A wildlife monitor will alert work crews to the presence of dens or non denning polar bears in the vicinity of the program area, and ensure that measures are implemented to avoid interaction or disturbance. Firearms will be used as a deterrent in the event that a bear enters the vicinity of program activities.

12.1.5 Cultural Resources

Based on the archaeological assessment conducted, the program was modified to ensure all known and newly identified sites were avoided. Therefore, no impacts are anticipated in connection with the construction or operational activities associated with the drilling program. However, should an archaeological site be discovered during development, the appropriate agencies will be notified, and operations will cease in the immediate area of the discovery until permitted to proceed by the appropriate authorities.

12.2 Mitigating Potential Environmental Impacts of Accidents and Malfunctions

Accidents and malfunctions may affect safety and productivity on a drilling program, and may also negatively impact the environment. When the final well site has been identified, EnCana will conduct a thorough hazard identification and assessment, and establish policies and procedures to mitigate those risks. EnCana requires all staff and contractors to strictly adhere to its environment, health and safety policy, , and to all practices established for the project. The EnCana EHS Field Supervisor will be on site to monitor compliance with these practices and thus, likelihood of an accident is greatly reduced.

Should an incident or accident occur however, the emergency response plan will be followed. The ERP is designed first to minimize the consequences of an incident or accident on people and the environment, and second to minimize the risk that such events will reoccur. All incidents are reported, reviewed and follow-up measures are identified to avoid future similar incidents. In the event of any leak or spill of oil or other chemicals, the spill response plan would be implemented.

Some of the accidents and malfunctions that may occur are described below, along with an indication of the likelihood of occurrence and the techniques used to mitigate the impact.

Hydraulic Oil Leak

The drilling rig accumulator unit, which functions the blow-out preventors, uses hydraulic oil to run the system. Hoses and/or fittings may crack or leak causing a loss of fluid and/or pumps can overheat resulting in a leak in the pump casing. Any leaks would primarily collect on the floor of the manifold building. Depending on the amount of fluid lost, the fluid could leak from the manifold building, and eventually to the ice pad.

EnCana proposes to minimize the potential for an accidental leak by implementing regular maintenance checks on the accumulator unit. Regular maintenance of the unit and associated hoses and fittings will help to identify components with the potential to leak. Thus the risk of hydraulic oil spilling onto the ice pad is very low.

Glycol Spill

The mud cooler contains glycol. Mechanical failure of the mud cooler or improper handling of the glycol during transfer may potentially result in a spill. Impacts to the environment may occur if glycol was spilled on the ice pad. However, this is extremely unlikely.

The floor of the mud coolers should contain any fluids should a leak occur. A glycol storage reservoir has been added to the mud cooler, reducing the need to manually fill the unit with glycol on site. The cooler is maintained regularly according to standard operational procedures. These measures reduce the risk of a glycol spill, from the mud cooler, to low.

Handling procedures to be used during the transfer of glycol are developed to minimize the risk of spillage. Inspections by supervisory staff and the EHS Field Supervisor will ensure proper procedures are being followed, and corrective actions will be implemented if necessary. The risk of a glycol spill due to human error is considered low.

Other Fuel/Fluid Leaks or Spills

Fuel and other deleterious substances may be introduced into the water should a vehicle fall through the ice. To avoid an accident, both mechanical and electronic ice thickness profiling will be conducted throughout the program and maximum load size restrictions will be strictly followed. With these mitigative measures in place, accidents are unlikely and thus the risk of a leak or spill is low.

All tanks will have secondary containment, and/or be located within a bermed area. The likelihood of any spill exceeding the capacity of the secondary containment is unlikely.. Regular inspections will be completed to ensure tank and containment integrity. Any noted leaks or spills will be cleaned up immediately and the cause corrected. The risk of a leak or spill outside the tank containment area is considered low.

Leaks or spills associated with vehicle fueling or maintenance are consider to be low due to the mitigative measures previously discussed. Any minor leaks or spills which may occur will be cleaned up promptly and no environmental effects are anticipated.

Well Kicks and Blowouts

Substances such as drilling fluids, sand or sediment, and gaseous or liquid hydrocarbons may be released to the flare stack or surface in the event of a well kick. It is possible that such materials may be released as a mist which would settle on the surrounding ground area. A loss of well control, if allowed to proceed unchecked, could result in a blowout, and could include the uncontrolled release of drilling fluid and hydrocarbons from the well, potentially at high volumes.

Well kicks are infrequent and blowouts are extremely rare, and are primarily managed through prevention - both by means of appropriate equipment and procedures, and also through regular inspections by the Drilling Manager and the EHS Field Supervisor. Encana will maintain dual barriers with respect to control of the well, with the mud weight providing one barrier, and the blowout preventors providing another barrier. EnCana will also maintain the drilling fluid density sufficiently high as to provide a hydrostatic over-balance in the wellbore at all times. The drilling rig is equipped with a blowout preventor system containing four independent wellbore-sealing mechanisms; and a choke manifold, all of which can be operated remotely, if required. In the event of a well kick, flaring can be carried out using standard equipment, using the BOPs and a choke on the mud return line, with minimal impact to the environment.

Wastewater

If the wastewater treatment system in the camp malfunctions, treated wastewater may not meet the specifications required to discharge to the environment. Given recent experience with wastewater treatment systems in camps in the Mackenzie Delta, the probability of this happening is considered probably to frequent. The significance of the risk, therefore is related to the impact and could be moderate, if moderate environmental damage was incurred, or if the effects extended off-lease. A number of contingency plans have been identified to minimize both the probability and the impact, and thus the overall risk (Section 5.5.1).

To avoid malfunctions, a new wastewater treatment system is being installed in the rig camp. A certified technician will be on-site throughout operations to ensure the wastewater treatment systems are being operated properly. A small laboratory will also be set up on-site, so treated wastewater can be sampled regularly, and adjustments made as required. The EHS Field Supervisor will conduct inspections to ensure appropriate testing and follow-up actions are being undertaken.

12.3 Mitigating Potential Impacts of the Environment on the Project

EnCana has designed its program with consideration for how the environment may impact the project (i.e. access has been routed to avoid known heritage sites). Potential impacts of the local physical environment have been addressed through field reconnaissance and a good working knowledge of the area. Implementation of mitigation measures to avoid impacts to the environment will also minimize the potential impacts of the environment on the project. One of the potentially most significant impacts of the environment on the project is weather and it cannot be predicted. However, through detailed contingency planning and by establishing safe operating procedures and practices, potential impacts can be mitigated.

Late Ice Formation

Warmer than average weather and/or heavy snowfall early in the season could affect ice formation, potentially delaying the project start-date. To ensure ice conditions are safe, electronic and manual ice profiling will be used throughout the program. Strict ice management guidelines and procedures will be in place to avoid potential accidents. EnCana has also planned to stage the Arctic Star barge, and construction equipment, near the beginning of the planned overland route. This will allow construction to begin on the overland route, while sufficient ice cover is forming on the East Channel of the Mackenzie, and should help to ensure the project start-date is not delayed.

Severe Weather

Severe weather conditions are expected, including extreme cold and blowing snow. To mitigate impacts a strict journey management plan will be established, the camp will have extra capacity and a contingent supply of food, fuel and fresh water will be maintained at all times.

Early Ice Breakup

The program is designed to be completed before break-up. However, should ice conditions deteriorate earlier than expected on the East Channel, the rig would be demobilized to Taglu.

12.4 Mitigating Impacts to Traditional Land Users

EnCana will rely on the environmental and wildlife monitors to assist in identifying areas being used by community residents for harvesting or travelling. The progress of the program will be regularly communicated to the local HTCs. EnCana has also established a Memorandum of Understanding with Kunnek Resource Development Corporation regarding communication of all activities in relation to the reindeer herd.

12.5 Communication and Implementation of Mitigation Measures

To achieve compliance with commitments made in the project description and the criteria established by the licenses and permits, EnCana will:

- Ensure the Drill Crew Supervisor and Construction Supervisor, and other appropriate personnel, have read the project description, all information requests and responses associated with the application, and the conditions of all licenses and permits;
- Require all crew members to attend a project kick-off meeting with EnCana representatives and regulators to review commitments and requirements outlined in the project description, licences and permits and to ensure crew members understand the role of the Environmental Monitor, Wildlife Monitor and Environment, Health and Safety (EHS) Field Supervisor. A kick-off meeting will be held for both the construction and drilling crews;

- Hold daily meetings with crew members, monitors and supervisors to identify environmental/wildlife issues encountered, to identify issues that may be encountered during upcoming tasks and to address areas where improvements can be made;
- Ensure supervisors are in daily contact with the Environmental Monitor regarding the status of operations and issues of concern identified by the monitor;
- Post maps indicating areas of environmental concern in visible and accessible locations.

Environmental and wildlife monitors will be hired for the duration of the program to ensure mitigation measures are implemented and environmental and wildlife concerns are addressed as they are encountered. EnCana will also maintain an EHS Field Supervisor on-site throughout the activities to monitor compliance, and conduct regular inspections and audits on all activities. The monitors and EHS Field Supervisor will be responsible for reporting daily to site supervisors, and to regulators, as required.

Reports are filed with regulators, including the NEB, INAC and Water Board, throughout the program, as required and include progress, discharge monitoring and incident reports. Final reports are also submitted after program completion.

13 CUMULATIVE EFFECTS

The following assessment of potential cumulative effects is based on an approach that answers a series of questions, posed as the following four steps (Kavik-Axys 2002):

1. Is the project likely to have negative environmental effects on VCs in the ISR?
2. If so, will the residual negative environmental effects (i.e., that remain after mitigation) act in a cumulative fashion (i.e., combine with the effects of other projects, past, present, or future)?
3. What are the significance of the overall cumulative environmental effects and the contribution of the proposed project to those effects?
4. If this proposed project, in combination with other projects in the area, is likely to create a "significant negative cumulative effect", are there further mitigation measures that could reduce or eliminate the project's contribution to these effects so that the combined effect is not significant?

The following sections respectively discuss each of the above steps. A summary of the results of is provided in Table 10.

TABLE 10 SUMMARY OF CUMULATIVE EFFECTS ASSESSMENT

Valued Component	Project-specific effect	Is there a possible overlap with other projects/activities?			EffectsManagement cumulative effect on the VC?		Probable	Effect Trend of VC	Estimated	Class of Effect	Significance Magnitude of Effect	
	Description	ZOI	Spatial	Temporal		Project-specific	Regional					
Surface Water Flow	Water withdrawal from lakes	Local	No	No	No	Section 12.1.2	None required	Stable	Project	low	3	Not Significant
									Overall	low	3	Not Significant
Surface Water Quality	Sediments and discharges.	Local	No	No	No	Sections 5.5.1 and 12.1.2	None required	Stable	Project	low	3	Not Significant
									Overall	low	3	Not Significant
Permafrost	Thaw and Local erosion	No	No	No	Section 12.1.1	None required	Stable	Project	low	3	Not Significant	
									Overall	low	3	Not Significant
Fish and Fish Habitat	Water withdrawal, disturbance to riparian habitat, stream blockage at crossings	Local	No	No	No	Section 12.1.2	None required	Stable	Project	low	3	Not Significant
									Overall	low	3	Not Significant

Valued Component	Project-specific effect	Is there a possible overlap with other projects/activities?		EffectsManagement cumulative effect on the VC?	Probable		Effect Trend of VC	Estimated	Class Type of Effect	Significance Magnitude	of Effect
	Description	ZOI	Spatial	Temporal		Project-specific	Regional				
Vegetation communities	Compaction	Footprint	No	No	No	Section 12.1.3	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Wildlife	Human interaction; habitat alteration or destruction, sensory disturbance	Local	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Barren-ground caribou	Sensory disturbance; temporary habitat alteration	Footprint	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Polar Bear	Disturbance of dens, habitat loss	Local	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Grizzly Bear	Disturbance of dens, habitat loss	Local	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Muskrat	Damage to push-ups	Local	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Arctic fox	Disturbance of dens, sensory disturbance	Local	No	No	No	Section 12.1.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant
Resource Harvesting	Change to harvested species (abundance, occurrence)	Local	No	No	No	Section 12.4	None required	Stable	Project	low	3 Not Significant
									Overall	low	3 Not Significant

Notes:

1. Includes the following species: Arctic Cisco, Broad Whitefish, Burbot or Loche, Inconnu or Coney, Lake or Humpback Whitefish, Least Cisco, Northern Pike or Jackfish, Pacific or Blue Herring
2. "Local" is larger than the project footprint but within the lease; typically in the order of tens of meters

Explanation of columns

1 VC=Valued Component (includes cultural components)

2 Describes effect

3 ZOI= Estimated Zone of Influence (e.g., in metres or kilometres)

4 Spatial overlap (i.e., effect occurs at the same place) of effect on VC with other project effects on same VC

5 Temporal overlap (i.e., effect occurs at the same time) of project effect on VC with other project effects on same VC

6 Answers Yes (Y) or No (N) if there is now a cumulative effect

7 Describes any effects management (e.g., mitigation) committed to for project

8 Describes regional mitigation

9 Describes the trend of the resource (i.e., positive, neutral or negative

10 Describes the magnitude of the change caused by the project on the VC (e.g., as a % change, or as Low, Moderate or High)

11 States the class of effect as [Class] 1, 2 or 3, based on the matrix below

12 States the significance conclusion as significant (S) or not significant (NS)

Explanation of Rows

1 First row for each VC: provide all information shown, then identifies project-specific contribution to magnitude, class and significance

2 Second row for each VC: provides overall (i.e., as a result of all projects) contribution to magnitude, class and significance

Class Matrix

Magnitude of Change to Benchmark	Trend in Resource	
	Positive	Negative or Neutral
Low (< 1%)	Class 3	Class 3
Moderate (1-10%)	Class 3	Class 2
High (> 10%)	Class 2	Class 1

13.1 Likelihood of Negative Environmental Effects

Potential project-specific effects have been assessed on the following valued components (VCs): permafrost, hydrology (surface water flow and quality), fish and fish habitat, vegetation communities, wildlife, including barren-ground caribou, polar bear, grizzly bear, muskrat, arctic fox, and resource harvesting. The results of this assessment conclude that project-specific residual effects (i.e., after application of mitigation) are measurable but will likely be negligible for all VCs. Primary factors in reaching these conclusions include timing the activities over winter, localizing effects and applying appropriate mitigation, which contribute to effects being substantially minimized or to effects pathways for VCs being avoided.

However small, because there remains the likelihood of some degree of negative environmental effects, the assessment of cumulative effects proceeds to Step 2.

13.2 Characterization of Possible Interactions

For the effects of this project to act cumulatively, there must also be other human actions affecting the same VCs (e.g., to the point of the same water particle or individual animal). To understand if this may happen requires an understanding of the nature of other human actions, past, present and future, surrounding the proposed project.

In the proposed project region, which generally includes the northern Mackenzie Delta and Tuktoyaktuk Peninsula, the most likely human actions to possibly cumulatively interact with the project includes renewable resource harvesting (e.g., hunting and fishing), transportation (e.g., vehicular, air, and marine traffic) and other industrial projects, principally oil and gas exploration. Actions of greatest potential to act cumulatively are related to nearby oil and gas exploration and development. As such, temporal and spatial boundaries were selected by considering recent, proximal (nearby) development projects that would be most likely to contribute to any cumulative effects to VCs.

Most of the Delta is already under some form of oil and gas disposition (DIAND 2003), including 15 exploration licenses (ELs) and 65 significant discovery licenses (SDLs). A number of these ELs and SDLs occur immediately adjacent to both EL384 and EL385 (Figure 6):

- to the east: SDL092 (Imperial), SDL 093 (Imperial), and SDL 032 (ConocoPhillips)
- to the north: EL393 (Burlington) and EL409 (Devon)
- to the west: EL394 (Burlington) and SDL060 (Imperial)

A number of inactive oil and gas wells are located in both EL384 and EL385 (Figure 6):

- in the north portion of EL384, four wells (two Imperial, two ConocoPhillips)
- on the southeast portion of EL385, three wells (ConocoPhillips).

Past activities which overlap with the proposed Burnt Lake Drilling Program include a 2D seismic program (2000/01), a 3D seismic program (2001/02) and a 2D seismic program (2002/03), all conducted by EnCana. Recent past activities in proximity to the proposed program include a 3D seismic program on Ellice Island/Mallik Bay (2001/02) and drilling programs at Mallik Bay (2001/02), Langley Island (2002/03), south of Tuktoyaktuk (2001/02) and north of Parsons Lake (2002/03).

Effects from road construction and traffic are not expected to act at all, or are expected to act negligibly, on VCs.

13.3 Relevance of Possible Interactions

The proposed project will most likely not directly overlap temporally with any other development activities. The concern with any overlap is potential effect on grizzly bear and polar bear denning habitat and caribou movements. However, after all mitigation measures have been implemented, residual impacts are unlikely from the proposed program. Therefore, given the negligible project effects, no reasonable project contributions to cumulative effects are anticipated.

Specific descriptions of each activity (e.g., wellsites) in other licenses is generally not available, or in enough detail to adequately characterize those activities. Even in cases when information is available with sufficient resolution to meaningfully map and assess, the use of such data and analysis are questionable given the relatively small size of the proposed project, of the other similar projects, and the considerable distances that separate these projects.

Conventional quantitative analysis of the contribution of this proposed project to overall (regional) effects is not considered useful to the Inuvialuit, as such analysis is typically presented as a percentage contribution of project aerial coverage in comparison to a study area that is orders of magnitude larger (e.g., project contributes 0.0002% to regional loss of a vegetation type). Instead, the assessment follows a qualitative approach in which best professional judgment of experienced assessment specialists is used, supplemented by available data and community contributions of knowledge.

The zone-of-influence (ZOI) of the project residual effects remains in relatively close proximity to the proposed project (the ZOI is the distance from a project impact in which an effect on a VC remains measurable). As such, project effects are mitigated (e.g., for water quality, though plume dispersion) below measurable values before they may interact with effects from other actions.

Possible exceptions to this occur for VCs that respond to project effects, move on and then possibly interact with other activities, or for VCs that are affected by mobile actions (i.e., harvesting activities by hunters with vehicles); namely, fish, caribou, polar bear, grizzly bear, arctic fox and muskrat.

The winter timing of the project may affect grizzly and polar bear denning. Females with newborn cubs can be prematurely displaced from their winter dens by the noise, vibrations and other disturbances associated with development. However, the probability of grizzly or polar bear denning in the proposed project area is likely low and no residual impacts should occur if all mitigation measures are implemented.

The discussion above is based on known human actions in the past and present. It is likely that future actions of greatest relevance, representing a change from current conditions, are related to oil and gas exploration and development that may follow the construction of a northern gas transmission pipeline. However, the environmental implications of such a project can only be conjectured at this time, and any such discussion would not reveal any new information beyond that already known by the Inuvialuit. Further analysis based on this future scenario is therefore not considered for this project application.

13.4 Significance of Cumulative Effects

Use of appropriately constructed winter roads, collaboration and cooperation with RWED, and other discipline-specific mitigation measures (e.g., avoidance of muskrat push-ups) result in a negligible contribution of this project to cumulative effects.

At this time, there is no known indication that overall cumulative effects in the Mackenzie Delta region (i.e., by all human actions) have caused concern to environmental values or to renewable resource harvesting. Furthermore, aside from water quality and harvesting quotas for some species, thresholds representing limits of acceptable change to VCs do not yet exist against which cumulative effects can be compared. Application and adherence to land use guidelines in the CCPs in part addresses some aspects of cumulative effects in the region.

In conclusion, the project contribution to cumulative effects is not considered to be significant, and overall cumulative effects are not significant on the VCs assessed.

14 EMERGENCY RESPONSE PLANS

In the event of an emergency, EnCana's Emergency Response Plan will be followed. Copies of the plan have been provided to all regulators and reviewers may request additional copies directly from EnCana. When the final location is selected, EnCana will also conduct a complete hazard assessment and develop detailed site specific operating procedures, polices and plans.

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

Upon completion of the drilling program, the wells will be capped and suspended or permanently abandoned. All equipment, survey stakes and construction debris associated with the operations will be disposed of upon completion of drilling. The rig and camp will be de-mobilized to Tuktoyaktuk, Inuvik, Swimming Point or Lucas Point. However, if weather conditions should deteriorate ice conditions on the East Channel earlier than expected, the rig may be de-mobilized to Taglu. The access to be used, in this contingency, is identified on Figure 2. The only permanent facility planned is the wellhead, which will be above ground level, and appropriately marked, staked, and signed as per NEB regulations.

Upon completion of program operations, any equipment will be removed from the site and debris will be disposed of in an appropriate off site facility. In the summer, a follow-up inspection will also be conducted to ensure no debris was inadvertently left on-site and to better assess if, and where, any surface disturbance may have occurred. An assessment of the sump area will be conducted for three years after program completion as outlined in Section 5.4.5.

Any surface disturbance will be reported to regulators and reclamation efforts will be initiated if warranted. Effects related to surface disturbance requiring remediation would be discussed with INAC to determine the appropriate action to be taken and a reclamation plan would be established. If post program monitoring identifies any issues related to sump integrity, a remediation plan would also be established with the agreement and input of the Inspector.

16 OTHER ENVIRONMENTAL ASSESSMENT

No other environmental assessments have been conducted or submitted directly in relation to this program. EGT will be submitting a project description to the Environmental Impact Screening Committee and NWT Water Board to support its application for a water license to operate the Arctic Star barge camp.

17 PERSONAL COMMUNICATION

EnCana wishes to acknowledge John Nagy (Supervisor Wildlife Management, RWED, Inuvik, NT) and Marsha Branigan (Wolf/Bear Biologist, RWED, Inuvik, NT) for their assistance in supplying information and comments incorporated into this report

18 REFERENCES

Aklavik Inuvialuit Community Conservation Plan (AICCP). 2000. Community of Aklavik, Wildlife Management Advisory Council (NWT) and Joint Secretariat.

Amstrup, S.C. 1993. Human disturbances of denning polar bears in Alaska. Arctic. 46(3):246 250.

Amstrup, S.C. 2000. Polar Bear. In Truett, J.C. and S.R. Johnson (eds.). 2000. The Natural History of an Arctic Oilfield: Development and the Biota. Academic Press. San Diego, CA. pp 133-157.

Amstrup, S.C., G.M. Durner, I. Stirling, N.J. Lunn and F. Messier. 2001. Movements and distribution of polar bears in the Beaufort Sea. Canadian Journal of Zoology. 78:948 966.

Amstrup, S.C., G.M. Durner, T.L. McDonald, D.M. Mulcahy and G.W. Garner. 2000. Comparing movement patterns of satellite tagged male and female polar bears. Canadian Journal of Zoology. 79:2147-2158.

Argus, G.W. 2001 A guide to the identification of willows in Alaska, the Yukon Territory and adjacent regions.

Bell, K.L. and L.C. Bliss. 1980. Plant reproduction in a high arctic environment. Arctic and Alpine Research. 12(1):1-10.

Bergerud, A.T. 2000. Ecology and Management of Large Mammals in North America. In Caribou. Demarais, S. and P.R. Krausman (eds.). Prentice Hall. Upper Saddle River, NJ. 778 pp

Bigras, S.C. 1990. Hydrological regime of lakes in the Mackenzie Delta, Northwest Territories, Canada. Arctic and Alpine Research 22(2): 163-174.

Bond, W.A. and R.N Erickson. 1985. Life history studies of anadromous coregonid fishes in two freshwater lake systems on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1336. Western Region, Department of Fisheries and Oceans. Winnipeg, MB. 61 pp.

Burgess, R.M. 2000. Arctic Fox. In The Natural History of an Arctic Oil Field Development and the Biota. J.C. Truett and S.R. Johnson (eds.). Academic Press. San Diego, CA. 159-173 pp.

Case, R., L. Buckland and M. Williams. 1996. The status and management of the Bathurst Caribou herd, Northwest Territories, Canada. Department of Renewable Resources, Government of the Northwest Territories. File Report No. 116. Yellowknife, NWT.

Chapin III, F.S. and G.R. Shaver. 1981. Changes in soil properties and vegetation following disturbance of Alaskan arctic tundra. Journal of Applied Ecology 18:605-617.

Cody, W.J. 1978. Range extensions and comments on the vascular flora of the continental Northwest Territories. Canadian Field-Naturalist. 92(2):144-150.

Cody, W.J. 2000. Flora of the Yukon Territory: second addition. National Research Council of Canada. Ottawa, Ontario: NRC Research Council.

COSEWIC. 2002. Prioritized Candidate List, June 3, 2002. Committee on the Status of Endangered Wildlife in Canada.

Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. 1982. Environmental Impact Statement for Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region. Volume 3A: Beaufort Sea-Delta Setting. Calgary, Alberta.

Ecological Stratification Working Group (ESWG). 1995. A National Ecological Framework for Canada. Agriculture and Agri Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. Website: http://www1.ec.gc.ca.

Erb, J., N.C. Stenseth and M.S. Boyce. 2000. Geographic variation in population cycles of Canadian muskrats (Ondatra zibethicus). Canadian Journal of Zoology. 78:1009-1016.

Fee, E.J., R.E. Hecky, S.J. Guildford, C. Anema, D. Mathew and K. Hallard. 1988. Phytoplankton primary production and related limnological data for lakes and channels in the Mackenzie Delta and lakes on the Tuktoyaktuk Peninsula, Northwest Territories. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1614. Central and Arctic Region, Department of Fisheries and Oceans. Winnipeg, MB. 112 pp.

Ferguson, M.A.D. and F. Messier. 2000. Mass emigration of Arctic tundra caribou from a traditional winter range: population dynamics and physical condition. Journal of Wildlife Management. 64(1):168-178.

Forbes, B.C. 1992. Tundra disturbance studies, I: long-term effects of vehicles on species richness and biomass. Environmental Conservation 19(1):48-58.

Government of the Northwest Territories (GNWT). 2000. NWT Species Monitoring - Infobase. Website: www.nwtwildlife.rwed.gov.nt.ca/monitoring/speciesmonitoring/default.htm. Resources, Wildlife and Economic Development, GNWT. Yellowknife, NWT. Accessed June 2003.

Gunn, A. and F.L. Miller. 1986. Traditional behaviour and fidelity to caribou calving grounds by barren ground caribou. Rangifer, Special Issue. 1:151-158.

Harding, L.E. 1976. Den-site characteristics of arctic coastal grizzly bear (Ursos arctos L.) on Richards Island, Northwest Territories, Canada. Canadian Journal of Zoology. 54:1357-1363.

Harding, L.E. and J.A.Nagy. 1980. Responses of grizzly bears to hydrocarbon exploration on Richards Island, Northwest Territories, Canada. International Conference on Bear Research and Management 3:277-280.

Harding, L.E. 1976. Den-site characteristics of arctic coastal grizzly bears (Ursus arctos L.) on Richards Island, Northwest Territories, Canada. Can. J. Zool. 54(8):1357-1363.

Hobbie, S.E. and F.S. Chapin III. 1998. An experimental test of limits to tree establishment in Arctic tundra. Journal of Ecology. 86:449-461.

Inuvialuit Environmental & Geotechnical Inc. (IEG). 2002. Vegetation classification and wildlife habitat suitability modeling in the Mackenzie Delta Region. Calgary, AB. 66 pp. + appendices.

Inuvik Inuvialuit Community Conservation Plan (IICCP). 2000. Community of Inuvik, Wildlife Management Advisory Council (NWT) and Joint Secretariat.

Jalkotzy, M.G., P.I. Ross and E.M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Prep. by. Arc Wildlife Services Ltd. for Canadian Association of Petroleum Producers, Calgary, AB. 115 pp. + appendices.

Jelinski, D.E. 1989. Seasonal differences in habitat use and fat reserves in an arctic muskrat population.
Canadian Journal of Zoology. 67:305-313.

Jorgensen, J.C. and P. Martin. 2002. Effects of winter seismic exploration on tundra vegetation and soils. In Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska. Iverson, S. (ed.) Proceedings of NPR-A symposium, Anchorage, Alaska, April 16-18, 1997. U.S Department of the Interior, Minerals Management Service, Anchorage, Alaska. Available at: wwndo.ak.blm.gov/npra/sympos/html/paper14.html. Accessed November 13, 2002.

KAVIK-AXYS. 2002. *Cumulative Effects in the Inuvialuit Settlement Region: A Guide for Proponents.* Prepared for the Environmental Impact Screening Committee and the Environmental Impact Review Board. Inuvik, NWT.

Knight, R. R. and L. E. Eberhardt. 1985. Population dynamics of the Yellowstone grizzly bear. Ecology 66:323-334.

Knight, R. R., B. M. Blanchard, and L. E. Eberhardt. 1988. Mortality patterns and population sinks for Yellowstone grizzly bears,1973-85. Wildl. Soc. Bull. 16:121-125.

Lawrence, M.J., G. Lacho and S. Davies. 1984. A survey of the coastal fishes of the southeastern Beaufort Sea. Can. Tech. Rep. Fish. Aquat. Sci. 1220

Mackay, J.R. 1980. The origin of hummocks, western arctic coast, Canada. Canadian Journal of Earth Science. 17:996-1006.

Mackay, J.R. 1992. Lake stability in an ice-rich permafrost environment: examples from the western Arctic coast. In Aquatic Ecosystems in Semi-Arid Regions: Implications for Resource Management, Robarts R.D., Bothwell M.L. (eds). NHRI Symposium Series 7. Environment Canada: Saskatoon, Saskatchewan. 1-26.

Mackay, J.R. 1995. Active layer changes (1968 to 1993) following the forest-tundra fire near Inuvik, N.W.T., Canada. Arctic and Alpine Research. 27(4):323-336.

Mackay, J.R. 1999. Periglacial features developed on the exposed lake bottoms of seven lakes that drained rapidly after 1950, Tuktoyaktuk Peninsula area, western arctic coast, Canada. Permafrost and Periglacial Processes. 10: 39-63.

Mackay, J.R., V.N. Rampton, and J.G. Fyles. 1972. Relic Pleistocene permafrost, Western Arctic, Canada. Science. 176:1321-1323.

Martell, A.M., D.M. Dickinson and L.M. Casselman. 1984. Wildlife of the Mackenzie Delta Region. Occasional Publication No. 15. Boreal Institute for Northern Studies, The University of Alberta, Edmonton, Alberta. 214 pp.

McJannet, C.L., G.W. Argus, W.J. Cody. 1995. Rare vascular plants in the Northwest Territories. Canadian Museum of Nature. Syllogeus 73.

Messier, F., M.K. Taylor and M.A. Ramsay. 1992. Seasonal activity patterns of female polar bears (Ursus maritimus) in the Canadian Arctic as revealed by satellite telemetry. Journal of Zoology. 226:219-229.

Nagy, J.A., A.M. Veitch, M.L. Branigan, K. Zittlau, N.C. Larter, D. Cooley, B.R. Patterson, and C. Strobeck. in preparation. Defining herds within the range of 'Bluenose' barren-ground caribou in Canada's Northwest Territories and Nunavut. Journal of Wildlife Management.

Nagy, J.A., M. Branigan, A.M. Veitch, R. Popko, E. McLean, and N.C. Larter. 1999. DRAFT Co-Management Plan for the Cape Bathurst, Bluenose-West and Bluenose-East caribou herds. Northwest Territories and Nunavut. Department of Resources, Wildlife and Economic Development. Inuvik and Sahtu Regions, Inuvik and Norman Wells.

Nagy, J.A., M. Branigan, E. McLean, N. Larter, A. Veitch and R. Popko. Draft. 2001. Co management plan for the Cape Bathurst, Bluenose West and Bluenose East caribou herds, Northwest Territories and Nunavut. Department of Resources, Wildlife and Economic Development, Inuvik Region, Inuvik, and Sahtu Region, Norman Wells. 41 pp.

Nagy, J.A., R.H. Russell, A.M. Pearson, M.C.S. Kingsley and C.B. Larsen. 1983. A Study of Grizzly Bears on the Barren Grounds of Tuktoyaktuk Peninsula and Richards Island, Northwest Territories, 1974 to 1978. Canadian Wildlife Service. 136 pp.

Nagy, J.A., R.H. Russell, A.M. Pearson, M.C. Kingsley and C.B. Larsen. 1983. A study of grizzly bears on the barren grounds of the Tuktoyaktuk Peninsula and Richards Island, Northwest Territories, 1974-1978. Canadian Wildlife Service Report.

Pearson, A.M. 1975. The northern interior grizzly bear *Ursus arctos*. L. *Can. Wildl. Serv. Rept.* Ser. No. 34, Ottawa, ON.

Percy, R. 1975. Fishes of the outer Mackenzie Delta. Beaufort Sea Project Tech. Rep. 8.

Pienitz, R., J.P. Smol, and D.R.S. Lean. 1997. Physical and chemical limnology of 59 lakes located between the southern Yukon and the Tuktoyaktuk Peninsula, Northwest Territories, Canada. Canadian Journal of Fisheries and Aquatic Sciences. 54: 330-346.

Porsild, A.E. and W.J. Cody. 1980. Vascular Plants of Continental Northwest Territories, Canada. National Museum of Natural Sciences. Ottawa, ON. 667pp.

Quimby, R. 1974. Grizzly bear. *In Mammal studies in northeastern Alaska with emphasis within the Canning River drainage*. Jakimchuk, R.D. (ed). Arctic Gas Biological Report Series. Vol. 24.

Quinton, W.L. and P. Marsh. 1999. A conceptual framework for runoff generation in a permafrost environment. Hydrological Processes. 13: 2563-2581.

Rampton, V.N. and M. Bouchard. 1975. Surficial geology of Tuktoyaktuk, district of Mackenzie. Department of Energy, Mines and Resources. Ottawa, ON.

Ramsay, M.A. and I. Stirling. 1990. Fidelity of female polar bears to winter den sites. Journal of Mammalogy. 71(2):233-236.

Resources, Wildlife and Economic Development (RWED). 1999. Minerals Oil and Gas Division, GNWT. Beaufort-Mackenzie Mineral Development Area. Website: http://www.bmmda.nt.ca.

Sekerak, A.D., N. Stallerd and W.B. Griffiths. 1992. Distribution of fish and fish harvests in the nearshore Beaufort Sea and Mackenzie Delta during ice-covered periods, October-June. Environmental Studies and Research Funds Report No. 117. Calgary, AB.

Slaney, F.F. & Company Limited. 1974. 1972-74 Environmental Program, Mackenzie Delta, N.W.T., Canada. Vol. 5, Mammals. Unpublished report for Imperial Oil Ltd., Gulf Oil Canada Ltd., Shell Canada Ltd., and Canadian Arctic Gas Study Ltd., Calgary. 133 pp.

Slaney, F.F. & Company Limited. 1975. Grizzly Bear Denning Survey, Mackenzie Delta, N.W.T., Canada - Spring, 1975. Prep. for Imperial Oil

Limited, Shell Canada Limited, and Gulf Oil Canada Limited.

Slaney, F.F. & Company Limited. 1975. Grizzly bear denning survey, Mackenzie Delta, N.W.T., Canada - spring, 1975. Prepared for Imperial Oil Limited and Gulf Oil Canada Limited.

Slaney and Company Ltd. 1973. Interim Report, 1972 Environmental Field Program Taglu-Richard's Island, Mackenzie Delta, Part 2 Soils and Vegetation. Prepared for Imperial Oil Ltd. Calgary, AB.

Smith, S.L., M.M. Burgess and F.M. Nixon. 2001. Active layer and permafrost temperatures in the Mackenzie Delta, at Alert and Baker Lake in 1998. Summary Report for the CCAF Funded Project: The State of the Arctic Cryosphere during the Extreme Warm Summer of 1998: documenting cryospheric variability in the Canadian Arctic for assessing the significance of recent warming.

Svoboda, J. and G.H.R. Henry. 1987. Succession in marginal arctic environments. Arctic and Alpine Research. 19:373 384.

Taylor, A.E., S.R. Dallimore and A.S. Judge. 1996. Late Quaternary history of the Mackenzie-Beaufort region, Arctic Canada, from modeling of permafrost temperatures. 2. The Mackenzie Delta - Tuktoyaktuk Coastlands. Canadian Journal of Earth Sciences. 33:62-71.

Todd,B.J. and S.R. Dallimore. 1998. Electromagnetic and geological transect across permafrost terrain, Mackenzie River delta, Canada. Geophysics. 63(6):1914-1924.

Tuktoyaktuk Community Conservation Plan (TCCP). 2000. Community of Tuktoyaktuk, Wildlife Management Advisory Council (NWT) and
the Joint Secretariat.

Wein, R.W. 1976. Frequency and characteristics of arctic tundra fires. Arctic. 29:213 222.

Yukon Renewable Resources. 1997. Grizzly bear management guidelines. Yukon Territorial Government. Whitehorse, YT.

APPENDIX A EAST CHANNEL MACKENZIE RIVER FLOW RATE

Environment Canada has modeled daily flow values for the East Channel using water level information gathered from the Water Survey Canada monitoring station 10LC013, which is located near Lousy Point. This is the closest metering station and best represents channel flow in the vicinity of the proposed discharge location. Flow values were modeled with the One-D hydrodynamic model of the Mackenzie Delta developed by Environment Canada: Atmospheric & Hydrologic Sciences Division, Arctic Section. The model was calibrated for 1982-1995 and then validated for 1996-1999. Model results provide 'fairly good' estimates for spring (+3%) and summer (-4%), but underestimates fall (-49%) and overestimates winter (+114%) flow.

Average monthly flow values have been calculated from the 1995-2000 daily flow rate data provided by Environment Canada. Average monthly flow rates for 1995-2000 are compiled below:

MONTHLY FLOW AVERAGES FOR MACKENZIE RIVER - EAST CHANNEL

Month	1995	1996	1997	1998	1999	2000
January	482	445	631	491	456	465
February	439	424	552	511	440	428
March	424	415	522	539	424	414*
April	573	566	629	726	571	576
May	1908	1690	2455	2928	1782	1657
June	1601	2824	3591	2522	2572	2580
July	1304	2120	2467	1608	1210	2076
August	1408	2042	2223	-	-	1911
September	1372	1826	1772	-	-	1316
October	1001	1417	1473	-	-	983
November	453	510	718	-	-	538
December	452	576	483	466	422	437

Station 10LC013 1995 - 2000 (m^3/s) (rounded to the nearest full unit)
Source: Vir Khanna; Environment Canada, Atmospheric & Hydrologic Sciences Division - Arctic Section
*Lowest monthly flow average.

The lowest average monthly flow rate observed occurred in March 2000. To be conservative in estimating a minimum average discharge value for the East Channel, the lowest average monthly flow rate was halved to compensate for potential modeling overestimation of winter flow rate values. Therefore, an estimate of the minimum average discharge rate at Lousy Point is approximately 17,884,800 m^3/day in winter.

APPENDIX B PRODUCTS TO BE STORED ON-SITE

Acid soluble plug
Alcomer RD60
Alpex
Ammonium Bisulphite
API Bentonite
API Wyoming Bentonite
Asphaltic resin
Attapulgite
Barite
Biocide
Blend of Granular Flake and Fibrous Materials
Calcium Hydroxide
Caustic Soda
Cellophane/Pol-E-flak)
Chrome Free Lignsulfonate
Chrome Lignite
Chrome Lignsulfonate
Citric Acid
Defoamer
Drilling detergent
Encapsulating Polymer
Ethoxlyated Alcohol
Extreme Pressure Lubricant
Fatty Easter Lubricant
Filming corrosion inhibitor
Filtration Control Agent (Invert System)
Glass Spheres
Ground Walnut Shells
H2S Scavenger
High Molecular weight Xanthan Gum Biopolymer
High Quality Low Viscosity Grade Polyanionic Cellulose (PAC - LV)
Hydroxyethyl Cellulose
Hydtrated calcium sulphate
Large protein chain
Ligco
Lignite
Liquid low MW polyacrylate
Liquid Shale Swelling Suppressant
Liquid Viscosifier and Gelling Agent for Oil Mud
LSRV Rheology Modifier
Lubricant
Magnesium Oxide
Mica
Modified Starch
Oil Soluble resign
Oil-Wetting Agent
Olefin based ROP enhancer
Organic Surfactant Emulsifier
Organophilic Clay
Oxygen Scavenger
PHPA polymer
Polyphenolic Tannin Base Thinner
Potassium Chloride
Potassium Hydroxide
Potassium Nitrate
Premium Quality Regular Grade Polyanionic Cellulose (PAC - R)
Premium-grade, clarified xanthan gum
Resinated Lignite
ROP Lubricant
Salt (NACL)
Sawdust
Scale inhibitor organic phosphorus compound
Seepage Loss Circ, Agent
Sized Calcium Carbonate Coarse/Medium/Fine/Ground marble
Sized Salt Briding Agent
Sized salt material
Sodium Acid Pyrophosphate (SAPP)
Sodium Bicarbonate
Sodium Carbonate
Sodium Chloride
Sodium Nitrate
Sodium Silicate Dry/Liquid
Sodium Sulphite
Soya Lecithin
Starch
Sulfonated asphalt
Surfactant Cleaner
T-307 - Bleach
Technical Grade High Viscosity Carboxy Methyl Cellulose (CMC-HVT)
Technical Grade High Viscosity Carboxy Methyl Cellulose (CMC-LVT)
Technical Grade High Viscosity Sodium Carboxy Methyl Cellulose (Starch)
Variable Density Oil Base Spotting Fluid Concentrate
Viscosifier
Viscosifier Basic Emulsifier package
Wetting Agent for Oil Mud