT

Species [1]	Latin Name	Habitat	COSEWIC [2]
MAMMALS			
Caribou[3]	*Rangifer tarandus*	Hornaday, Brock and Horton Rivers area for calving, winter habitat northeast of Inuvik.	Not listed
Grizzly bear	*Ursus arctos*	Prefers open areas of alpine tundra, subalpine mountains or subarctic tundra. Richards Island, Kugaluk River, delta.	Special Concern
Polar bear	*Ursus maritimus*	Southern broken edge of the arctic ice pack. Less use of delta region during summer and fall.	Special Concern
Wolf	*Canis lupus arctos*	Treeline-tundra transition zone. Bluenose caribou wintering range.	Indeterminate
Wolverine	*Gulo gulo*	On tundra between treeline and arctic coasts. North Slope, Cache Creek, Sheep Creek, Big Fish River, Foothills west of Aklavik. Relatively few in delta.	Special Concern
BIRDS			
Yellow billed loon[3]	*Gavia adamsii*	Arctic tundra on large lakes or in backwater areas of flooded rivers. Winter in the Gulf of Alaska.	Not listed
Red-throated loon[3]	*Gavia stellata*	Coastal and tundra ponds during summer; large lakes, bays, estuaries, and ocean during migration and winter.	Not listed
Bald eagle[3]	*Haliaeetus leucocephalus*	Lakes, rivers, marches, seacoasts. Willow River, Fish Creek, First Creek, Mackenzie delta.	Not listed
Golden eagle[3]	*Aquila chrysaetos*	Mountain forests and open grasslands; can be found in any habitat during migration. Willow River, Fish Creek, First Creek, Mackenzie delta.	Not listed
Peregrine falcon	*Falco peregrinus tundrius*	Nests on cliffs or buildings, and hunts over open tundra habitats.	Special Concern
Gyrfalcon[3]	*Falco rusticolus*	Arctic tundra and rocky cliffs near water. Nests in cliffs and occasionally trees.	Not listed
Eskimo curlew[4]	*Numenuis borealis*	Formerly bred in the tundra and woodland transition zones of the Mackenzie District. Present day habitat is unknown.	Endangered
Short-eared owl	*Asio flammeus*	The owl prefers extensive stretches of relatively open habitat. It is primarily a bird of marshland and deep grass fields. It likes to hunt and roost in abandoned pastures, fields, hay meadows, grain stubble, airports, young conifer plantations and marshes in the winter. It frequents prairies, grassy plains or tundra in the summer.	Special Concern

1. Bird species are included only if they are known to be confirmed, possible or probable breeders within a particular subregion that the proposed project impacts.

2. Committee on the Status of Endangered Wildlife in Canada 2000.

   Endangered = A species facing imminent extirpation or extinction.
   Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural events.
   Indeterminate = A species for which there is insufficient scientific data to support status designation.

3. Species are included due to their listing in Community Conservation Plans as species of interest or declining in population.
4. Species not observed for approximately 100 years. Thought to be extinct.

11.7 Hydrology and Fish

The Mackenzie River delta is a dynamic complex of lakes, islands, braided channels and oxbows. The hydrological regime is the primary factor controlling vegetation and wildlife habitat in the area. It is an estuarine delta with poorly developed levees, formed largely from sediments transported by the Mackenzie River over the last 13,000 years. The southwest sector also receives sediment from the Peel and Rat rivers. The major channels appear largely unchanged in the last century. The present delta is flat and dotted with numerous lakes, ponds and river channels, but also contains land varying from stable forested areas to tidal flats (MRBC 1981).

Ice covers the waters of the delta for approximately eight months of the year and can be up to 2.5 m thick in the main stem of the Mackenzie River. Ice break-up usually begins in April, and ice movement occurs before peak spring water levels. Water levels fall during late summer and into fall. The basic hydrology of the delta is a complex interaction of aggrading and degrading forces, with spring break-up the major hydrological event each year (MRBC 1981).

A large number of fish species occur within the freshwater and marine environments of the project area. Fish species of concern are listed in Table 8 along with their spawning habitats and spawning times.

11.7.1 Fisheries Assessment

A fisheries assessment was conducted to determine whether potential issues of concern related to fish and fish habitat, existed within the proposed Burlington project vicinity, and to provide Burlington with information that would enable the program operation while avoiding negative impacts to fish populations and habitat. Upon review of the available aquatic resource data, the fisheries assessment includes recommendations for environmental mitigation and an environmental monitoring program, if warranted. These procedures are designed to avoid harmful alteration, disruption or destruction (HADD) of productive fish habitat, and take into account seismic exploration guidelines developed by DFO. The fisheries assessment is found in Appendix A.

TABLE 8

FISH SPECIES FOUND IN THE VICINITY OF THE PROPOSED SEISMIC PROJECT

Species [1]	Latin Name	Habitat	Spawning Period	COSEWIC [2]
FRESHWATER				
Burbot	*Lota lota*	Mouths of creeks. Winter and spring may be abundant in fresh or brackish waters of Kugmallit Bay's coastal embayment.	January – March	Not listed
Arctic char	*Salvelinus alpinus*	Fish Hole, Rat River, Big Fish River, Fish Creek, Babbage River, Peel River, Shingle Point, occasionally travel the Mackenzie near Inuvik.	August, early September	Not listed
Flathad chub	*Platygobio gracilis*	Shallow sandy bars in smaller tributary streams, survives well in turbid water.	Summer	Not listed
Lake chub	*Couesius plumbeus*	Most of Canada west of Hudson Bay. Cool streams, lakes, ponds. Moves into deeper water during the summer.	Late March – early May	Not listed
Arctic cisco	*Coregonus autumnalis*	Mackenzie River and estuary, tributaries to the Mackenzie (spawning habitat - inland lakes).	Fall	Not listed
Least cisco	*Coregonus sardinella*	Mackenzie River and estuary, tributaries to the Mackenzie (spawning habitat), inland lakes. Inner Shallow Bay / Niakunak Bay and Kugmallit Bay are important overwintering and nursery areas.	Early October	Not listed
Finescale dace	*Chrosomus neogaeus*	Bog ponds, streams, and lakes. Mackenzie River drainage.	April to June	Not listed
Longnose dace	*Rhinichthys cataractae*	Prefers small streams, generally in riffles of gravel and boulders. Often found in turbulent waters. Also the wave lashed shores of very large lakes and often found in trout streams.	April and May	Not listed
Inconnu	*Stenodus leucichthys*	Mackenzie River and estuary (rearing habitat). Turbid lakes on Richard Island throughout summer, Mallik and Mason Bays.	Late September – early October	Not listed
Arctic grayling	*Thymallus arcticus*	Kugalak River, coastal rivers of North Slope. Occasionally Richards Island.	Spring	Not listed
Lake trout	*Salvelinus namaycush*	Outer delta lakes (including minor channels) with high oxygen levels, a good connection to adjacent water bodies, small to moderate volumes available and poor to moderate water quality.	Fall	Not listed
Northern pike	*Esox lucius*	Tributaries, creeks and shallow lakes in Mackenzie delta.	Early spring	Not listed
Deepwater sculpin	*Myoxocephalus thompsoni*	Habitat preferences are not known. Spawning areas are not known.	May and June	Threatened

TABLE 8 Cont'd

Species [1]	Latin Name	Habitat	Spawning Period	COSEWIC [2]
Slimy sculpin	*Cottus cognatus*	Coldwater streams. Stream bottom.	Late April and May	Not listed
Spoonhead sculpin	*Cottus ricei*	Turbid rivers or deep areas of lakes.	Fall	Not listed
Pond smelt	*Hypomesus olidus*	Arctic and Pacific drainages from Rae River (Coronation Gulf) and Great Bear Lake in Northwest Territories, Canada to Copper River in Alaska Seines of Shallow Bay near mouth of west channel.	Late spring – early summer.	Not listed
Rainbow smelt	*Osmerus mordax*	Found only along mainland coast from Bathurst Inlet westward.	Spring	Not listed
Ninespine stickleback	*Pungitius pungitius*	Shallow vegetated areas of lakes, ponds, and pools of sluggish streams. Sometimes in open water over sand. Seining locations Shallow Bay, Kendall Island, Swan Channel and East Channel.	Spring	Not listed
Longnose sucker	*Catostomus catostomus*	Arctic mainland in lakes and occasionally in the brackish water of estuaries.	Spring	Not listed
White sucker	*Catostomus commersoni*	Lakes, small rivers and streams.	Late April to June	Not listed
Trout-perch	*Percopsis omiscomaycus*	Stream habitats with high water quality, deep pools and bottoms consisting of sand and gravel. Lake populations avoid mud-filled bays.	May through August	Not listed
Walleye	*Stizostedion vitreum*	Intermediate to large cool lakes, rivers, and streams. Prefers large shallow lakes with high turbidity.	April to late June	Not listed
Broad whitefish	*Coregonus nasus*	Several overwintering areas in East Channel and Whitefish Bay. Tuktoyaktuk Harbour, Mason Bay, Mallik Bay, Shallow Bay, streams of Tuktoyaktuk Peninsula, spawning throughout the Mackenzie system.	October, November	Not listed
Round whitefish	*Prosopium cylindraceum*	Inhabits shallow areas of lakes and clear streams, rarely entering brackish water. Most often found in clear fast flowing water. Outer Mackenzie delta.		Not listed
SALTWATER				
Capelin	*Mallotus villosus*	Cold deep waters.	June / July	Not listed
Arctic char	*Salvelinus alpinus*	Fish Hole, Rat River, Big Fish River, Fish Creek, Babbage River, Peel River, Shingle Point, occasionally travel the Mackenzie near Inuvik.	Fall	Not listed
Arctic cod	*Boreogadus saida*	Within Mackenzie estuary.		Not listed
Greenland cod	*Gadus ogac*	Cold temperatures usually inshore regions. Arctic coast of Canada.		Not listed
Saffron cod	*Elegiums navaga*	Saline bays and offshore.		Not listed
Tom cod	*Microgadus proximus*			Not listed
Starry flounder	*Platichthys stellatus*	West coast of Tuktoyaktuk Peninsula and Mallik Bay.	February - April	Not listed
Blue herring	*Clupea spp.*	Mackenzie River and estuary, tributaries to the Mackenzie, inland lakes.	Late June	Not listed

TABLE 8 Cont'd

Species [1]	Latin Name	Habitat	Spawning Period	COSEWIC [2]
Sand lance	*Amodytes sp.*	Shallow intertidal with sandy bottoms.	December - March	Not listed
Chum salmon	*Oncorhynchus keta*	Pacific and Arctic oceans, spawning in rivers from the Mackenzie westward.	Fall	Not listed
Pink salmon	*Oncorhynchus gorbusha*	Pacific and Arctic oceans, spawning in rivers from the Mackenzie westward.	Fall	Not listed
Fourhorn sculpin	*Myoxocephalus quadricornis*	Lakes and streams of the Arctic archipelago.	May and June	Special Concern

Notes:

1. Fish species are included only if they are known to be confirmed, possible or probable breeders within a particular subregion that the proposed project impacts.

2. Committee on the Status of Endangered Wildlife in Canada 2000.

   Threatened = A species likely to become endangered if limiting factors are not reversed.
   Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural event

11.8 Cultural and Historic Resources

Cultural and historic resources include the physical traces of culture and societies as well as the current resources utilized by local people. Heritage sites recognized by Federal agencies are also considered. These sites include archaeological sites, historic structure sites, traditional trails, campsites, berry picking areas, sacred or medicinal plant picking areas, burials, ceremonial sites, traditional hunting grounds and places associated with traditional names or legends.

The project is situated within the Mackenzie River delta, portions of which have seen previous historical resources survey efforts. A records search was completed for mapped locations of heritage resource sites on file at the Canadian Museum of Civilisation for locations of known archaeological and historical resource sites in the project area. Palaeontological finds of Quaternary age have also been recorded in the delta and are not on file with the Canadian Museum of Civilisation but are considered heritage resources (FMA 2000). There are 22 recorded site locations within the project vicinity. These recorded site locations currently on file are listed in Table 9 and are shown in Figure 5.

TABLE 9

PREVIOUSLY RECORDED HISTORICAL SITES IN THE VICINITY OF THE PROPOSED SEISMIC PROGRAM

Site	Type	Location	Association	Distance To Project (m)
NgTt5	P Campsite	Yaya lake	Kame	5000
NgTt6	P Artifact Scatter	Yaya Lake	Saddle/kames	5000
NgTt7	Cairn	Yaya lake	Hill/shore	5500
NgTt8	Isolated Find	Yaya Lake	Upland/lake shore	4500
NgTu2	Campsite	Yaya Lake	Kame/west shore	2000
NgTu3	Stone Feature	Yaya Lake	Kame/west shore	1000
NgTu4	Campsite	Yaya Lake	Kame	7000
NgTu5	Stone Feature	Yaya Lake	Kame	7000
NgTu7	Stone Feature	Yaya Lake	Kettle lake	7500
NgTu8	Stone Feature	Yaya Lake	Lake	4000
NgTu9	Stone Feature	Yaya Lake		5000
NhTt1	Artifact Scatter	Yaya Lake	Ridge/north shore	1000
NhTt2	Artifact Scatter	Yaya lake	Ridge/east shore	750
NhTt3	Artifact Scatter	Yaya Lake	Ridge/east shore	750
NhTu1	Burial	Richards Island	Shore	1000
NhTu2	Campsite	Harry Channel	West Bank	500
NiTs 10	Artifact Scatter	Richards Island	Lake Shore	7000
NiTt 1	Campsite	Richards Lake	Bluff/lake	4500
NiTt 2	Artifact Scatter	Richards Island	Lake	2500
NiTt 3	Campsite	Richards Island	Lake	7000
NiTu 1	Campsite	Big Horn Point	Pingo	750
NiTu 2	Burials	Big Horn Point	Pingo	1000

Notes: ? indicates timing or content of archaeological site is unknown

BURLINGTON RESOURCES CANADA ENERGY LIMITED

ARCHEOLOGICAL AND CULTURAL SITES WITHIN THE VICINITY OF THE PROJECT

- (2) Camp Site / Landing Strip
- Burlington Proposed Seismic - Phase I
- Burlington Proposed Seismic - Phase II
- NgTu 5 Archeological Identifier

FIGURE 5

SCALE 1:500,000

Kilometers: 10 0 10 20 30 40 50

Miles: 5 0 5 10 15 20 25 30

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12.0 PROPOSED MITIGATION AND ANTICIPATED ENVIRONMENTAL IMPACTS

Burlington's winter seismic program has been designed to minimize impacts on the environment and land users. Potential environmental impacts were identified through ongoing public consultation, a review of existing literature and maps, as well as a field reconnaissance of the project area on August 8, 2000. On this date, Brad Johnston and Ann Stewart (Burlington), Wayne Ross (Veritas) and Cynthia Py (IEI), flew over the proposed lines and sleigh camp locations. The intent of the aerial reconnaissance was to identify environmentally significant areas. During this site visit, steep slopes to be avoided by the sleigh camp were identified. The pre-survey scouting will provide additional information on sensitive areas.

Without adequate mitigation, potential environmental impacts resulting from the winter seismic program may include temporary disturbance to terrain, soils and permafrost; vegetation; wildlife; aquatic resources; and other land uses. Potential environmental impacts and mitigative measures are described in Table 10.

It is predicted that the use of proposed mitigative measures by Burlington and their seismic contractor will ensure that no significant residual impacts will occur as a result of the project. Burlington has taken measures to decrease environmental impact of the seismic program by aligning line sets to coincide with other operators conducting seismic in the vicinity of the proposed project. Sensitive terrain features such as erosion prone slopes and eroded banks will be avoided during line routing and where appropriate, shooflies and/or snow ramps will be used. Any shooflies will be clearly marked and all traffic on the lines will be confined to right-of-way. Frozen ground conditions, the use of tracked equipment, and the cushioning effect of snow, will minimize impacts to the soil profile and organic mat along seismic lines and access routes.

Line sets are located in areas of sparse vegetation, limited mainly to willow and shrub communities. Along lines, shrubs and willows will be rolled over, with the impacts related to crushing restricted to the aboveground woody material with the root systems remaining intact. Where clearing is required, care will be taken to ensure that there is no organic mat disturbance. Cleared woody vegetation will be sheared off at ground level using a cutter blade in frozen ground conditions, thereby leaving root systems intact. This ensures soil stability and promotes vegetation regeneration in the following growing season. Fluctuating water levels in the delta will also assist in natural vegetation regeneration. Woody debris will be rolled back over the right-of-way upon project completion to enhance natural revegetation. No slash or debris will be left in waterbodies.

During final program design, areas of dense vegetation cover will be avoided to the extent feasible, while considering the other environmental constraints of the area (*e.g.*, setback distance from waterbodies for fisheries protection). In addition, mechanical overland travel of personnel or transport of equipment will be restricted to seismic access routes wherever feasible. Frozen ground conditions, snow cover and tracked or low-pressure wheeled vehicles will minimize impacts to vegetation communities. Additionally, the project will be completed during the dormant season for plants.

Due to natural revegetation and the local extent of the disturbance, the potential environmental impacts to vegetation should be minimal. The pre-scouting survey conducted by Veritas will identify sensitive areas, productive waterbodies and surface features that will require mitigation and line adjustment. General seismic activities will follow Indian and Northern Affairs Canada (INAC) *Environmental Guidelines: Northern Seismic Operations.*

Impacts to wildlife will be restricted to the immediate project area and will be short in duration. Once a program area is shot, the equipment will move out of the area. The use of a mobile sleigh camp and tracked vehicles will decrease impact to terrestrial vegetation and wildlife. Maintaining a 30 m setback for vibroseis and a 50 m setback from waterbodies for dynamite will protect aquatic furbearers. Setback distances described in Table 10 and the presence of an Environmental Monitor will mitigate potential impacts to wildlife. All critical time periods for bird and mammal migrations will be avoided by program scheduling during the winter. Inuvialuit environmental and wildlife monitors will be employed to limit the potential for environmental disturbance and human/wildlife conflicts. Offshore seismic activity and activity within waterbodies will follow the guidelines set out by the Fisheries and Oceans Canada (DFO).

No effects on fish habitat are predicted to result from this project due to the mitigative measures developed for the project. Water withdrawals from the Mackenzie River and its channels will be small and intakes used for water withdrawal will be screened to avoid impingement or entrainment of fish. Activity within waterbodies will follow the guidelines set out by Fisheries and Oceans Canada (DFO).

Known cultural and archaeological sites will be identified during survey control, and avoided through the use of a vehicle tracking alarm system. Since the seismic program will be conducted under winter conditions and low-impact vehicles are being employed during the program, no impacts to these sites are predicted. A buffer of 100 m will be maintained between the reported locations of these sites and the activities associated with the seismic program. The specific details of potential impacts and mitigative measures are presented in Table 10. Mitigation techniques proposed for the program follow industry best practices.

TABLE 10

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIVE MEASURES

Environmental Concerns/ Potential Impacts		Mitigative Measures	Significance/ Duration/ Scope of Residual Impacts
1. Permafrost and Permafrost Features			
1.1 Disturbance of permafrost	.1	Dozers will be equipped with mushroom shoes to elevate blade. A minimum of 10 cm will be left on all access trails and low ground pressure vehicles (tracks) will be used to mitigate permafrost disturbance.	Insignificant. Effects would be short-term, localized and reversible.
	.2	Camp sleighs raise heated buildings above ground surface.	
	.3	Low pressure wheeled vehicles will only be used on compacted snow	
	.4	Vehicle movement will be restricted in the event of thaw or soft ground conditions.	
1.2 Pingos	.1	All pingos will be avoided by a minimum of 150 m.	
2. Terrain and Soils			
2.1 Disturbance to the soil profile (i.e. soil loss, compaction, admixing)	.1	The program will be completed under frozen ground conditions limiting soil disturbance caused by uprooting.	Insignificant. Effects would be short-term, minor and restricted to the immediate area.
	.2	Any inadvertent surface disturbance will be repaired immediately and covered with slash as appropriate.	
	.3	Access routes and trails will be limited to seismic rights-of-way and ice access routes wherever possible.	
	.4	Any soil or organic material displaced during shot hole drilling (*i.e.* cuttings) will be replaced and compacted. If a "flowing hole" is created where dynamite is used as the energy source, bentonite clay will be used to plug the shot hole.	
	.5	Tracked and low-pressure tire vehicles will be used to minimize surface disturbance.	
	.6	Equipment turnarounds will be restricted to designated locations. Turnarounds on ice roads or waterbodies will be utilized as often as possible.	
	.7	Equipment pulling the sleigh camp will be adequately powered to prevent tracks from spinning and rutting soils. Multiple cats or a winch system may be employed.	
	.8	Airstrips will be cleared on waterbodies or existing seismic rights-of-way wherever possible.	
2.2 Disturbance to erosion prone banks and slopes.	.1	Snow ramps will be constructed on riverbank slopes to prevent equipment damage and erosion.	Insignificant. Effects would be short term and localized.
	.2	Sensitive areas will be avoided by using shooflies.	
	.3	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.	
	.4	Camp trains will be winched up erosion prone slopes to prevent soil disturbance by pulling equipment.	
2.3 Disturbance to drainage	.1	Snow bridges or ice roads will be constructed across drainage or waterbodies. Only clean snow and/or ice will be used for drainage crossings.	Residual impacts would be insignificant, short term and localized.

TABLE 10 Cont'd

Environmental Concerns/ Potential Impacts	Mitigative Measures	Significance/ Duration/ Scope of Residual Impacts
	.2 Drainages will be left free of debris.	
	.3 Any clearings will be re-contoured to restore natural cross drainages.	
	.4 Surface drainage ditches will be reclaimed to original condition. V-notching of snow bridges will be performed upon completion.	
3. Vegetation		
3.1 Loss of vegetation communities	.1 Vegetation will be rolled over on seismic lines and emergency airstrips rather than cleared to accommodate natural revegetation.	Insignificant. Residual impacts are insignificant, short term and localized
	.2 Right-of-way widths will be restricted to 8 m.	
	.3 Disturbed areas will be stabilized and slash rolled back to promote natural revegetation.	
3.2 Potential disturbance to rare, sensitive or unique plant species or vegetation communities	.1 Drilling operations will occur in winter, coinciding with the dormant period for herbaceous plants.	
	.2 Natural re-vegetation of rights-of-way will be promoted.	
4. Wildlife		
4.1 Disturbance to wildlife	.1 Regular (daily) garbage patrols will be conducted to remove materials (i.e. metals, plastics, chemicals) that may be potentially harmful to wildlife.	Insignificant. Effects would be short term, minor and localized.
	.2 All activity will be restricted to access routes, camp locations and seismic rights-of-way.	
	.3 Inuvialuit Environmental and Wildlife monitors will be employed to assess potential wildlife conflicts in the area of operations.	
	.4 Aircraft will maintain a ceiling of 500 m in areas of wildlife concentration (*ie.* caribou herd) and 3000 m in goose staging areas where feasible.	
4.2 Disturbance of wildlife migration	.1 Seismic operations will be completed prior to the arrival of the majority of migratory bird species and prior to mating or calving of resident species.	Insignificant. Effects would be short term, minor and localized.
	.2 Work within the Kendall Island Bird Sanctuary will be completed prior to critical bird migration (May 1 to September 30).	
	.3 Project drilling will be completed prior to breakup (August) when beluga whales migrate into Beluga Bay.	
4.3 Attraction of nuisance animals	.1 Kitchen wastes will be disposed of at approved facilities.	Insignificant. Effects will be short term, minor and restricted to the immediate area.
	.2 Camp wastes will be incinerated daily using a suitable container.	
	.3 Wildlife will not be harassed or fed.	
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. Local RWED biologists and officers will be notified if a bear is encountered.	
	.2 Vegetation supporting stick nests will not be cut down or rolled over where feasible.	

TABLE 10 Cont'd

Environmental Concerns/ Potential Impacts		Mitigative Measures	Significance/ Duration/ Scope of Residual Impacts
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.	Insignificant. Properly designed access to project area will reduce any potential residual impacts.
	.2	Shooflies will be utilized to avoid any steep slope where activity may increase the erosion potential.	
	.3	Tracked units and low pressure tires will be used to reduce the possibility of surface disturbance.	
	.4	Clean ice bridges will be constructed if ice thickness tests reveal ice cannot support equipment load.	
	.5	If surface is disturbed in an area such as channels or lakes where drainage or erosion is a possibility, control measures may include using earth breaks or cross ditches. Slash may also be used as rollback for erosion control.	
	.6	Channel crossings will be made at a level location as often as possible. Crossings will be scouted in advance and will be constructed at 90 degree angles.	
5.2 Damage to Fish or Fish Habitat	.1	Waste materials or debris will not be disposed of in waterbodies.	
	.2	No materials will be stored on any ice surface of a waterbody or within 30 m of such a waterbody.	
	.3	Water intake from waterbodies will utilize screens on intake hoses to prevent damage to stream or lake bottoms and to prevent the entrainment of fish.	
	.4	Water will be collected at permitted sites. Water sources and fisheries will not be affected by drawdown as the Mackenzie River and its channels, or lakes previously identified will act as water sources.	
	.5	Dynamite shot holes on land will not be initiated within 50 m of any waterbody not frozen to bottom	
	.6	Charges will be set to a minimum depth below lakebed as recommended by DFO (Wright and Hopky 1998).	
	.7	Drill cuttings will be disposed of in drill holes or a minimum of 30 m away from waterbodies.	
5.3 Damage to Marine Animals or Habitat	.1	No explosives will be knowingly detonated within 500 m of any marine mammal	Effects will be minor and localized.
	.2	An Inuvialuit Environmental Monitor will locate any breathing holes present in ice and notify operations immediately.	
	.3	Shot holes will be cased when drilling under the seafloor in areas not frozen to bottom to bring cuttings to surface and prevent suspension and sedimentation.	
	.4	Drill cuttings will be immediately removed from ice surface and properly disposed of on land 30 m away from shore.	Insignificant, short-term and localized.
	.8	Snow ramps will be made of clean snow only.	

TABLE 10 Cont'd

Environmental Concerns/ Potential Impacts	Mitigative Measures	Significance/ Duration/ Scope of Residual Impacts
5.4 Introduction of oil, fuel or other pollutant to waterbody	.1 The sleigh camp 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.	Insignificant.
	.2 Liquid fuels and oils will be stored in a closed system during transportation.	Effects would be short to medium - term, and restricted to the project vicinity.
	.3 Storage of fuels or hazardous materials within 100 m of a waterbody will not be permitted.	
	.4 Access routes will be on ice channels and down the lines. When access routes parallel lakes or streams, the access will be more than 30 m from the waterbody to prevent deleterious material from entering the waterbody and to prevent disturbance of banks resulting in sedimentation.	Spill contingency plans will minimize potential impacts.
	.5 Drill cuttings will be removed from the ice cover of all waterbodies.	
	.6 Any deleterious material that accidentally falls into a waterbody will be removed.	
	.7 Any mobile equipment will be refueled and serviced a minimum of 100 m away from waterbodies.	
	.8 Spill proof "Fuel-Com" interlocking fueling systems will be used when re-fuelling.	
	.9 In the event of a spill, the Fuel and Oil Spill Contingency plan will be followed (Appendix C).	
	.10 Spills will immediately be reported to Burlington's Environmental, Health and Safety Coordinator, Indian and Northern Affairs Canada and the Inuvialuit Land Administration. All accidental spills will be reported to the NWT Emergency Spill Response Line (867-920-8130), and John Korec, the Environmental and Safety Officer with the National Energy Board (403-292-6614).	
	.11 Personnel will be trained in spill response procedures and equipment use.	
5.5 Snow fills/ ramps/ bridges can act as dams during break-up resulting in damage to channels and banks	.1 Snow fills/ ramps/ ice bridges will be removed by V-notching upon completion of drilling operations and prior to break-up.	Effects would be short term and localized.
6. Interference with Other Land Uses		
6.1 Possible conflict with wildlife harvesting in the area	.1 Public consultation with all local communities is underway. There will be ongoing communication to notify communities of seismic operations and timing.	Insignificant. Effects would be reversible.
6.2 Trapline operators	.1 Local trappers will be notified of seismic operations and timing through their HTC.	Insignificant. Effects would be reversible.
	.2 Coloured lath will be present along seismic routes.	
6.3 Traffic accident on winter access	.1 Ice roads will have restricted access and traffic safety will be implemented.	
6.4 Disturbance to snowmobile trails	.2 When an access route or seismic line crosses snowmobile trails utilized by community members. any debris from the seismic operation will be removed and the trail left clean and open.	

TABLE 10 Cont'd

Environmental Concerns/ Potential Impacts	Mitigative Measures	Significance/ Duration/ Scope of Residual Impacts
6.5 Loss or damage to existing cabins	.1 Burlington will discuss appropriate site-specific mitigative measures with cabin owners in the vicinity of the proposed project.	
7. Future Land Use		
	.1 The project is not anticipated to affect future land use by local and/or recreational users of the region.	
8. Archaeological, Historical or Palaeontological Sites		Insignificant. Effects would be short term, minor and restricted to the immediate area.
	.1 A 100 m buffer between camp facilities, access routes and seismic lines, and archaeologically or culturally important sites will be maintained.	
	.2 Should any archaeological or palaeontological sites be discovered during construction or operations, work will be suspended at that location until permission is granted by the appropriate Inuvialuit organizations. Notification shall be provided in writing within 2 days.	
9. Health or Environmentally Threatening Emergency		
	.1 In the event of an emergency, Burlington's Emergency Response Plan will be implemented (Appendix C).	
10. Abandonment and Restoration		
	.1 All equipment and materials will be removed from area immediately following project completion.	Proper abandonment and restoration activities will result in no significant residual impacts.
	.2 Equipment will be removed before spring break up to prevent permafrost and organic mat disturbance.	
	.3 All garbage will be incinerated or transported to a waste management facility. No waste will be left at a sleigh camp sites.	

13.0 EMERGENCY RESPONSE PLANS

In the event of an emergency, Veritas's Emergency Response Plan will be followed (Appendix C) and Indian and Northern Affairs Canada as well as the Inuvialuit Land Administration will be contacted immediately. In the event of a spill, the Fuel and Oil Spill Contingency Plan will be followed (Appendix C), and Indian and Northern Affairs Canada, the Inuvialuit Land Administration, National Energy Board and NWT Emergency Spill Response Line will be notified immediately as outlined in Table 10. Contingency plans for storm surges, permafrost degradation or fires will be in place prior to seismic operations.

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

Equipment, materials and any other debris will be removed from the project area prior to spring break-up and taken to Inuvik or Tuktoyaktuk. Any waste fluids generated and excess fuel or fuel containers (*e.g.*, drums or propane bullets, fuel tanks or sloops) will be removed from the project area and disposed of appropriately.

15.0 OTHER ENVIRONMENTAL ASSESSMENT

A previous environmental screening of a winter seismic program was conducted for Petro-Canada by Golder Associates Ltd. during the winter 1999/2000. In addition, an environmental assessment was conducted for the Ikhil Gas Development, also located in the region. Both project descriptions are on file with the Environmental Impact Screening Committee and the National Energy Board. Indian and Northern Affairs Canada was contacted regarding the availability and existence of previous environmental assessment reports in the project area. INAC indicated that there were no reports available for review. A number of assessments for proposed developments within the vicinity of the project area are currently underway. Additional studies utilized in preparation for this Project Description are listed in the References section.

16.0 COMMUNITY CONSULTATION

Early in the planning phase of the project, Burlington initiated public consultation with communities, regional organizations and government representatives interested in, or potentially affected by the proposed exploratory seismic program. Burlington's consultation program is focused on the provision of conceptual information about the proposed work and exploration schedule; early identification of environmental and socio-economic issues and concerns; and review and discussion of the technical details of the seismic program.

The consultation process includes meetings with representatives of governmental and non-governmental organizations, open community meetings with the residents of Aklavik, Tuktoyaktuk, and Inuvik, telephone discussions and the exchange of information through e-mails and facsimiles. This process allows Burlington to gather information related to the impact assessment of their proposed seismic project from various sources, and formulate mitigative measures to minimize the effects of the proposed project. It also facilitates successful negotiation of agreements such as the Comprehensive Cooperation and Benefits Agreement signed July 12, 2000 with the Inuvialuit Regional Corporation. These consultation initiatives will continue throughout the project.

On July 21, 2000, IEI, on behalf of Burlington, sent an initial project overview along with a request for comments to all pertinent territorial, federal and Inuvialuit agencies with jurisdiction in the project area. Agency representatives were requested to identify any concerns they might have and to provide any information that might influence the project. IEI followed up the contacts by telephone to discuss specific concerns and mitigative measures. A summary of the government and non-government notification process is provided in Table 11. A summary of government and non-government consultation meetings attended by representatives of Burlington is provided in Table 12.

TABLE 11

GOVERNMENT AND NON-GOVERNMENT NOTIFICATION

Name	Agency	Date	Method
GOVERNMENT			
Rudy Cockney District Manager North Mackenzie District	Indian and Northern Affairs Canada, Inuvik, NWT	July 21, 2000 July 26, 2000 July 28, 2000	Email sent Meeting in Inuvik Telephone conversation
Karen Ditz Area habitat Biologist NWT Area	Fisheries and Oceans Canada, Yellowknife, NWT	July 21, 2000 July 21, 2000 August 21, 2000 August 24, 2000	Email sent Telephone conversation Telephone conversation Meeting
John Nagy Wildlife Biologist	Resources, Wildlife and Economic Development	July 21, 2000 July 28, 2000	Email sent Telephone conversation
Anne Wilson Water Pollution Specialist, Northern Division	Environment Canada, Yellowknife, NWT	July 21, 2000 July 21, 2000 July 29, 2000	Email sent Email received Email sent
Sevn Bohnet Coordinator, Inuvialuit Region	Indian Affairs and Northern Development, Water Resources Division, Yellowknife, NWT	July 21, 2000 July 25, 2000	Email sent Telephone conversation
Hans Arends Land Administrator	Inuvialuit Land Administration, Tuktoyaktuk, NWT	July 21, 2000	Email sent
Paul Latour Habitat Biologist, Western Arctic	Canadian Wildlife Service Yellowknife, NT	July 21, 2000 July 26, 2000	Email sent Telephone conversation
NON-GOVERNMENT			
Duane Smith Chair	Inuvialuit Game Council	July 21, 2000 July 28, 2000	Email sent Message left
Frank Pokiak Chair	Tuktoyaktuk Hunters and Trappers Committee	July 21, 2000 July 28, 2000	Email sent Message left
Richard Binder Chair	Inuvik Hunters and Trappers Committee	July 21, 2000 July 28, 2000	Email sent Message left
Danny Gordon Chair	Aklavik Hunters and Trappers Committee	July 21, 2000 July 28, 2000	Email sent Telephone conversation
Patrick Gruben Chair	Tuktoyaktuk Community Corporation	July 21, 2000 July 28, 2000	Facsimile sent Message left
Donna Kisoun Chair	Inuvik Community Corporation	July 21, 2000 July 28, 2000	Facsimile sent Telephone conversation
Alex Illasiak Chair	Aklavik Community Corporation	July 21, 2000 July 29, 2000	Facsimile sent Message left
Linda Graf Secretary	Environmental Impact Screening Committee	July 21, 2000 July 21, 2000	Email sent Email received

TABLE 12

GOVERNMENT AND NON-GOVERNMENT CONSULTATION

Date	Activity	Organization
July 25, 2000	Meeting to discuss role of field inspectors and their requirements for compliance with terms and conditions of the Land Permit and Water Permit.	Rudy Cockney, District Manager, North Mackenzie District, INAC Inuvik, NWT
July 25, 2000	Introductory meeting and discussion re: employment (recruitment, training)	Otti de Kock, HR Advisor Vina Norris, Employment/Training Officer IRC, Inuvik, NWT
July 25, 2000	Meeting to discuss contracting process within the Benefits Agreement. Note: Agreement signed July 12, 2000	Wilf Blonde, CFO IRC, Inuvik, NWT
July 25, 2000	Introductory meeting to discuss Work Plan requirements.	Gerry Roy, Legal Counsel IRC, Inuvik, NWT
July 27, 2000	Joint Meeting to discuss concerns associated with activities in and around the Kendall Island Bird Sanctuary.	Anne Wilson, Water Pollution Specialist, Environmental Protection Branch and Dr. Paul Latour, Habitat Biologist, Canadian Wildlife Service Both with: Environment Canada Yellowknife, NWT
July 27, 2000	Introductory meeting and discussion regarding Water Permit application requirements/process.	Sevn Bohnet, Regional Coordinator Water Resources Division, INAC Yellowknife, NWT
July 27, 2000	Introductory meeting to discuss proposed project and potential Inuvialuit business opportunities.	Jim Guthrie, Arctic Oil and Gas John Furnell, Inuvialuit Development Corp. Inuvik, NWT
July 27, 2000	Introductory meeting: Project overview and identification of key DFO contacts.	Kelly Withers, Habitat Biologist Pete Cott, A/Senior Biologist Central and Arctic Region Fisheries and Oceans Canada Yellowknife, NWT
August 10, 2000	Introductory meeting to discuss communication between industry and IRC.	Peggy Jay, Communications Advisor IRC, Inuvik, NWT
August 10, 2000	Meeting to discuss proposed project.	Richard Nerysoo, President Gwich'in Tribal Council Inuvik, NWT
August 11, 2000	Environmental Screening Committee/Wildlife Management Advisory Council	Linda Graf, Secretary, EISC Brian Johnston, Resource Person, WMAC
August 24, 2000	Meeting to discuss potential fisheries issues.	Karen Ditz Area Habitat Biologist, NWT Area Fisheries and Oceans Canada Yellowknife, NWT

Meetings were held on August 9th through 11th, 2000 in the communities of Tuktoyaktuk, Inuvik and Aklavik to discuss issues of concern and mitigative measures to be adhered to during the project. The open community consultation meetings were advertised through radio and television announcements, a newspaper advertisement in the Inuvik Drum and community posters. The agenda for the meetings consisted of a short presentation on Burlington, its exploration plan, the proposed seismic program and the ongoing consultation process. A formal question and answer period followed the presentation, after which the residents were encouraged to talk individually with Burlington's project team regarding their specific concerns or questions. This team included a geologist, environmental staff, IEI consultants, a community affairs representative and representatives of Veritas, Burlington's seismic contractor. Project maps and information handouts were also distributed and a small display provided information and photos on the people, equipment and work associated with a seismic program.

A schedule of meetings is provided in Table 13. Table 14 summarizes the key issues and responses identified during the meetings with community organizations and residents. Copies of the notes and transcripts of the meetings are available on request.

TABLE 13

COMMUNITY CONSULTATION MEETINGS

Date	Consultation Group	Location
August 9, 2000	Hamlet of Tuktoyaktuk	Tuktoyaktuk
August 9, 2000	Tuktoyaktuk Community Corporation	Tuktoyaktuk
August 9, 2000	Tuktoyaktuk Hunters and Trappers Committee	Tuktoyaktuk
August 9, 2000	Community Open House	Tuktoyaktuk
August 10, 2000	Inuvik Community Corporation	Inuvik
August 10, 2000	Inuvialuit Regional Corporation	Inuvik
August 10, 2000	Community Open House	Inuvik
August 11, 2000	Aklavik Community Corporation and Hunters and Trappers Committee	Aklavik
August 11, 2000	Community Open House	Aklavik

TABLE 14

COMMUNITY CONSULTATION ISSUES AND RESPONSES

Issue	Response
ENVIRONMENT	
There is a concern about the location of bear dens in the vicinity of the project.	Burlington's environmental consultants will obtain information on previous locations of bear dens and Burlington's seismic contractor will hire a wildlife monitor to identify bear dens during project operations.
What plan do you have regarding an oil spill?	Veritas has a Fuel and Oil Spill Contingency Plan and an Emergency Response Plan in the event of an incident.
What kind of funding do you have available for research in the area?	Burlington supports educational research initiatives in the region, through its participation in the Environmental Studies Research Fund.
If a caribou herd is encountered, can Burlington shoot on a different line, or will they move the program temporarily?	This can be discussed further with the seismic contractor.
Can you explain the grey water disposal options being proposed?	Grey water consists of shower and kitchen water only. This water will be contained in snow berms temporarily until the camp moves on and it will then be spread out in the area. No sewage or black waste will be disposed of on the ground.
There is concern about the environment. We want to continue enjoying a traditional lifestyle, and have jobs.	Burlington is committed to minimizing impacts to the environment while conducting exploration activities within the region.
OPERATIONS	
Could the companies provide periodic updates on their programs as things progress?	These updates will be provided to the IRC and other interested parties.
What type of equipment will Veritas use?	Veritas provided photos of equipment examples.
Who will be hiring wildlife monitors?	Wildlife monitors will be hired by Burlington as directed by IRC and their Benefits Agreement.
Can you explain seismic offshore techniques *ie.* dynamite vs. vibroseis?	Explained.
How long will be here (operating in the region)?	Approximately 3 to 4 years is currently planned. Length of exploration dependant upon success of current activities.
How wide is a seismic line?	Approximately 12 feet wide or equal to 2 seismic vehicles operating beside each other.
How will you deal with emergencies?	The appropriate community agencies will be contacted in case of an emergency.
Can orientation be provided to show local people the seismic equipment and how it works?	Yes, Veritas will look into organizing this.
There were areas where brush was left in creeks last year.	Veritas will endeavor to minimize this kind of impact. Post monitoring of the area will occur after spring.
Will you be using the same equipment as last year?	Yes, similar equipment will be used.
Can we find out who your subcontractors are?	Yes. We can supply a list of successful bidders to the employment coordinators'offices.
SOCIO-ECONOMIC	
Will all of the jobs go to people in Inuvik?	Jobs will be available to all Inuvialuit beneficiaries.
Oil and gas companies should look at building an all weather road from Inuvik to Tuktoyaktuk.	This issue is not within the scope of the currently proposed project.
Would the companies be prepared to run a gas pipeline to the community of Tuk?	This issue is not within the scope of the currently proposed project, and should be brought up at a later date as things progress in the delta region.
Communities would like more advance notice of contract opportunities.	Burlington and their contractors are currently providing the communities with advance notice and will continue to do so.

TABLE 14 Cont'd

Issue	Response
Burlington should address community (TUK) needs such as a bigger garbage dumps, a highway, crowded schools, nursing station closures.	This issue is not within the scope of the currently proposed project. Will raise issues with Mackenzie Delta Operators Group (MDOG).
Money made through IRC businesses does not filter to the communities.	This is an internal community issue and outside the scope of the company.
How will contracting within Tuk be handled?	Veritas will contract with businesses according to the Comprehensive Cooperation and Benefits Agreement.
Smaller businesses should have access to bidding processes.	Burlington will follow the guidelines of the Comprehensive Cooperation and Benefits Agreement.
Training should include University degrees, not just skills for laborers.	Burlington,, as a member of the Mackenzie Delta Operators Group, will work with the IRC, Aurora College and the Regional Coordinating Committee to bring training to the area. Individuals with basic training may pursue additional education on their own.
If someone fails the first drug/alcohol test, can they come back later and try again?	Yes.
Are your subcontractors subject to drug/alcohol testing?	Subcontractors cannot be tested by Veritas, but should an incident involving drugs or alcohol occur, a subcontractor can be dismissed. All subcontractors are expected to adhere to the project's safety and performance standards.
There should be a compensation agreement with the HTC's in case someone loses a trapline due to industrial activity.	Burlington will look into this.
Benefits should be spread out to all Inuvialuit beneficiaries.	Burlington will abide by their Benefits Agreement.
Can the companies help Aklavik find a gravel source?	The seismic data acquired will not resolve shallow gravel deposits. However, if information is found that can be of use to the community, it may be provided to them.
Will additional workers mean that there will be more stress on local medical resources such as nurse's etc?	Each sleigh camp will have their own paramedics to sustain life in the event of an accident, until a medivac can airlift the individual to Yellowknife.
When will you be starting training programs?	Exact dates are under discussion, but notice will be given well in advance of training.
Will Gwich'in people have opportunities to work?	Based on the number of companies with proposed projects, there will likely be more work in the region than can be fulfilled by Inuvialuit personnel.
How long will people be out of town working?	We want people to commit to working a few weeks at a time. There will be a regular crew rotation period.
Are the jobs available to only Inuvik, Tuk and Aklavik?	Job opportunities will be available on a regional basis, but will go to Inuvialuit workers first as per the Benefits Agreement.
What happens when the 3 months are over? Will there be more training?	This is seasonal work and we cannot promise work beyond the proposed program. However, if individuals want to work outside the ISR, that opportunity will be made available to them.
Will you be hiring based on experience?	Experience will be an asset during the hiring process.

17.0 PERSONAL COMMUNICATIONS

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

Boag, Thomas. Fisheries Biologist. Applied Aquatic Research Ltd. Calgary, AB

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Wright, Dennis. Coordinator, Environmental Affairs, Fisheries and Oceans Canada, Winnipeg, MB.

Wilson, Anne. Water Pollution Specialist, Northern Division. Environment Canada, Yellowknife, NT

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APPENDIX A

FISHERIES ASSESSMENT

1.0 INTRODUCTION

1.1 Project Overview

Burlington Resources Canada Energy Limited is proposing to conduct a 2D seismic exploration program in winter 2000/2001 on and around Richards Island, Langley Island, Kendall Island and Ellice Island within the Mackenzie Delta region of the Northwest Territories. Upon review of the available aquatic resource data, the fisheries assessment includes recommendations for environmental mitigation and an environmental monitoring program, if warranted. These procedures are designed to avoid harmful alteration, disruption or destruction (HADD) of productive fish habitat, and take into account seismic exploration guidelines developed by DFO.

1.2 Fisheries Assessment Methods

Information collected and reviewed for this report came from existing literature, interviews with DFO staff, a helicopter over flight of the study area, and community meetings with Aboriginal representatives of the area. Available technical information on lakes and streams in the Mackenzie River Delta is primarily found in the unpublished or "grey" literature, however, information also exists in published scientific journals. Both sources were reviewed.

A search was conducted of the scientific literature to obtain relevant papers pertaining to the ecology of lakes and streams in the region. The geographic scope of the search was expanded beyond that of the immediate project area, since extrapolated data from nearby areas was necessary for a preliminary understanding of aquatic resources within the study area. The literature search was conducted using electronic bibliographic search tools, and interviews with DFO staff. The following library indexes were searched: Waves (DFO Library Catalogue), Biological Abstracts, University of Victoria catalogues, and the Fish and Fish Habitat Database (prepared by Bruce Fallis, DFO). Keywords used to search these databases included: Mackenzie Delta and Mackenzie River, in combination with fish, hydrology, lakes, and limnology. References cited in the literature obtained, and key authors identified by DFO (D. Wright, Freshwater Institute), were used as a basis for additional searches.

A list of key fish species in the project area was developed based on our review of existing fish populations and limnological data. Life-histories and associated habitat requirements for each species was described and factors limiting fish production were identified.

2.0 RESULTS AND DISCUSSION

2.1 Aquatic Habitat and Fish Populations

Located within the Burlington project area are numerous streams and lakes, as well as nearshore marine areas on and around Richards Island and the northern Mackenzie Delta. The Mackenzie River delta, covering approximately 12,000 km^2, is comprised of low elevation land and a maze of channels and shallow lakes that are ice-covered for up to eight months of the year (Bigras 1990). The modern, or active delta, extends some 120 km north from Point Separation, where the Mackenzie River splits into numerous channels that flow to the Beaufort Sea (Mann 1975).

Water levels in delta channels and lakes are controlled by the discharge of the Mackenzie River. During annual floods, most of the delta is covered with silt-laden water. Lakes in the southern portion of the delta are inundated less frequently because they are located on top of levees. In some portions of the delta, such as on much of Richards Island, lakes are less influenced by the floodwaters of the Mackenzie River. Consequently, these lakes are oligotrophic and support a different fish fauna than those in the inner delta (Mann 1975; DeGraaf and Machniak 1975). The extent of interaction with Mackenzie River flows influences the biophysical characteristics of aquatic habitats throughout the area.

2.1.2 River Channels

Delta channels provide feeding, spawning, and rearing habitat, as well as migration corridors for fish that reside in the lower Mackenzie River (Mann 1975). Investigations of fish populations conducted previously for the proposed Arctic Gas Cross Delta pipeline by de Graaf and Machniak (1975) found that river channels had the most diverse fish fauna (18 species present) of any of the freshwater systems investigated. Although most existing data for fisheries resources in Mackenzie River channels comes from outside the proposed Burlington project area, channels within the project vicinity are likely used by a similar community of fish species.

Arctic char, inconnu, lake and broad whitefish, and Arctic and least cisco pass through the delta channels during migrations. Broad and lake whitefish spawn in back eddies of the Mackenzie River near the Arctic Red River and in the Middle Channel at Horseshoe Bend in early October. Least and Arctic cisco are thought to utilize the lower portions of the Peel River as well as Peel and Husky channels for spawning and the Peel River, some of its tributaries, delta channels, and the Beaufort Sea coast near Shingle Point, for nurseries. Grayling, pike and burbot remain in the delta throughout the summer.

In general, large, deep lakes with connections to river channels are used more extensively for wintering than are small channels, which are more important for wintering of fish than are large channels. Overwintering data is found primarily in research conducted by Mann (1975) during

three winter surveys in October and November, 1974 and April, 1975 at locations between Moose Channel and Shallow Bay. Conditions in the area studied were generally sufficient for overwintering. Turbidity and suspended sediments were relatively low compared to mid-summer values, under-ice water temperature was near freezing, and dissolved oxygen levels were generally saturated. A total of 12 fish species were captured during the three winter surveys. Lake whitefish were the most abundant, followed by least cisco, inconnu, northern pike, and broad whitefish.

2.1.3 Delta Lakes

Delta lakes are dynamic, with their mean depth, lake volume, and surface area varying as a function of Mackenzie River stage (Fee *et al.* 1988). All delta lakes, except closed lakes, have the potential to undergo changes in morphometry during ice-free periods.

Elevation of Mackenzie delta lakes relative to the main river channels has the most important effect on their hydrologic regime. Based primarily on elevation, delta lakes are of two major types, connected or perched (Bigras 1990). A connected lake has a well-defined, water-filled channel connecting it to the main delta channel system from break-up to freeze-up. Water floods into or out of the lake, depending on whether the main channel level is rising or falling. The resulting exchange of water, sediment, and nutrients influences the biota of lakes (Marsh and Hey 1991) such that fish species of connected lakes are similar to those of channels. Because connected lakes are subject to periodic influxes of silt and nutrient-laden water, turbidity levels are relatively high. The substratum of connected lakes is typically silt, and depths are uniform and generally less than four metres (McCart et al. 1980).

Perched lakes are not directly connected by channels in the delta, since they are perched atop levees and cut off from other lakes and channels except during flooding. Perched lakes can be further divided into three groups, high closure, low closure, and no closure. Closure refers to small depressions in the levee that connect the lake to other lakes or channels during high water periods. Flood frequency of perched lakes depends on the elevation of the depressions in the levee relative to the main river channels. Lakes located in the southern portion of the delta are classified as high-closure lakes, lakes located in the northern portion of the delta are classified as low-closure lakes, and no-closure lakes are located exclusively in the southern portion of the delta. Because no-closure lakes have no links to another lake system and are not flooded annually, they tend to have a negative annual water balance. As a result, the lakes experience declining water levels between flooding events (Bigras 1990; Marsh and Hey 1991). The substratum of perched lakes typically is organic matter (McCart et al. 1980). McCart (1980) suggested that fish species diversity and community composition are similar among connected and among perched lakes, but different between the two types of lakes.

De Graaf and Machniak (1975) found that turbid floodplain lakes had the most diverse fish fauna (15 species) of the Mackenzie Delta lakes. Clear upland lakes were also quite diverse (12 species), with clear floodplain lakes without connections to river channels having the least diverse fauna. Lawrence et al. (1984) captured broad whitefish, least cisco, lake whitefish, northern pike, lake trout, burbot, and pond smelt, in decreasing order of abundance while surveying for fish with gill nets in lakes on Richards Island.

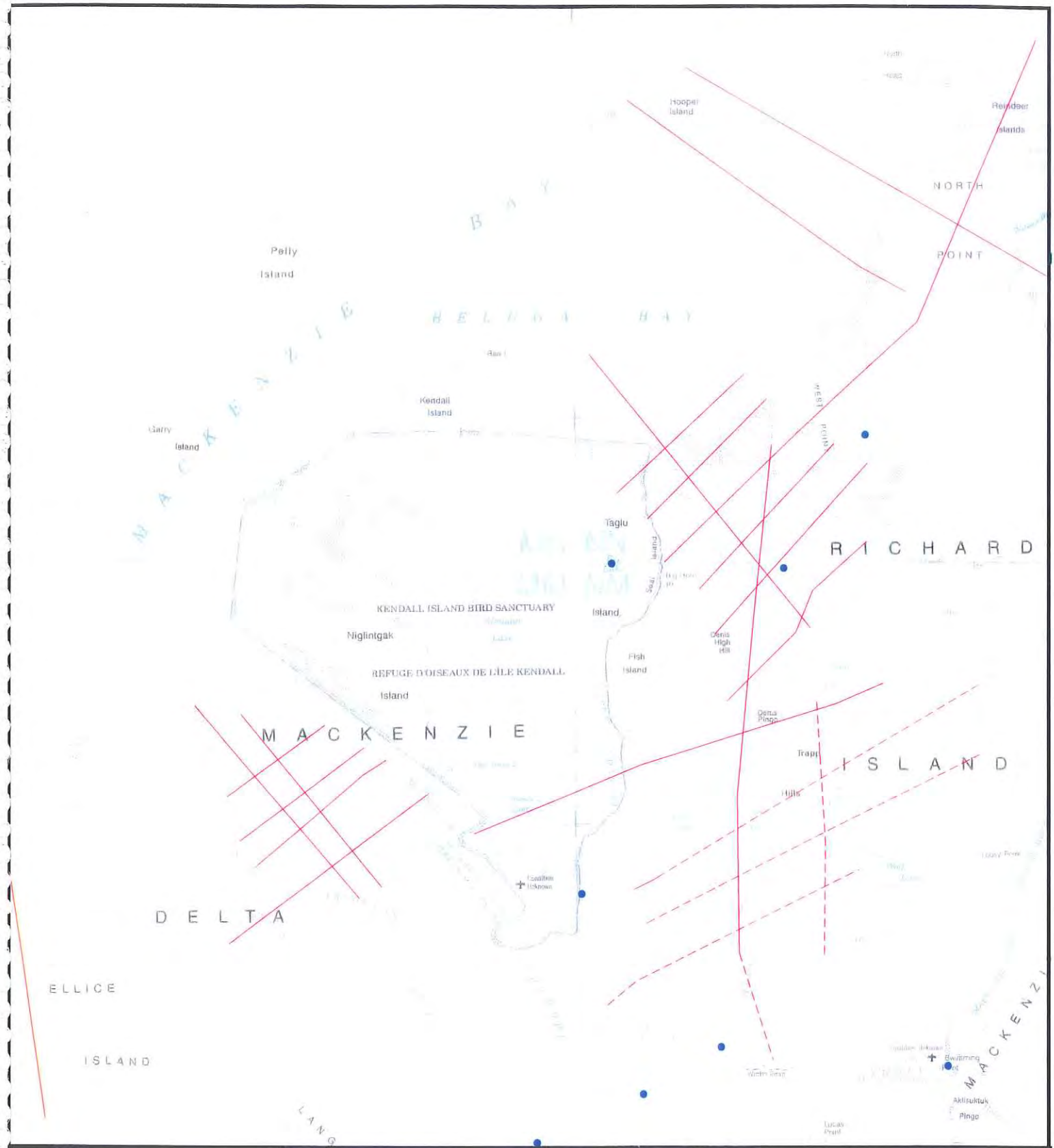
Ya-Ya Lake lies on the southwest corner of Richards Island, between the East and Middle Channels of the Mackenzie River. It is one of the largest lakes in the Mackenzie Delta, having an area of 20.4 km^2 and a maximum depth of 48.8 m. The south basin is shallow and turbid while the north basin is deep, clear and oligotrophic. The lake is connected to Harry and Middle Channels and is influenced substantially by Mackenzie River flows, particularly in the south basin. McCart et al. (1980) recorded 17 fish species during inventories of Ya-Ya lake in 1977 and 1978. Lakes near Ya-Ya are also known to contain several species of fish, including burbot, stickleback, broad whitefish, lake whitefish, least cisco, northern pike, and slimy sculpin.

2.1.4 Overwintering Habitat

Fisheries resource information from scientific reports and land use map data were compiled by Sekerak et al. (1992) in order to describe overwintering habitats and to note the occurrence of each of the major fish species in the different habitat types of the near shore Beaufort Sea and Mackenzie River delta area. The report is the only comprehensive review of overwintering locations on and around the Burlington project area, and no recent data were found during the literature review. Site locations of winter catches reported in scientific reports up to and including 1992 are summarized and plotted on Figure 6 for broad and lake whitefish, arctic and least cisco, inconnu, lake trout, burbot, pike, rainbow smelt, Pacific herring, and saffron cod.

Habitat descriptions should be considered preliminary, as limited amounts of physical, chemical and fish data are available for this area. The absence of a site marker on Figure 6 should not be interpreted as meaning there is no overwintering potential for a particular waterbody. The available data can be used in a general way to extrapolate findings to similar or nearby waterbodies. Additionally, the data plotted in Figure 6 does not include substantial TEK available in Inuvialuit communities.

De Graaf and Machniak (1975) conducted fisheries investigations along the proposed Arctic Gas Cross Delta pipeline route, which extended from the Yukon side of the delta to the East Channel of the Mackenzie River. Twenty fish species were collected, and spawning and overwintering habitat preferences were identified for each species when possible.



Inuvialuit Environmental Inc.

Scale 1: 250,000

0 5km

Identified Fish Overwintering Habitat within the Vicinity of the Project

Legend

Seismic Lines

Fish Overwintering Habitat

September 2000

698-00

Figure 6

River channels had the most diverse fauna (18 species present) followed by turbid floodplain lakes (15 species) and clear upland lakes (12 species). Clear floodplain lakes without connections to river channels had the least diverse fauna. Shallow lakes without connections to channels were used during ice-free periods only by ninespine stickleback, but deeper lakes of the same type supported 5 fish species. Fish collections from lakes generally were larger than those from channels, however this result may be an artefact of gillnet sampling and not necessarily an indication that lakes have higher densities of fish per unit area. This report does not give exact locations of inventory sites.

Fish overwintering habitat located in the active Mackenzie River delta region is classified as primarily inner delta lakes and minor channels, major channels, estuarine coastal, and near shore marine. The region of inner delta lakes and minor channels includes the active Mackenzie Delta from approximately Arctic Red River, to but not including, outer delta islands. The dominant fish species overwintering in inner delta lakes and channels include inconnu, burbot, northern pike, lake whitefish, and broad whitefish. Thus, the overwintering sites in this habitat category contain both migratory and resident populations. The physical characteristics of inner delta lakes and minor channels are poor to moderate water quality, small to moderate volumes of water available, many lakes and channels that are subject to annual flooding, connections to major channels of the Mackenzie River for at least a portion of the year allowing fish migration, and turbid and shallow water in summer.

Riverine habitats include the mainstem Mackenzie, Peel River, and lower Arctic Red River. Major rivers offer large size, reliability, and good connections to other water bodies. The dominant fish species overwintering in major rivers include broad and lake whitefish, burbot, inconnu, Arctic cisco, northern pike, and rainbow smelt. Physical characteristics of this habitat type are good to excellent water quality, substantial winter flow, and good connections to adjacent waterbodies.

The region of estuarine coastal habitat includes coastal waters adjacent to the Mackenzie Delta including portions of Liverpool Bay affected by freshwater runoff. The dominant fish species overwintering in estuarine coastal habitat include Arctic cisco, least cisco, rainbow smelt, pacific herring, and saffron cod. The physical characteristics of estuarine coastal habitat are good to excellent water quality, salinity variable from freshwater to 10-20 ppt (parts per thousand), and connections to other waterbodies.

High salinity (>20 ppt) and low temperatures (0°C) are characteristic of near shore marine overwintering habitat around Richards Island. In addition, water quality is good to excellent and the near shore marine environment is well connected to other water bodies. Saffron cod was the most frequently reported fish in this overwintering habitat (Sekerak *et al.* 1992).

2.1.5 Near shore Marine Environments

The outer Mackenzie River delta and adjacent areas provide essential habitat for the maintenance of freshwater, coastal marine and anadromous fish resources in much of the southern Beaufort Sea area (Percy 1975). The inshore zone is an important nursery, feeding and overwintering site for both near shore and offshore organisms. It is especially important to anadromous species that form the basis of the domestic and commercial fishery in the delta—species such as broad whitefish, Arctic char, Arctic cisco and inconnu (Percy 1975). Many bays and lagoons along the coast serve as rearing areas for juvenile coregonids and smelt that originate in the Mackenzie River, and for juvenile fourhorn sculpin, flounder, and Pacific herring (Lawrence *et al.* 1984).

Existing inventory data indicate the presence of the following fish species in this near shore marine environment: arctic cisco, arctic flounder, arctic lamprey, boreal smelt, broad whitefish, burbot, fourhorn sculpin, humpback whitefish, inconnu, lake trout, lake whitefish, least cisco, longnose sucker, ninespine stickleback, northern pike, pacific herring, polar cod, saffron cod, starry flounder, and threespine stickleback (Percy 1975; Byers and Kashino 1980). Abundance and distribution varies among species, time of year and life stage. However, evidence exists that many species overwinter here (Percy 1975; Sekerak et al. 1992). Arctic cisco and least cisco were the most abundant and widely distributed anadromous fish. The most abundant and widely distributed marine species captured was the fourhorn sculpin. It should be noted that this species has been listed by COSEWIC as vulnerable. This designation is likely based on a restricted distribution, rather than low population numbers in the project vicinity.

3.0 Factors Limiting Fish Production

Almost all waterbodies in the project area are likely capable of supporting fish at some time of the year, however many may be non-fish-bearing. The primary limiting factors are generally insufficient overwintering habitat (related most often to depth), or inadequate access to the waterbody for colonization or seasonal use. Many waterbodies in the area are shallow and freeze to bottom or nearly so, such that fish are incapable of overwintering at these sites.

4.0 Implications for Seismic Program

The primary environmental concern with seismic operations is the potential negative effect of dynamite explosions on fish. There are also concerns of effects to fish habitat such as sedimentation, riparian vegetation alteration, nutrient input, and disturbance to sediments as a result of shock waves and/or drilling. Sediments may contain deleterious substances, which may be mobilized or suspended in water.

4.1 Potential Effect of Explosive Charges

Explosive charges have the potential to harm or kill fish even when the charges are relatively small and the fish are a considerable distance from the explosion (Falk and Lawrence 1973; Wright and Hopky 1998). Effects from charge explosion are dependent on size of charge, depth of charge and consistency of the subsurface material. Fish may be injured or killed by the effects of underwater explosions in several ways, ranging from minor injuries such as loss of scales and minor blood vessel rupture, to major damage such as tearing of muscle tissue, rupture of internal organs and disruption of the nervous system. The swim bladder is the organ most sensitive to pressure changes from explosions. The effect of explosions on invertebrates is believed to be negligible.

DFO has published specific guidelines to aid proponents in the safe use of explosives in Canadian fisheries waters (Wright and Hopky 1998). This guideline indicates that 100 kPa pressure differential in the swim bladder of a fish is the maximum allowable by a single charge. Table 15 provides a summary of setback distances (*i.e.,* distance from shoreline or sediment-water interface) that will achieve the guideline of 100 kPa overpressure. Equations are available to calculate setback distances for different charge sizes than those noted in the table.

TABLE 15

SETBACK DISTANCE (M) FROM CENTRE OF DETONATION OF AN EXPLOSIVE TO FISH HABITAT TO ACHIEVE 100 KPA OVERPRESSURE GUIDELINE (Wright and Hopky 1998)

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	1	2	5	10	25	50	100
Rock	3.6	5.0	7.1	11.0	15.9	25.0	35.6	50.3
Frozen Soil	2.3	3.2	4.5	7.2	14.3	16.0	22.6	32
Ice	1.5	2.1	3.0	4.7	6.6	10.5	14.8	21
Saturated Soil	1.5	2.1	3.0	4.8	6.7	10.0	15.1	21.3
Unsaturated Soil	0.7	1.0	1.4	2.2	3.1	4.9	6.9	9.8

No effects on fish are predicted to result from this project due to the mitigative measures developed for the project. Activity within waterbodies will follow the guidelines set out by Fisheries and Oceans Canada (DFO) for charge size and depth of emplacement, where dynamite is used as an energy source. DFO setback distances for the use of dynamite explosives on land will follow those outlined in Table 15 above.

4.2 Potential Effect of Drilling

The immediate environmental effect of drilling in fish-bearing waters comes from the physical disturbance that may result during the drilling process. The effects may be direct disturbance to fish, and/or disturbance and suspension of sediments.

The consequences of either of these effects will depend on their magnitude and timing, relative to life history of fish in the waterbody. Since Burlington's seismic activities are to be restricted to winter, effects on overwintering behaviour and overwintering habitat capability are of primary concern. Conversely, no effects on rearing and spawning behaviour is anticipated since these activities occur outside of the winter season.

Burlington will endeavour to employ drilling technology used for charge emplacement that does not require augering. This will minimize the footprint of explosive emplacement and may be adopted as the favoured method providing that substrate conditions are suitable. This should minimize mobilization of suspended sediments. Where augering is necessary, cuttings will be collected and placed outside the perimeter of the watercourse, so that they do not create additional sedimentation at spring breakup (Table 10).

4.3 Potential Effect of Vehicles

Size of the carrying vehicle is dependent on size and weight of the ram or drilling equipment required, which in turn is dependent on the depth of hole required. The weight and size of vehicle is not generally relevant to activities on a frozen waterbody, however, environmental effects on fish-bearing water may result from disturbance to riparian vegetation, and disturbance to slopes and banks adjacent to waterbosies. Additionally, vehicles and machinery have the potential to release deleterious substances such as fuel and lubricants.

Burlington has taken measures to decrease environmental impact of the equipment used during the seismic program. During final program design, areas of dense vegetation cover will be avoided to the extent feasible, while considering the other environmental constraints of the area (*e.g.*, setback distance from waterbodies for fisheries protection). In addition, mechanical overland travel of personnel or transport of equipment will be restricted to seismic access routes wherever feasible. Frozen ground conditions, snow cover and tracked or low-pressure wheeled vehicles will minimize impacts to vegetation communities.

Sensitive terrain features such as erosion prone slopes and eroded banks will be avoided during line routing and where appropriate, shooflies and/or snow ramps will be used. Frozen ground conditions, the use of tracked equipment, and the cushioning effect of snow, will minimize impacts to the soil profile and organic mat along seismic lines and access routes.

Along lines, shrubs and willows, where they occur, will be rolled over, with the impacts related to crushing restricted to the aboveground woody material with the root systems remaining intact. Where clearing is required, care will be taken to ensure that there is no organic mat disturbance. Cleared woody vegetation will be sheared off at ground level using a cutter blade in frozen ground conditions, thereby leaving root systems intact. This ensures soil stability and promotes

vegetation regeneration in the following growing season. Fluctuating water levels in the delta will also assist in natural vegetation regeneration. Woody debris will be rolled back over the right-of-way upon project completion to enhance natural revegetation. No slash or debris will be left in waterbodies.

Equipment used during the proposed project will be maintained in good working order and inspected periodically for leaks. Re-fuelling will take place utilizing a Fuel-Com system, thus reducing the potential for fuel spills or leaks.

4.4 Monitoring and Mitigation

The greatest obstacle to developing a detailed protocol for aquatic resource protection is the absence of a complete inventory of aquatic habitat in the project area. Without this information it is difficult to determine which locations will be fish-bearing at the time of seismic work. This uncertainty is especially noteworthy in the Burlington project area due to the considerable diversity of habitat types.

To ensure proper protection, the simplest strategy is to treat each watercourse as potentially fish-bearing unless the site is frozen to the bottom, or is known to be non-fish-bearing from existing data. Alternatively, a more detailed decision framework could be developed based on bathymetric profile and proximity to known fish-bearing locations. For example, lakes that are known to support fish year-round (from previous inventory work or through Traditional Ecological Knowledge) have to be sufficiently deep (>3 m) to overwinter fish successfully (Figure 6).

Lakes that have an average depth of 2-3 m will probably have extensive portions that are frozen to bottom during winter. Consequently, seismic crews would retain a medium probability of encountering water when holes are augered through the ice. Those that are <2 m deep will be frozen to bottom and have low probabilities associated with encountering water when drilled. These rankings can be applied to a lakes potential to support fish at the time the seismic program is planned. This ranking is simple, but defensible and reproducible. If feasible, depths of ice on augered lakes can be recorded for use on subsequent exploration programs.

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APPENDIX B

DETAILS OF MOBILE SLEIGH CAMP

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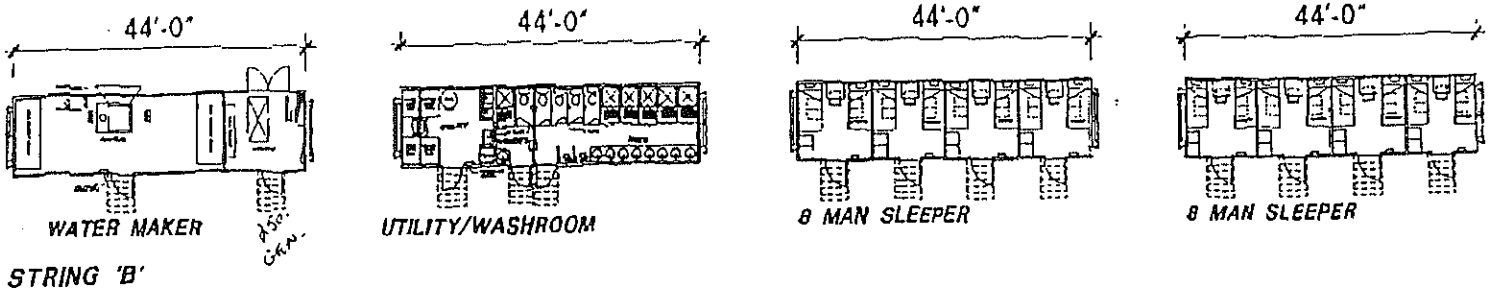

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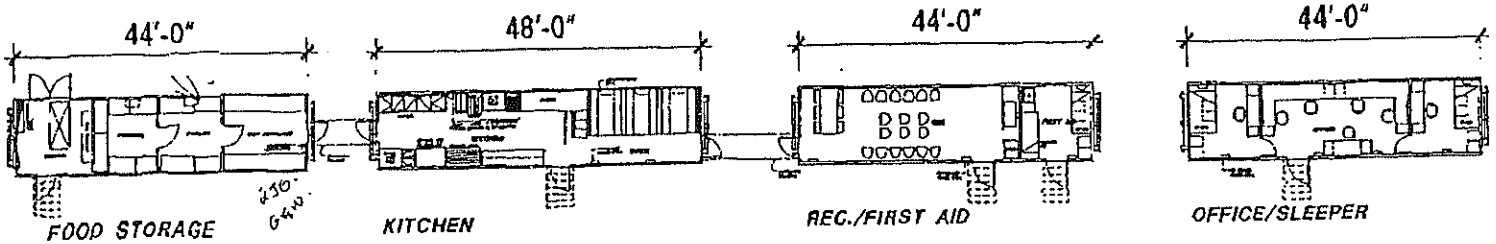

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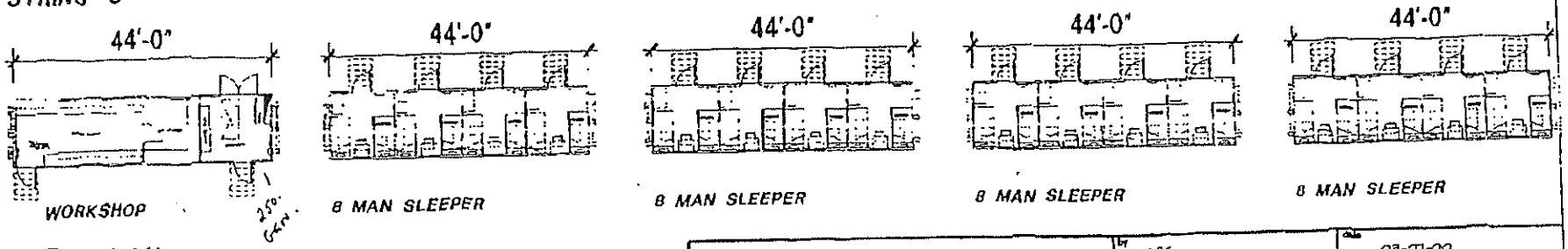
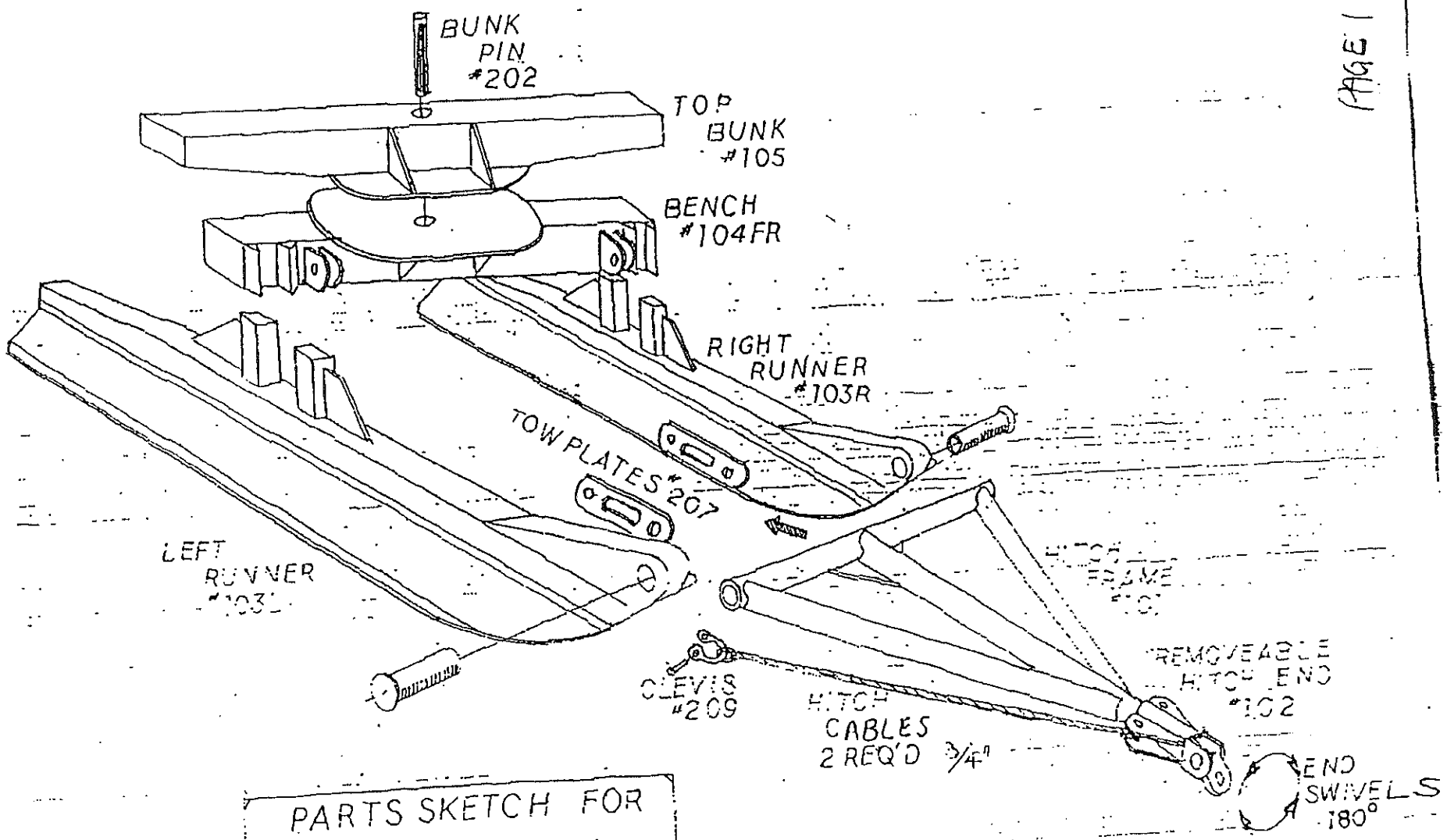


SITE PLAN

SCALE: 1"=20'-0"

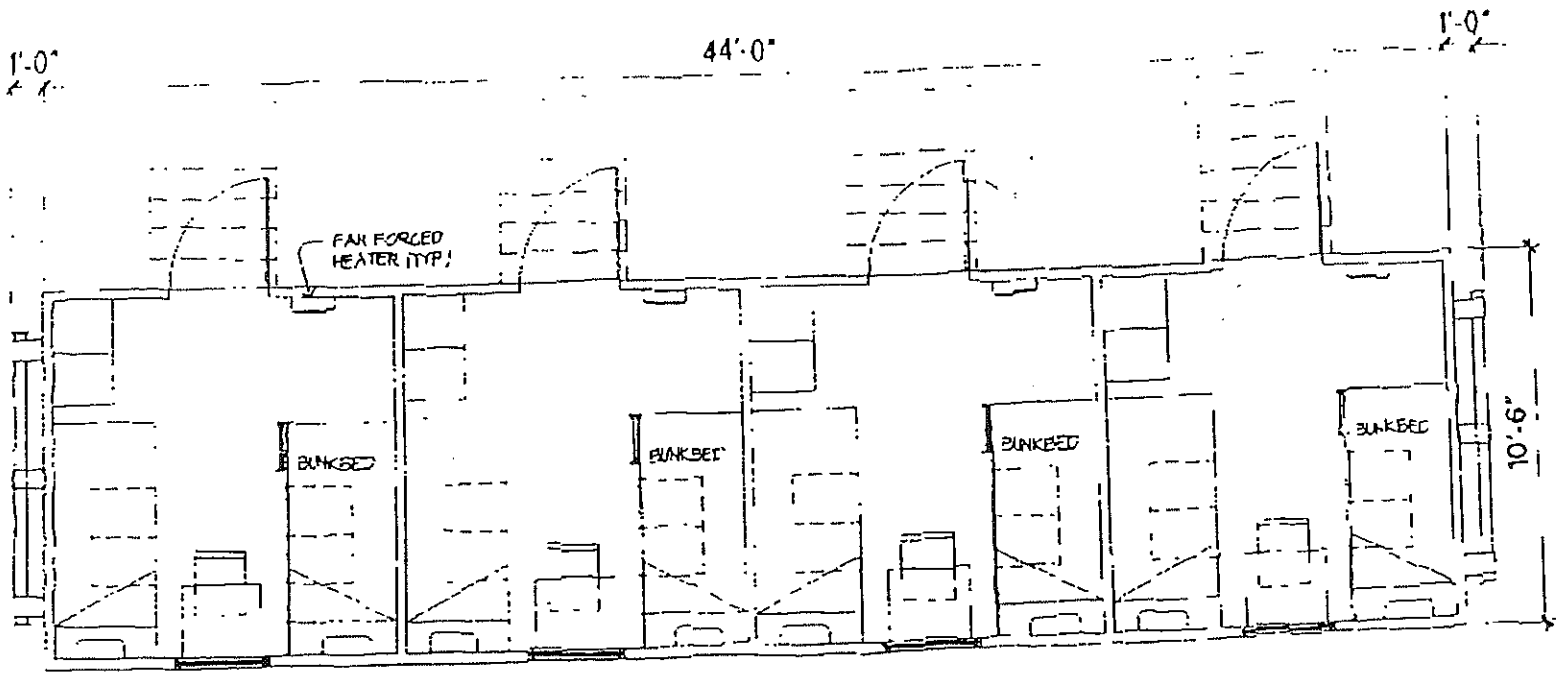
	by VIC	date 03-07-00
	scale 1"=20'-0"	plot number F-117A
project	SLEIGH CAMP COMPLEX	
drawing	SITE PLAN	



PARTS SKETCH FOR

FRONT BOB ASS'Y

HERB'S WELDING LTD. (403-624-3304)



FLOOR PLAN

SCALE 3/16" = 1'-0"

	by VC	date 01-07-00
	scale 3/16" = 1'-0"	sheet number F-1178

SLEIGH CAMP COMPLEX
10'-6" x 44' SLEEPER UNIT
FLOOR PLAN