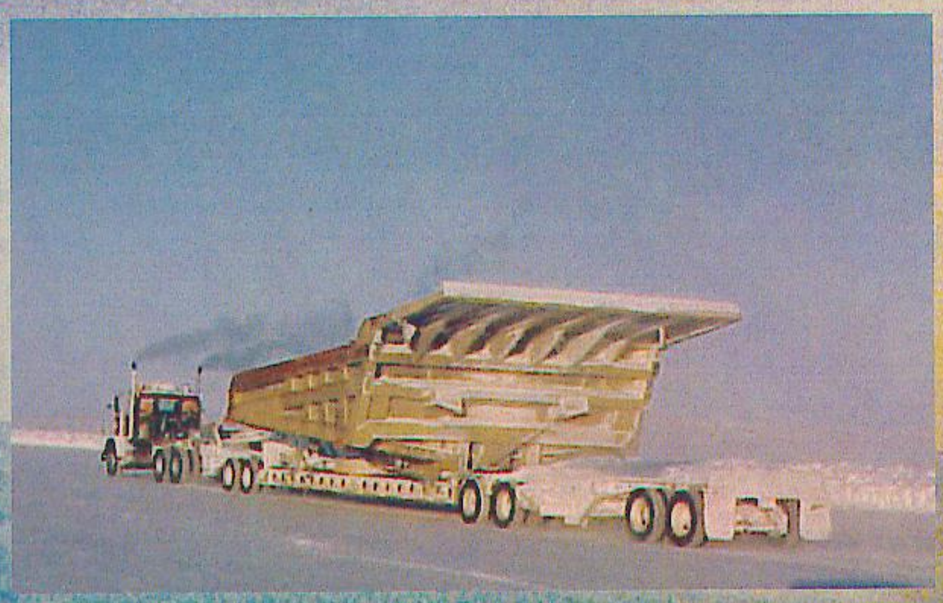
TIBBITT TO CONTWOYTO WINTER ROAD

PROJECT DESCRIPTION REPORT



TIBBITT TO CONTWOYTO
WINTER ROAD JOINT VENTURE

September, 2001

A-54890

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PROJECT DESCRIPTION
REPORT

Prepared by:

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On behalf of the

TIBBITT TO CONTWOYTO WINTER ROAD JOINT VENTURE
Yellowknife, NT

Submitted to:

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
Yellowknife, NT

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September 2001

TIBBITT TO CONTWOYTO

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TIBBITT TO CONTWOYTO WINTER ROAD
SUMMARY

Introduction

This is the "Plain English" summary of the Tibbitt to Contwoyto Winter Road Project Description Report. The Tibbitt to Contwoyto Winter Road Joint Venture (Joint Venture) produced the report with the assistance of EBA Engineering Consultants Ltd. The Joint Venture is made up of BHP Billiton, Echo Bay Mines Ltd. and Diavik Diamond Mines Inc.

The winter road is currently operated under a Licence of Occupation (LO) which expires in April 2003. The Lockhart and Lac de Gras camps operate under Land Leases that expire in 2006 and 2007, respectively. Dome Lake Camp, the gravel quarries and communications sites are run under a Land Use Permit. There is also a Quarry Permit for each of the gravel borrow sites. The Department of Indian Affairs and Northern Development (DIAND) issued and administers the present Land Leases, Quarry Permit and the LO. The Mackenzie Valley Land and Water Board (MVLWB) issued a new Land Use Permit for Dome Lake Camp and access to quarries in August, 2001.

This report has been prepared as part of the application process to renew the LO. Renewal of the LO is needed to allow the winter road to continue to operate in 2004 and thereafter. The LO regulates the general route, operation and clean-up of the winter road from year to year.

In addition to the current LO, the Joint Venture plans to apply for a separate lease for Dome Lake Camp and the communication tower sites. The new lease would be issued and administered by DIAND. At some point in the future, a Type B Water Licence may be needed for one or more of the maintenance camps. This would happen because of predicted increases in traffic on the road, resulting in the need for larger service camps. Currently though, all three camps meet the regulations that specifiy the conditions which trigger the need for water licences. The Joint Venture is looking ahead to prepare for such future needs.

This report was produced so that government, mining companies and the people of the north may look at environmental and socio-economic issues related to operating the winter road. It provides the information necessary for the environmental screening of the winter road during the re-permitting process.

The Joint Venture

The Joint Venture consists of the fully permitted and operating mining companies which currently use the road. BHP Billiton, Echo Bay and Diavik use the road to bring in supplies needed to run their mines. The road is run as a *not-for-profit* operation.

Shortly after the EKATI™ Diamond Mine began production in 1998, BHP and Echo Bay formed the Joint Venture to operate the winter road. Management of the winter road

has been undertaken by a Management Committee. Diavik has recently joined the Joint Venture. Echo Bay currently manages the day-to-day operation of the road. BHP Billiton is in charge of applying for licences and permits to operate the road and Diavik has assisted with the management of environmental baseline studies for the winter road.

Other companies that use the winter road sign annual road-use agreements with the Joint Venture. A fee per tonne per kilometre is set each year to recover the costs of operating the road from all the commercial users.

After the 2000 winter road season, the Joint Venture set-up a sub-committee to advise on safety and environmental management for the road. De Beers and Tahera are currently members of this committee along with the Joint Venture partners. To improve the usefulness of this committee, the Joint Venture recently invited the Yellowknives Dene, North Slave Metis Alliance, Dogrib Treaty 11 and the Kitikmeot Inuit Association to join the Winter Road Sub-Committee on Safety and Environment. The North Slave Metis Alliance has already agreed to join the Sub-Committee and in their letter of acceptance they stated:

> *"Your offer signifies a consistent message that it is much better 'working with us' then 'working around us'. Our relationship can only strengthen through a co-operative approach to development, and this committee hopefully can be an example of this."*

Description of the Winter Road

The winter road passes through the boreal forest south of Lockhart Lake. The forest is made up of tall, closed stands of aspen, poplar, birch and spruce trees. North of the treeline the winter road cuts through a rocky, frozen tundra landscape. On both sides of the treeline, daily temperatures often drop below -30°C during the winter months. Rain and snowfall are limited and combine to supply about 200 to 400 mm of water to the area each year. Half of that falls as snow. Cold winter conditions are needed to successfully build the road. Building and using the winter road to re-supply the mines has resulted in few environmental effects over the past 20 years. With the successful past record and proposed improvements in the construction, operation and management of the winter road, this good result is expected to continue in the future.

The winter road begins at the end of the Ingraham Trail about 70 km west of Yellowknife at Tibbitt Lake in the NWT. From there, the road is built across frozen lakes and streams for about 568 km to the Lupin Mine on the shores of Contwoyto Lake in Nunavut. A total of 495 km of the road is built on the surface of frozen lakes. Construction of the winter road typically begins in December. It is usually open for trucks hauling freight from middle to late January, to early April. On average the winter road has historically operated for about 67 days each year.

Although most of the winter road is built across frozen water, there are sections that cross low-lying areas which connect the lakes along the route. Other sections of the winter road are built through forests or the barrenlands, especially where the lakes are

further apart. These sections of overland winter road, which connect the lakes, are called portages. Portages make up about 73 km of the length of the winter road.

Current Winter Road Operations

The winter road has been used since 1982. At first, the winter road was only used to truck supplies to the Echo Bay Lupin Mine. At that time about 700 truck loads per season were transported via the winter road. For almost 20 years Echo Bay has been responsible for the operation of the winter road. In 1997, Echo Bay contracted Nuna Logistics to build and maintain the winter road. Many of the senior personnel have 10 or more years experience working and managing winter road operations. Having experienced ice road operators and technicians is essential to building and operating a safe winter road.

During the 2001 season, 8,090 truck loads of supplies were moved north via the winter road. This is double the number of loads in 2000. The continued growth of the diamond industry means that more companies may be using the winter road in the future. Based on the predicted mine lives of BHP Billiton and Diavik, it is expected that the winter road will be used for at least the next 30 years.

Based on 20 years of experience and engineering studies of the ice conditions along the winter road, there are several conditions that must be in place before the Joint Venture allows traffic to use the winter road:

- Ice must be at least 0.61 m (two feet) thick before the winter road is opened. Only trucks carrying smaller, lighter loads are allowed to use the winter road early in the season. As the ice thickens heavier loads are allowed on the winter road.
- There are a number of speed limits along the route. While travelling with a load over lakes south of Lockhart Lake the speed limit is 30 km per hour. The speed limit over lakes north of Lockhart is 35 km per hour. The speed limit going on and off lakes, and over small lakes, is 10 km per hour. All speed limits are strictly enforced.
- It is important for drivers to follow speed limits. For example, in some cases, high speeds can cause cracks in the ice.
- The number of loads travelling along the winter road at any time and traffic spacing is controlled by Dispatch in Yellowknife. The trucks usually travel in groups called convoys.
- The Joint Venture reviews and adjusts these criteria each winter based on current ice conditions.

There are three road maintenance camps operating along the winter road:

- Dome Lake Camp is located about 30 km from the southern end of the winter road. Crews who build and operate the southern part of the winter road stay at this camp. There is enough room for 30 people to stay at the camp.
- Lockhart Lake Camp is located on a peninsula in Lockhart Lake about 170 km from Tibbitt Lake. Winter road crews use the camp to maintain the equipment used on the road. In addition, transport regulations state that all truck drivers must stop for

an eight-hour rest period every fifteen hours. Drivers can eat, shower and sleep at Lockhart.

- Lac de Gras Camp is located about 350 km from the beginning of the winter road. Road crews working on the northern section of the winter road use this camp. Drivers travelling to or from Lupin or Jericho overnight at Lac de Gras camp in both directions.

Future Plans for the Winter Road

Traffic

During 2000, an average of about 71 trucks per day moved along the winter road. In 2001, this number increased to about 154 trucks per day. By 2003, an average of about 167 trucks per day are predicted to travel north to various places along the winter road. This could happen if De Beer's Snap Lake and Tahera's Jericho Diamond projects are permitted. Other projects may also develop in the future.

To help with future planning of winter road improvements, the Joint Venture has used a future number of 12,000 loads per year based on the information provided by each of the major winter road users. At this rate, an average of about 167 loads will move up the winter road each day. As use increases, continued upgrades to the winter road may be needed to maintain high standards of safety and environmental protection.

The safety of drivers and staff using the winter road and environmental protection have always been the top priorities of the Joint Venture. All drivers are required to review safety and orientation materials each year before they start north on the winter road to the mines.

Travelling over the more remote sections of the winter road can be challenging for drivers if they have an engine problem or get into an accident. The Joint Venture is improving the traffic signs along the winter road and especially on the portages. Improved kilometre markers are being installed along the winter road to help the drivers to more accurately mark their location if they need to call for help. It is important for drivers to be able to tell emergency staff, dispatchers and other drivers exactly where they are on the winter road. In addition, temporary signs are used to warn drivers where crews are flooding the winter road or where cracks waiting for repair are located.

As traffic on the winter road increases, some of the portages may need to be improved. For example, some portages may be relocated, some may be widened and gravel pads may be added to a few others. These improvements would eventually allow two-way traffic along the length of the winter road.

Camps

- Dome Lake Camp
  It is expected that an average of 20 people per day will stay at Dome Lake Camp during 2002. This number may grow to 30 by 2010. Because of this expected

increase the sewage pit may need to be expanded. Water consumption and solid waste will increase but will not approach the level of 50 people required for a Type B Water Licence. The current incinerator used at the camp will be able to handle the expected increase.

- It is expected that the amount of hazardous waste (such as batteries and used oil) produced at Dome Lake Camp will be approximately the same in 2002 as it was in 2001. These wastes will continue to be shipped to approved recycling facilities in the south.

- Lockhart Lake Camp
  In 2002 the average number of staff members at Lockhart Lake Camp is not expected to exceed 49. By 2010 the camp staff is expected to increase to 60 people. The sewage lagoon would be expanded, if necessary, to handle the increase in people using the camp. Lockhart Lake Camp will produce about 329 kg per day of solid waste in 2002. This may increase to 412 kg per day by 2010.

  By 2010, around 4,000 litres of waste oil and 250 kg of used batteries and oil filters will be produced per winter road season at Lockhart Lake Camp. This hazardous waste material will continue to be shipped south to a certified recycling facility. The amount of fuel used will increase by about 20% in 2010 compared with today's rate.

- Lac de Gras Camp
  In 2002, 47 staff will be working at Lac de Gras Camp. The size of the camp staff is expected to remain the same through 2010.

  Water consumption and sewage production will drop by nearly half in 2010 compared to 2002. This change will occur as the Lupin Gold Mine reaches the end of its expected mine life. The camp will produce about 3,600 litres of waste oil and 225 kg of used batteries and oil filters during 2002. These amounts are expected to remain about the same through 2010.

Environmental Management of the Winter Road

The Joint Venture is committed to continuously improving the operation of the winter road. Environmental management of the winter road has continuously improved over the past 20 years. These improvements continue today. Currently, the Joint Venture is up-dating the guidelines for use of the winter road to enhance the safety and environmental practices followed by the truck drivers and winter road staff.

Over the last five years, three environmental assessments have been conducted that included the winter road. Each assessment looked at the potential environmental effects of operating the winter road. These included the 1996 assessment of the EKATI™ Diamond Mine by an Environmental Assessment Review Panel, the 1998 assessment of the Diavik Diamond Project by the Canadian Environmental Assessment Agency, and the 2000 assessment of BHP Billiton's plans for Sable Pigeon and Beartooth by the Mackenzie Valley Environmental Impact Review Board. Each assessment found that no potential significant negative environmental effects from increased use of the winter road were predicted that could not be managed.

Air Quality

Trucks and maintenance equipment travelling on the winter road during the 10 weeks that it is open produce most of the exhaust emissions around the winter road. These emissions include sulphur dioxide, carbon monoxide and nitrogen oxide. Recent air quality samples taken at the Diavik site show that the air quality around the winter road is good. The levels of chemicals in the air are low and well below the guidelines set by Environment Canada.

Over the next 20 years, the number of trucks travelling along the winter road is expected to increase. However, the increased traffic on the winter road is still not expected to affect air quality in the region.

Land and Vegetation

Thirteen percent of the winter road, involving about 73 kilometres, consists of 65 overland portages. South of the treeline, narrow strips of forest between lakes have been cleared along some portages. As well, over the years, about 22 quarries have been used to supply sand and gravel for the winter road and camps. Sand and gravel have been used to build pads at the camps and on about 20% of the portages. Gravel pads make the portages more stable so that heavy trucks can pass safely over them. In total, about 55 hectares of boreal forest and 14 hectares of land and vegetation have been cleared or changed to build and maintain the winter road.

As traffic along the winter road increases the Joint Venture may need to widen, straighten and improve several portages. Such improvements will make travel safer along the route. In most cases this will also help to further protect the environment. However, to make these improvements some trees and land will need to be cleared in

some areas. More gravel and sand will also be needed to construct new or to widen existing embankment pads.

The Joint Venture is committed to minimizing the effects of any future improvements carried out. To help with the planning of future winter road improvements, the Joint Venture is in the process of making GIS-based digital maps of each of the portages and surrounding areas. This computer mapping will also include important engineering, environmental and cultural information collected at each portage during the summer of 2001. It will show important fisheries, wildlife habitat and human use sites which need to be avoided or protected.

Commercial traffic along the winter road is usually completed in early April. This is when the winter road officially closes. In past years, the general public has continued to use the winter road after it closes. Many hunters use the winter road as an easy way to locate caribou. During the spring, this non-commercial traffic has caused rutting along the winter road and has damaged vegetation on some of the portages between Tibbitt and Gordon lakes. Measurement of the tire tracks at these sites suggests that light 4x4 trucks that use the winter road after the winter road closes for the season have been causing most of the damage.

The Joint Venture will work with the regulators to close the winter road to light vehicle access following winter road closure to commercial truck traffic. Closing the winter road at certain times will address public safety concerns during construction and after the winter road season when ice conditions may not be safe. It will also limit damage to portages that has been caused by the inappropriate use of the winter road after the commercial trucking season has ended.

Aquatic Life and Habitat

Protection of the fish and aquatic habitat along the winter road is important. For generations, the Aboriginal peoples of the north have fished many of the lakes and rivers along the route. The water from the lakes drain into several large drainage basins – the Great Slave Lake and Mackenzie River Basin, the Coppermine River Basin, and the Back and Burnside Rivers Basin.

Most of the streams and wetlands that the winter road crosses freeze to the bottom during the winter. Fish living in these shallow waters swim to larger lakes for the winter. Aquatic life could be harmed if fuel oil, gasoline, antifreeze or other potentially hazardous materials are spilled into the water below the ice. Sixty percent of all goods trucked along the winter road consist of diesel fuel or other petroleum products.

The Winter Road Rules and Regulations instruct drivers on how to safely use and travel on the winter road. These strict safety guidelines are in place to prevent accidents from happening. Winter road security staff-monitor and enforce the rules 24-hours per day.

Over the last 20 years, about 38 spills have occurred along the winter road. Most of the spills have been contained by ice or snow. This material is quickly cleaned up using specialized equipment and the proven procedures outlined in the Winter Road Spill

Contingency Plan. About eighty percent of the spills experienced so far have involved diesel or other petroleum products. Most of the other spills involved dry cement or ammonium nitrate. No major petroleum product spills have occurred where fish or other aquatic life were affected.

Since the mid-1990s more trucks have been using the winter road. Records show that even though there has been more traffic, there has not been a corresponding increase in the number of spills per year. This good performance is mainly due the continual improvements that have been made to traffic management procedures and environmental management practices. As we move into the future, the Joint Venture remains strongly committed to the continued safe and clean operation of the winter road.

Wildlife and Habitat

The winter road begins in the forested area, passes through a transition zone between the trees and the barrenlands stretching from about Drybones Lake to Lockhart Lake Camp, and continues through the barrenlands north of Lockhart Lake Camp to the Lupin Mine. This large and diverse territory is the year-round or seasonal home of various kinds of wildlife. Of greatest importance are the Bathurst caribou that range throughout this land from season to season. Other important animals include bears, wolves, wolverines, various smaller furbearers, raptors (hawks, eagles), ptarmigan, waterbirds (geese, ducks) and many other small birds.

The animals that may be affected by the winter road during the operating season are those that live and move through the road corridor during the winter months. These include caribou, wolves, wolverines, foxes, lynx and marten. The winter road and its associated activities may affect wildlife in the following ways:

- animals may travel on it
- it may act as a barrier that animals do not want to cross
- animals may die because of accidents and increased hunting

Wildlife may respond to the winter road in the following ways:

- move away from the winter road because of noise
- delay crossing or fail to cross the winter road
- reduced use of habitat located close to the winter road
- become attracted to any food and garbage along the winter road or in camps that is not properly disposed of after use
- negative health effects if they drink water or eat plants that have been affected by spills
- loss of some potential denning habitat because of the use of esker material for gravel pads

The rules of the road include a number of requirements to help protect wildlife. Caribou and other animals have the right-of-way on the winter road. This means that trucks and

equipment must slow down or stop to let animals cross the winter road. Littering is not tolerated. A spill plan is in place on the winter road to ensure that any spills are properly cleaned up to protect the land, water and wildlife. Waste management at the camps has been upgraded to minimize the attraction of animals. Security staff monitor traffic speeds throughout the day and night. Officers from Resources, Wildlife and Economic Development (RWED) monitor hunters using the winter road during periods when large numbers of caribou are present.

The Joint Venture is committed to limiting disturbance to all wildlife and habitat resulting from the annual construction and operation of the winter road.

Socio-Economic Effects of the Winter Road

The winter road provides jobs and income to the northern economy. These are called socio-economic effects. In 1997-98, Echo Bay hired Nuna Logistics to build and operate the winter road. Nuna Logistics is a 51% Inuit-owned company. As truck traffic has increased on the winter road more security staff have been hired. As well, the number of dispatch and maintenance staff has been increased to match the need.

The winter road is important to the local economies of Yellowknife, N'dilo and Dettah. Many people from these communities work on the winter road. Whenever possible the Joint Venture purchases goods and services to operate the winter road from northern communities. Approximately 95% of supplies and services used on the winter road are purchased in Yellowknife. As contracts with southern suppliers end, the Joint Venture will publicly tender them. This will give more northern contractors the opportunity to work on the winter road.

Last winter, 156 employees and contract workers were employed to build and maintain the winter road during the short construction and operating period which ran from the end of December, 2000 to early April, 2001. It cost between $10,000 to $11,500 per km to operate the winter road. Currently, the winter road adds from $5.7 million to $6.5 million per year to the economies of the NWT and Nunavut.

Over the next 20 years the mining operations that use the winter road are expected to add about $1.2 billion per year to the economy of the NWT annually. Over the same time period they are predicted to contribute about $27 million to Nunavut's economy, and $309 million to the economies of the southern provinces every year. In total, operations that use the winter road are predicted to contribute about $31 billion to Canada's economy over the next 20 years.

During this same time, the mines that are expected to use the winter road are predicted to directly add about 43,000 person years of employment to the economy of the NWT and around 2,300 direct jobs to the economy of Nunavut.

Community Consultations

The Joint Venture is strongly committed to effective, open and honest consultations with all people potentially affected by the operation of the winter road. Consultations

related to the current existing and proposed new mines and the winter road have been taking place for many years. During the last year, specific consultations have been carried out between the Joint Venture, the potentially affected local communities and other stakeholders related to the winter road and the need to renew the Licence of Occupation (LO).

From these consultations and other knowledge, the Joint Venture has come to understand that many generations of northern Aboriginal peoples have used the land and waters between Tibbitt and Contwoyto lakes. Long before the winter road was first built, this large area was important hunting and trapping grounds for Yellowknives Dene, Inuit, Dogrib and Metis.
The winter road follows a traditional Yellowknives Dene travel route. This trail led hunters north to the barrenlands to hunt caribou and muskoxen, and to trap fox. Hunters would traditionally take canoes up the Weledeh (Yellowknife) River in late summer to early fall. The Yellowknives Dene called Contwoyto Lake, the "lake of many camps," because they made winter hunting camps there. This route is still used by the Yellowknives Dene, the North Slave Metis and recreational canoeists.

Inuit hunters from the West Kitikmeot traditionally hunted caribou, wolf and wolverine in an area that reached from Bathurst Inlet to Contwoyto Lake. The land around Contwoyto was an important winter camping ground. Several Inuit families still live around the lake year-round and they continue to hunt caribou, wolves and wolverines near Contwoyto and Pellatt lakes along the winter road.

During the fur trade, the Dogrib and Metis peoples travelled to the barrenlands to hunt and trap. Trapping was an important source of income into the 1960s. Yellowknives Dene, North Slave Metis and the Dogrib from Yellowknife and Snare Lake continue to hunt and trap within the area of the winter road.

The Joint Venture understands that the animals, land and water are important to northern Aboriginal peoples. Discussions are taking place between the Joint Venture and the Yellowknives Dene, Kitikmeot Inuit Association, Lutsel K'e, North Slave Metis Alliance and Dogrib of Treaty 11. The groups feel that usually they are simply asked to respond to plans created by others. To change this, the Joint Venture has invited the Aboriginal groups to join the Winter Road Safety and Environment Committee. If the Aboriginal groups choose to become committee members they will be more directly involved in making decisions on future plans for the winter road.

Aboriginal groups have raised concerns about the winter road in various environmental assessments. Yellowknives Dene elders have suggested that the winter road should be built away from traditional hunting and trapping routes.

Yellowknives Dene and North Slave Metis have stated that they should be directly involved in monitoring the winter road. Both groups are concerned that:

- more hunters will have access to traditional hunting and fishing grounds
- caribou migration may change because of the winter road
- killing or wounding of caribou will increase, wasting meat

In public discussions, residents of Lutsel K'e and N'dilo have outlined their concerns about the winter road. Some of their concerns are related to:

Monitoring and Policing
- improved monitoring of speed limits is needed
- the movement of wildlife should be studied
- possible increases in the number of spills may result from increased traffic
- drivers feeding animals at rest stops
- improper handling of garbage at camps may attract animals
- more fishing camps may be built by the public without authorization

Impacts on Wildlife
- caribou migration may change
- caribou and other animals may not want to, or be able to, cross the winter road because of increased traffic

Hunting and Trapping Issues
- some hunters are wasting caribou meat
- outfitters bringing foreign hunters to hunt wolves along the winter road
- poachers hunting wolf and caribou on the winter road at night
- would like to see 24-hour hunting check stations

Employment and Human Safety
- use the traditional knowledge of local trappers and hunters who know where the thin, dangerous ice is
- should hire local people to build winter roads
- portages are too narrow for the trucks

The Joint Venture believes strongly that community involvement needs to be an ongoing part of the winter road operation.

Conclusion

The Project Description brings together the experience of 20 years of successful operation of the winter road. In reviewing the past operation and the projections of future needs for the winter road, the Joint Venture has considered the experience of the operators, scientific and engineering data and the experience of the Aboriginal people who still actively use the winter road corridor. It is the general conclusion of this review that there are few potential environmental effects associated with the Tibbitt to Contwoyto winter road and all can be lessened or eliminated by the continued application of sound environmental management practices.

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1.0 INTRODUCTION

1.1 Purpose

This Project Description Report (Report) for the Tibbitt to Contwoyto Winter Road (winter road) has been prepared to support applications by the Winter Road Joint Venture to re-permit the existing winter road corridor and maintenance camps. The Report is designed as an issues analysis of the past, present and future operation of the winter road. It reviews past use and examines future operational requirements. Based on the known effects of winter road operations, it analyzes the existing environmental and socio-economic effects of the winter road operation and the mitigation measures that have been implemented over the last 20 years. From this direct and ongoing base of experience, predictions are made about the potential effects of the continued operation of the winter road over the next 30 years. This time-frame represents the predicted life of the winter road based on the known operating, reclamation and closure schedules for both existing and reasonably foreseeable future projects.

This analysis is intended to provide the basis for the Preliminary Environmental Screening of applications for the re-permitting of the winter road.

The winter road route is illustrated in Figure 1.1-1. An ortho-rectified satellite image of the winter road is provided in Appendix A. More detailed maps of the entire winter road are presented in the "*Tibbitt to Contwoyto Winter Road Map Book" which* accompanies this Project Description Report. The environmental setting for the winter road is provided in another supporting document entitled "*Tibbitt to Contwoyto Winter Road – Environmental Setting Report*", referenced as EBA (2001a).

1.2 Management of the Winter Road

The winter road is currently managed as a *non-profit* business by a Joint Venture between the two operating mines that use the winter road for their annual re-supply requirements – BHP Billiton's EKATI™ Diamond Mine and the Echo Bay Mines Ltd. Lupin Gold Mine. Diavik Diamond Mines Inc. has recently joined the Joint Venture. Membership in the Joint Venture is linked to the ability of the companies to be a signatory on the licences and permits, which in turn is tied to the operational status of their properties.

The current administrator of the regulatory instruments that apply to the winter road operation, the Department of Indian Affairs and Northern Development (DIAND), has requested that the Licence of Occupation be held by the permitted, operating mines. To date, the producing mines have been in the best position to assess the projected need for the winter road and to provide for its eventual closure. Their role as manager of the winter road arises from their willingness to assume the environmental liability for the operation. Diavik Diamond Mines Inc. (DDMI) recently entered the Joint Venture and will become a signatory on the regulatory instruments that govern the operation of the

winter road. BHP (now BHP Billiton) entered into the Joint Venture with Echo Bay Mines Ltd. (Echo Bay) in 1998 following the commencement of production at EKATI™. In May of 2001, the Licence of Occupation, which is the regulatory instrument that provides tenure for the operation of the winter road, was transferred from Echo Bay to Echo Bay and BHP as Joint Venture partners. Both companies have appointed senior personnel to a Joint Venture Senior Management Committee that manages the operation of the winter road. Current responsibilities are split such that Echo Bay oversees the day-to-day operation, while BHP Billiton is managing the re-permitting process (Figure 1.2-1).

Other industrial users operate on the winter road based on annual winter road use agreements signed with the Joint Venture. These include De Beers Canada Mining Inc. (De Beers), which is undergoing regulatory review and permitting for the Snap Lake property, and Tahera Corporation (Tahera), which is currently seeking permits to develop its wholly-owned Jericho Diamond project in Nunavut. After the 2000 winter road season, the Joint Venture Senior Management Committee identified the need for an advisory committee on safety and environmental management. DDMI, De Beers, and Tahera were invited to participate on what became the Joint Venture Sub-Committee on Safety and Environment.

Operation of the winter road by the industrial end-users guarantees that the people who need the winter road for re-supply are responsible for it. However, this does not necessarily address the needs and concerns of First Nations whose traditional lands are traversed by the winter road corridor. Discussions are currently underway with the Yellowknives Dene, Kitikmeot Inuit Association, Lutsel K'e, North Slave Metis Alliance and Dogrib of Treaty 11 about the possibility of their joining the Joint Venture Sub-Committee on Safety and the Environment. In this way, the potentially affected Aboriginal people would have direct access to the decision-making process for the winter road.

Membership on the Senior Management Committee itself has to date been limited to the mines that are currently in operation. The possibility of an Aboriginal Corporation acquiring equity in the winter road has been raised and is under consideration by both parties. Issues related to the operation of the winter road as a *non-profit* business and the sharing of potential environmental liability are significant. Aboriginal companies typically do not have the financial resources to shoulder equity in a break-even operation on a facility such as the winter road. However, it is recognized that the affected Aboriginal groups certainly share in the potential risks associated with the operation of the winter road.

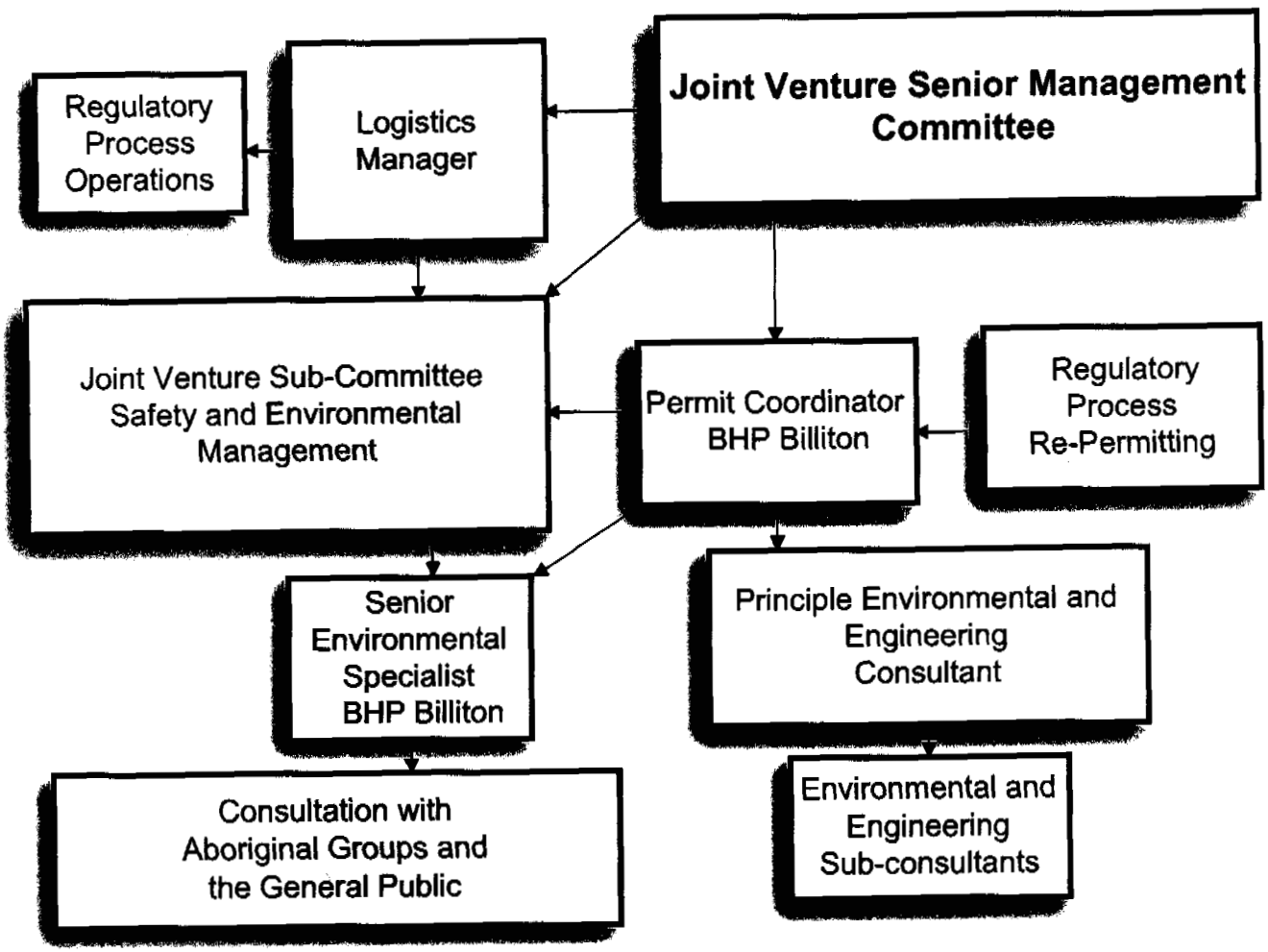

Figure 1.2-1 Winter Road Management Structure

1.3 Existing Approvals and Policies for Winter Road Use

The annual operation of the winter road and associated support facilities is approved by the Federal Government through the issuance of various licences, permits and land leases by DIAND. Table 1.3-1 outlines the primary instruments currently used for licensing the winter road and ancillary facilities.

Table 1.3-1
Existing Licences, Permits and Leases

Instrument	Holder	Administrator	Start Date	Expiration Date
Winter Road Licence of Occupation 75 M/11-1-2	Echo Bay Mines Ltd./ BHP Diamonds Inc.	DIAND	May 1, 1990	April 30, 2003
Land Use Permit MV2001X0049	Echo Bay Mines Ltd.	MVLWB	August 30, 2001	April 30, 2003
Lockhart Lake Camp Land Lease 85P/9-2-5	Echo Bay Mines Ltd.	DIAND	December 1, 1997	November 30, 2007
Lac De Gras Camp Land Lease 76D/8-1-3	Echo Bay Mines Ltd.	DIAND	April 1, 1996	March 31, 2006

The ***Licence of Occupation*** covers all aspects of construction, maintenance and operation of the winter road. This Licence is an exclusive long-term agreement between DIAND and Echo Bay Mines Ltd./BHP Billiton, that is set to expire on April 30, 2003. Terms and conditions in the Licence specify the general route of the winter road, environmental protection measures (i.e., suspension of overland travel in the event of rutting or gouging on the portages), payment amounts, clean-up requirements upon expiration of the Licence and permitted dates of operation. As a condition of the Licence, the Joint Venture is also required to present, before October 1 of each year, a comprehensive plan for the prevention and clean-up of spills of transported goods.

The ***Land Use Permit*** is supplemental to the Licence of Occupation and facilitates operation of the Dome Lake Camp, access to the aggregate borrow pits and the operation of several communications towers. A new Land Use Permit for these activities was approved by the Mackenzie Valley Land and Water Board (MVLWB) on August 30, 2001. The Permit is conditional upon receipt of a positive archaeological survey report, which is currently in preparation. The Permit also includes directives on waste removal and incineration, off-set distances from bodies of water, minimum snow cover for travel, allowable equipment, inspection frequency, camp layout, secondary containment for fuel storage, and erosion control. The Land Use Permit reiterates a number of the conditions in the Licence of Occupation, such as the requirement for a spill contingency plan and the suspension of travel on portages if rutting or gouging occurs. This Land Use Permit is for a term of two years and coincides with the expiration date of the current Licence of Occupation. Upon expiration, it is envisioned that a separate Land Lease and associated Land use Permit will be requested for Dome Lake Camp and the

communications towers sites. A Land Use Permit would still be required to facilitate operation of the quarry sites.

The two ***Land leases*** authorize the operation of the Lockhart Lake and Lac de Gras camps for the maintenance of the winter road. The leases dictate waste disposal and incineration methods, housekeeping standards, secondary containment requirements for fuel storage, inventory control and reporting methods. They also mandate that camp operations should cause no undue interference to the local drainage pattern and stress the importance of preventing spills and the migration of spilled fuel into bodies of water.

In addition to the instruments identified in Table1.3-1, ***Quarry permits*** are also required. Quarry permits are issued and administered by DIAND on an annual basis to Echo Bay. These permits authorize Echo Bay to extract predetermined quantities of sand and gravel for use on specific portage sections of the winter road. The work is subject to the conditions of the Territorial Quarrying Regulations and must be carried out in accordance with the NWT Mining Safety Ordinance. The Quarry Permit describes how the lands are to be restored at the end of each season of use and upon expiration of the permit, and specifies that a land-use inspector must approve the work. It also requires that a report be submitted by the 10th of each month detailing the amount of material quarried and the amount of material removed from each approved quarry site.

The Joint Venture directs all commercial transportation and associated activities to comply with Echo Bay Mines Ltd.'s ***Winter Road Rules and Regulations*** (Echo Bay 2000) and ***Winter Road Spill Contingency Plan*** (Echo Bay 2001).

The Rules and Regulations specify mandatory compliance requirements and expectations for all trucking companies and truckers contracted to operate on the winter road. Provisions pertain to the following conditions:

- winter clothing and equipment
- spill reporting
- speed limits
- load limits, dimensions and heavy loads
- right-of-way procedures on portages and lakes
- convoy and vehicle spacing
- littering
- drugs and alcohol
- penalties and various administrative matters.

The Rules and Regulations also outline the mandate of the winter road security system. In accordance with the rules established by Echo Bay and the Joint Venture Senior Management Committee, security personnel are responsible for traffic safety and have the authority to enforce the regulations of the winter road, including the issuance of warning tickets and/or suspending drivers from the winter road for infractions of the rules.

The Spill Contingency Plan is the primary instrument for effectively responding to any spill incident that may result from winter road traffic between the point of dispatch (Yellowknife) and the mine site(s). The plan details the notification responsibilities, first-response actions, containment, clean-up and other response procedures, and the physical equipment and human resources available to achieve effective response. The plan is tied by a Mutual Aid Agreement to other existing field and corporate response plans developed by BHP Billiton, DDMI, De Beers and Echo Bay.

1.4 Future Regulatory Approvals

As stated previously, the purpose of this Project Description is to support applications for various regulatory instruments that are required for the continued operation of the winter road. Some of the existing regulatory instruments, although requiring renewal upon expiration, are expected to remain appropriate. Others may be required because of recent changes in legislation. Table 1.4-1 summarizes the Joint Venture's understanding of the key regulatory instruments that may be required for the continued operation of the winter road beyond April 2003.

Table 1.4-1
Future Regulatory Framework

Instrument	Scope	Start Date
Licence of Occupation 75 M/11-1-2	Renewal of existing Licence of Occupation	May 01, 2003
Quarry Permits	Annually issued to permit specified quarrying activities	Annually (same as currently undertaken)
Land Use Permit	Facilitate access and operation of Quarry Sites	May 01, 2003
Land Lease 85P/9-2-5	Lockhart Lake Camp Area – Renewal of existing lease	Dec 01, 2007
Land Lease 76D/8-1-3	Lac De Gras Camp Area – Renewal of existing lease	April 01, 2006
Land Lease	Dome Lake Camp Area (new)	May 01, 2003
Land Lease (x3)	Communication Towers Area (new)	May 01, 2003
Land Use Permit	Dome Lake Camp Area (new)	May 01, 2003
Land Use Permit (x3)	Communication Towers Area (new)	May 01, 2003
Water Licence	Class "B" Licence for camp operations (new). One or more maintenance camps	Upon exceedence of 50 person camp site (if necessary
Land Use Permit	Camp operations (new)	Required to parallel water licence (if required)

1.5 Socio-Economic Significance of the Winter Road

While the winter road is run as a *non-profit* business, it's smooth, uninterrupted operation is critical to the economic future of the North Slave Region and more broadly the NWT and western Nunavut. The winter road services the producing mines, mines

currently under construction or in the permitting process and advanced exploration projects that may become mines in the near future. Further, its existence is critical to the grass roots exploration potential that is essential to the future prosperity of the NWT and western Nunavut.

At a macro-economic level, the mining and exploration operations that used the winter road for logistics support in 2001 directly contribute 34% of the GDP of the NWT and 5% of the GDP of Nunavut. Based on current estimates, the economic impact associated with operations that depend on the winter road will peak between 2008 and 2010. At that time, these operations will account for 56% and 9% of the GDP of the NWT and Nunavut, respectively. The mining operation will also draw on 10% to 14% of the annual employment available in the NWT (2,100 person-years) and about 3% of the annual employment available in Nunavut (252 person-years).

At a micro-economic level, the 8- to 10-week period of winter road operation each year provides seasonal business and employment benefits to the North Slave Region. Annual winter road construction and operating costs range from $10,000 to $11,500 per kilometre each year. This translates roughly to an annual contribution to the regional economy of between $5.7 million and $6.5 million.

In 2001, the winter road operation provided seasonal jobs for 156 people, 43% of whom were northerners. Supplies for the winter road operation and camps were purchased through Yellowknife businesses. More than 40% of the trucks contracted by the end-users to make the 8,090 winter road trips in 2001 were from northern and northern Aboriginal operators.

Currently, Nuna Logistics, a 51% Inuit-owned company, is contracted by the Joint Venture to construct, operate, and maintain the winter road and camps. Security on the winter road is provided by SECURE Check, a northern-owned and operated firm. More participation by Northern businesses in winter road and camp management activities can be expected as current contracts expire.

Effects on the traditional economies of the Yellowknives Dene, North Slave Metis and Inuit, whose traditional lands are traversed by the winter road, have been mixed. While the winter road has provided increased access for recreational hunting, trapping and fishing by non-Aboriginal people, it has also benefited traditional land users. Issues related to access are the subject of ongoing discussion with local Aboriginal groups.

The potential for adverse environmental effects from the winter road operation has been addressed in three separate environmental assessments over the last five years. The first assessment was within the context of the 1996 EARP review of the then - proposed NWT Diamonds Project (EKATI™). No significant adverse environmental effects resulting from the combined use of the winter road by Echo Bay's Lupin Mine and EKATI™ were predicted. CEAA's review of the proposed Diavik Diamond Mine in 1998 also considered the increase in traffic that would result from this new development. Once again, no significant adverse environmental effects were predicted. The potential for cumulative effects was re-assessed in 2000 when BHP Billiton's Sable, Pigeon and Beartooth proposal was reviewed by the Mackenzie Valley

Environmental Impact Review Board. In its February 2001 recommendations to the Minister of DIAND to approve the proposal, the Board identified no potential for significant adverse environmental effects associated with increased use of the winter road.

The operation of the winter road has resulted in few environmental effects to date and will continue to be managed in the years ahead to maintain and where possible improve on its past performance.

It is of note that the economic benefits resulting from winter road operation over the last 20 years have come with few environmental effects that cannot be effectively mitigated. The primary environmental issue with potential short-term consequences that requires continuing, ongoing diligence relates to future spill incidents resulting from winter road operations. Preventative measures and contingency procedures to deal with such events are addressed in Echo Bay's Winter Road Spill Contingency Plan. Operations safety and emergency response planning have also evolved to meet the challenges posed by the increased traffic on the winter road over the years.

2.0 PROJECT DESCRIPTION

2.1 General

The winter road first opened in 1982 to meet the annual resupply needs for the Lupin Gold Mine. The past decade has seen the birth and rapid expansion of a Canadian diamond mining industry centred in the Lac de Gras region. The diamond industry is now the predominant user of the winter road.

The winter road has a foreseeable future life of 30 or more years. This section addresses the changes needed in order to continue to optimize the operation of the winter road to meet projected traffic demands. The current operating methods are described along with the function of associated support facilities. Historical information on the annual operating period has been collected and analyzed with respect to its relationship to both traffic requirements and climatic conditions for the years of record. These analyses have been used to examine parameters that affect the ability of the winter road to continue to function into the future as the principal route for delivery of supplies.

Traffic projections have been generated for the foreseeable future. These have been based on the projected development of new mines, continued operations, and eventual mine closures. These projections provide a rational basis for determining a design traffic frequency. The projected maximum annual traffic volume has guided the anticipated extent of upgrades or improvements that are believed to be necessary for all aspects of winter road operations. The primary focus of the proposed system upgrades discussed in this section are traffic management, safety of ice crossings, portage reconstruction, and improvements to support infrastructure.

Successful construction and operation of winter roads in Canada can be largely attributed to accumulated experience of the respective field supervisory personnel. The Tibbitt to Contwoyto winter is no exception. It has been operated for many years by Echo Bay and, although construction and maintenance has been contracted to Nuna Logistics since 1997, many of the personnel who developed their experience with Echo Bay currently hold senior positions on the Nuna field management team.

Key individuals who are making decisions on critical aspects of winter road operations have 10 or more continuous years of direct experience on this winter road. That factor has been a key element in the ability of the contractor and the Joint Venture management team to adapt to a combination of escalating traffic demands coupled with the warmest years ever recorded in the 60 years of accumulated climatic history for the region. This section relies heavily on the operators' experience base in order to assess the current operations and to identify improvements that will be implemented to allow the winter road to meet traffic projections.

2.2 Description of Existing Winter Road Operations

2.2.1 Ice Crossings

Ice crossings make up about 495 km, or 87 %, of the 568 km route from Tibbitt Lake to Lupin Mine (Plates 2.2-1 and 2.2-2). The proportion of ice to land is lower in the southern section of the route, below the treeline, where about 137 km, or 75 %, of the ~183 km section is over ice. North of the treeline, about 357 km, or 93 %, of the ~383 km route is over ice. Table 2.2-1 summarizes the ice crossings located along the winter road corridor.

Table 2.2-1
Ice Crossing Summary for the Tibbitt to Contwoyto Winter Road

ICE CROSSING PARAMETERS		Ice Crossing Type		
		Lake	Pond*	Totals
Overall Route (Tibbitt to Lupin)	Number	55	10	65
	Length (km)	491.6	3.3	494.9
	Proportion of Ice Crossings	99%	1%	100%
	Proportion of Total Route	87%	<1%	87%
Below Treeline (southern route)	Number	35	9	44
	Length (km)	135.0	2.7	137.7
	Proportion of Ice Crossings	27%	1%	28%
	Proportion of Southern Route	73%	2%	75%
Above Treeline (northern route)	Number	20	1	21
	Length (km)	356.6	0.6	357.2
	Proportion of Ice Crossings	72%	<1%	72%
	Proportion of Northern Route	93%	<1%	93%

*** All ice crossings less than 0.5 km in length are referred to as ponds.**

Management of operations over lake ice strongly influences the overall effectiveness of the winter road throughout the operating season. A minimum ice thickness of 0.61 m (24") is generally required before the winter road is opened to light traffic. A thickness of 0.91 m (36") was adopted in 2001 as the guideline for allowing "full loads", designated as 57,000 kg (125,000 lb.) or a highway legal B-train of fuel. The winter road is operated at reduced load limits early in the season, gradually increasing to full load as the ice conditions improve. The Winter Road Superintendent, who is the most senior representative of the winter road contractor, makes decisions on allowable loads and early season speed restrictions (J. Zigarlick 2001 pers. comm.).

Speeds are limited along the route both on the ice and at the shore crossings. Normal operational speed for loaded traffic over ice is 30 km/hr south of Lockhart Lake and 35 km/hr north of Lockhart Lake. Speed limits for unloaded traffic are 10 km/hr higher than for loaded traffic. The speed limit at the shore transitions, and over lakes less than 2 km long, is 10 km/hr. Throughout the route, speed limits are posted with signs and are enforced by winter road security personnel using mobile radar units.

Plate 2.2-1 Winter Road Ice Crossings and Portages along Some of the Small Lakes Below the Treeline

Plate 2.2-2 Winter Road Ice Crossing on Lac de Gras

The spacing between loads is controlled, both between convoys and individual trucks. The dispatch centre at Yellowknife controls the size and spacing of convoys. Typically, convoys are smaller and spaced further apart in the early season. The required spacing between individual trucks ranges from 1 km in the early season to 0.5 km throughout the remainder of the season.

The primary operational challenges with the ice road after the initial opening become the control of cracking and associated maintenance of the ice surface. Excess speed can cause cracking of ice in two ways. In shallow water, either at an approach to a portage or over shoals and reefs within lakes, the hydrodynamic wave in the water under the ice generated by a vehicle can crack the ice when reflected back through the ice from the bottom of the waterbody. Such wave-induced cracks are referred to as "blowouts" (Plate 2.2-3). Over deeper water, excess speed and the associated pounding by vehicles on the ice can cause load surface failure, where blocks of ice "pop out" of the ice surface (Plate 2.2-4).

Road alignment on smaller waterbodies can be critical, with good practice forcing blow-outs to occur well away from the driving lane. To help dissipate the wave, the approach to a portage is often oblique rather than direct. Narrow bays at the end of the lakes are also avoided where practical.

Longitudinal cracking is a common feature of ice roads and they typically develop within a month of the initial clearing of snow and the opening of the winter road. These cracks form because the increased buoyant force caused by thicker ice below the driving lane, together with the weight of the snow banks acting down on the sides of the winter road, place the ice surface in tension (Plate 2.2-4). As long as these cracks remain dry, and as a result do not penetrate through to the bottom of the ice, they seldom pose a risk. However, longitudinal cracks will enhance the development of pop-outs if road speed is not controlled.

Transverse cracks initiated by blowouts most often develop near shore crossings and shoals. They are more likely to develop into "wet cracks". While wet cracks can develop naturally, it is more common that these cracks form in response to the cumulative, destructive effect of traffic traveling at excessive speed. The structural integrity of the ice has been substantially compromised if wet cracks develop. These pose an immediate risk of breakthrough. The response to wet cracks is to immediately re-route traffic and allow the crack to refreeze. Supplemental flooding is often used to repair transverse cracks.

Pressure ridges can form on large lakes through a combination of thermal contraction and expansion, and wind. These form naturally and are not related to ice road construction. Pressure ridges invariably have wet cracks and are therefore avoided by the ice road. Pressure ridges are common on Mackay Lake and Contwoyto Lake, but occur less frequently on the other large lakes. Observations by ice road operators suggest that pressure ridges occur more readily when there is little snow, a quick freeze, and considerable wind early in the winter. Experience has shown that a slow freeze in the fall will result in fewer pressure ridges.

Plate 2.2-3 Typical Ice "Blowout" Region near Shallows along Lake Shore

Plate 2.2-4 Surface Spalling "Pop-outs" at Longitudinal Cracks on Lockhart Lake

2.2.2 Portages

Portages make up about 73 km, or 13 %, of the ~568 km route from Tibbitt Lake to the Lupin Mine. The proportion of land to ice is greater in the southern part of the route. Below the treeline about 47 km, or 26 %, of the ~183 km section consists of portages. North of the treeline, about 26 km, or 7 %, of the ~383 km route is portages. Portages have been characterized into four main types as summarized in Table 2.2-2 and are discussed below.

2.2.2.1 Snow/Ice Pad

Snow/Ice pad portages are those portages where no granular material has been placed and a pad of snow and ice is built over the natural ground to provide the running surface (Plate 2.2-5). Nineteen snow/ice pad portages, with a combined length of 10.5 km, have been established below the treeline, but none are found above the treeline north of Lockhart Lake Camp. The original Licence of Occupation (1982) provided that all portages be snow/ice pads. The other types have evolved with the cooperation of DIAND to increase safety as traffic on the winter road has increased.

2.2.2.2 Embankment

Embankment portages have a continuous pad of sand and gravel placed along their length. The typical thickness of an embankment is in the range of 0.6 to 1.0 m (Plate 2.2-6). To date, nineteen embankment portages, comprising a total length of 19.6 km, have been constructed. Four are located below the treeline and 15 are found above the treeline.

2.2.2.3 Partial Embankment

Partial embankment portages have had some sand or gravel placed over the natural ground surface. However, the sand or gravel is either thin or discontinuous and does not cover the full length of the portage. Past gravel usage would suggest that the typical average thickness for a partial embankment is approximately 0.3 to 0.6 m (Plate 2.2-7). Twenty-three of the existing portages have partial embankments along portions of their 36.9 km total length. Twenty-two are located below the treeline.

2.2.2.4 Graded Surface

Portages that cross or run along a high, well-drained ridge, commonly an esker, are classified as graded portages. At these portages the ground surface has been graded to level and shape the surface but no new fill has been placed. The winter road currently has four graded surface portages. These portages have a combined length of 6.2 km and all are located above the treeline north of Lockhart Lake Camp (Plate 2.2-8).

Plate 2.2-5 Snow / Ice Cover Portage North of Gordon Lake

Plate 2.2-6 Embankment Portage North of Drybones Lake

Plate 2.2-7 Partial Embankment Portage with Snow / Ice Pad in Foreground and Embankment in the Background

Plate 2.2-8 Graded Surface Portage on the Barrenlands South of Lac de Gras

Table 2.2-2
Portage Summary for the Tibbitt to Contwoyto Winter Road

PORTAGE PARAMETERS		Portage Type				
		Embankment	Partial Embankment	Snow/Ice Padding	Graded Surface	Totals
Overall Route (Tibbitt to Lupin)	Number	19	23	19	4	65
	Length (km)	19.6	36.9	10.5	6.2	73.2
	Proportion of Portages	27%	50%	14%	8%	100%
	Proportion of Route	3%	7%	2%	1%	13%
Below Treeline	Number	4	22	19		45
	Length (km)	2.1	34.3	10.5		46.9
	Proportion of Portages	3%	47%	14%		64%
	Proportion of Route	1%	19%	6%		26%
Above Treeline	Number	15	1		4	20
	Length (km)	17.5	2.6		6.2	26.3
	Proportion of Portages	24%	4%		8%	36%
	Proportion of Route	5%	1%		2%	7%

The width of the portages south of the treeline was measured at six locations. The tree-to-tree cleared widths ranged from 8 to 16 m and averaged 12 m. The width of the winter road (tree-to-tree minus snow banks) was also measured at three locations and ranged from 8 to 12 m with an average of 9 m. On some curves, the cleared width is considerably greater than the winter road width to improve visibility.

Most portages are restrictions to truck traffic due to their narrow width, thus reducing the efficiency of overall operations. From a construction and maintenance point of view, the biggest hindrance is exposed rock and boulders that occur randomly along the route. Encounters with rocks pose problems for maintenance equipment and the associated downtime for repairs to equipment can be excessive on portages with rough, rocky micro-topography.

Portages below the treeline are the limiting factor in the operation of the winter road at the end of the season. Softening of the ice surface normally begins in late March. In particular, the route segment from the north end of Gordon Lake to Drybones Lake typically tends to deteriorate first. When this occurs, winter road traffic is restricted to night-time operations only. The effective application of this strategy can typically extend the season by a week or more. The winter road contractors have observed that late season, uncontrolled, light vehicle (public) traffic exacerbates the deterioration of the portages, because the narrow tires cause ruts in the surface on the portages. These, in turn, act as channels for runoff. There is an operational and safety need for light traffic to respect day road closures currently placed on late-season cargo traffic.

2.2.3 Camps and Associated Facilities

2.2.3.1 Setting

Currently there are three camps located along the existing winter road route that are used on a seasonal basis during the construction and operation of the winter road. The camps locations are depicted on Figure 1.1-1 and are:

- Dome Lake Camp, the most southerly camp, located at Kilometre 29 of the winter road
- Lockhart Lake Camp, located at Kilometre 170
- Lac de Gras Camp, the most northerly camp, located at Kilometre 350.

The camps represent an integral component of the overall winter road operation and provide accommodation for winter road personnel responsible for construction, operation (including traffic management) and maintenance, accommodation services, equipment repair and maintenance, and security. The Lockhart Lake and Lac de Gras camps also have rest stops for truck drivers travelling on the winter road.

Infrastructure at the camps generally includes accommodation buildings, a potable water supply, sewage treatment and disposal facilities, and solid waste incineration and disposal facilities. Other infrastructure generally includes service shops for winter road construction and maintenance equipment, communications systems, fuel storage and transfer facilities, and truck parking areas. A summary of the infrastructure associated with each camp is provided in Table 2.2-3.

The camps are generally operated between December and April annually, with the occupancy at each location varying throughout the winter road season. All camps are well maintained and operated in an environmentally sound manner by the staff associated with the winter operations.[1] The operations of the camps are regulated through various regulatory instruments administered by both the federal and territorial governments.

[1] Telephone conversation between John Clark of EBA and Mr Ken Dahl, Land Use Inspector, Department of Indian Affairs and Northern Development, 2001-04-01.

Table 2.2-3
Summary of Camp Infrastructure

	Dome Lake Camp	Lockhart Lake Camp	Lac de Gras Camp
Opening date	15 December	27 December	27 December
Closing date	15 April	15 April	15 April
Operating days	121	109	109
Typical full-time personnel	20	48	30
Estimated Trucks/day	N/A	320 – 350	17 (32 during storms)
Estimated daily water usage	6.81 m^3/day	36 m^3/day	5.66 m^3/day
Type of sewage disposal	Seepage pit	Lagoon	Lagoon
Size of pit/lagoon	18.3x11.0x2.4 m (483 m^3)	36.6x24x3.1 m (2,723 m^3)	31.0x29.3x2.3 m (2,100 m^3)
Volume of garbage/day	3 bags/1.3 m^3	35 bags/15.0 m^3	15 bags/6.4 m^3
Garbage disposal type	Combustibles are incinerated.	Burning barrel New Incinerator to be installed in 2001	Combustibles are incinerated.
Fuel storage on site	40,000 L	308,720 L	480,000 L

Note: Information is extracted from questionnaires completed by winter road operations personnel and is based on the 2001 operating season.

The primary regulatory instrument associated with the winter road is the Licence of Occupation, which, as discussed in Section 1.3, covers all aspects of construction, maintenance, and operation of the winter road. The main regulatory instruments associated with the camps are Land Leases administered by DIAND for the Lac de Gras and Lockhart Lake camps and a Land Use permit issued by the Mackenzie Valley Land and Water Board for the Dome Lake Camp.

These regulatory instruments permit the long-term operation of the camps required for the maintenance of the winter road. They include specific conditions covering waste disposal and incineration methods, housekeeping standards, secondary containment requirements for fuel storage, inventory control, and reporting methods. In addition, the NWT Public Health Act – Camp Sanitation Regulations specify requirements for the operation of the sewage treatment and disposal facilities at each camp.

DIAND Land Use inspectors enforce the terms and conditions of the Land Leases and Land Use permit by periodically inspecting the camps. Historically, the camps have been, and are currently, in compliance with all aspects of the terms and conditions of the regulatory instruments. When concerns have been identified, the camp staff have worked co-operatively with the inspectors to implement mitigative or corrective actions immediately.

2.2.3.2 Camp Descriptions

The following section provides a detailed description of the camps and associated facilities. The information provided was obtained from interviews with supervisory personnel associated with the operation of each of the camps and observations made by various members of the Joint Venture and their subcontractors during the 2001 winter road season.

Dome Lake Camp

Dome Lake Camp is located adjacent to Dome Lake at Kilometre 29 of the winter road (Figure 2.2-1). Dome Lake Camp is used primarily by personnel associated with the construction and maintenance of the winter road. Buildings on site comprise the living quarters and an equipment maintenance and service building. During the 2001 season the camp typically housed 20 personnel (up to 28 at peak times) and has the capacity to accommodate up to 30 personnel.

The water supply for Dome Lake Camp is trucked in as required from Dome Lake. Current usage is approximately 6.8 m^3/day. This is equivalent to a consumption of 341 L/occupant·day. For reference the GNWT uses a water consumption figure of 90 L/occupant·day for the design of trucked water and sewage systems. For camps with toilets and bathing facilities 132 – 189 L/occupant·day is considered within the acceptable range (Salvato 1982).

Sewage is presently disposed of in an approved pit located to the north of the new camp. The size of the pit is 18.3 m x 11.0 m x 2.4 m deep (483 m^3). With water consumption of 6.8 m^3/day, the pit has a capacity for 71 days without seepage or discharge. The pit functions as a seeping pit. There have been no reported overflows or other problems associated with the sewage system at Dome Lake Camp. The pit is located approximately 120 m from Dome Lake. The minimum required setback from a water body is 30 m according to the GNWT Camp Sanitation Regulations.

Dome Lake Camp presently generates approximately 1.3 m^3 of solid waste (garbage) per day. Combustible solid waste is incinerated in a Cyclonater CY-0120FA incinerator with a capacity of 64 kg/hour. The existing solid waste management system at Dome Lake Camp functions well.

Hazardous waste consists primarily of maintenance-generated substances including used batteries, waste oil and antifreeze. Dome Lake Camp generates approximately 1 m^3 (1,000 litres) of waste oil each year and 5 (135 kg) used batteries. All hazardous waste is hauled off-site to approved disposal facilities in the south. Before this practice was instituted, such materials were trucked to Lockhart Lake Camp for disposal in a designated landfill site.

There is also storage for approximately 40,000 litres of diesel fuel at Dome Lake Camp, which is provided by a double-wall 'Envirotank'.

Lockhart Lake Camp

Lockhart Lake Camp is located near Kilometre 170 along the winter road. It is situated on a narrow peninsula in Lockhart Lake near the tail end of an esker complex, which provides excellent foundation and site conditions for the camp site. A new accommodations camp was installed during the 2001 winter road season. In addition to its maintenance function, Lockhart Lake Camp is the designated truck stop on the winter road. All trucks are required to stop at this camp where they check in and receive renewed dispatch instructions. In addition to accommodation buildings, there are three equipment service buildings, several smaller buildings and containers used for storage and a fuel tank farm.

Duty hour restrictions (maximum 15 hour driving time) dictate that all trucks travelling from Yellowknife to the Lac de Gras area and further north require an eight-hour rest period on both northbound and southbound trips. Truckers are provided with meals and shower facilities and sleep in their trucks. This places an additional transient demand on the camp facilities during the operating season.

During the winter 2001 operating season the number of maintenance staff at Lockhart Lake Camp was typically around 48 personnel. The camp opens in late-December and closes in mid-April (roughly 109 days). In 2001[2] the maximum number of trucks through the Lockhart Lake Camp ranged from 320 – 350 trucks per day. Currently the camp does not require a water licence as the peak occupancy is less than 50 full time personnel. However, with the inclusion of transient truck drivers, the total number of persons serviced approached 235 per day.

The camp provides housing for winter road staff, maintenance facilities for winter road equipment, and fuel storage. The camp is not designed to provide sleeping accommodation for truck drivers, although meal service is provided and they use the sanitary facilities.

The camp water supply is drawn from Lockhart Lake. A new intake and 50 mm water supply pipeline was constructed to service the new camp in March 2001. Water usage is reported to be 36 m^3/day. Consumption is estimated at 103 L/occupant·day, including transient truck drivers.

Domestic sewage from the camp is initially piped to a septic tank. The effluent is then pumped from the tank to a lagoon located approximately 45 m from Lockhart Lake (minimum required setback from a water body is 30 m). The lagoon is nominally 36.6 m x 24 m x 3.1 m deep for a capacity of 2,723 m^3. With water usage of 36 m^3/day, the lagoon has a capacity for 75 days of camp operation without seepage or discharge. Seepage from the lagoon probably accounts for substantial exfiltration losses during the winter. The lagoon is pumped out each summer and the effluent is applied to the adjacent land.

[2] Questionnaire filled out by winter road supervisor.

Occasionally odours have been emitted from the lagoon. Discussions with camp staff indicate that this most commonly occurs when the tank pumps out to the lagoon, and when solids are removed from the tank, which occurs periodically. An engineering review of the lagoon was undertaken during the summer of 2001 to evaluate the current and future applicability of this system.

Lockhart Lake Camp generates approximately 15 m^3 of solid waste each day. Up to the end of the 2001 winter road season, combustible materials were burned in an oil-fired 'burning barrel'. There were no reported problems with the solid waste management system. For the 2002 season, an engineered and CSA approved incinerator will be installed to further improve combustion efficiency. Burned garbage is buried in an onsite landfill in accordance with the GNWT's Camp Sanitation Regulations.

Hazardous waste generated at Lockhart consists of waste oil, used batteries, and used oil filters. All hazardous waste is trucked off-site to approved disposal facilities. Approximately 3,600 litres of waste oil and 225 kg of used batteries are generated each year.

Lockhart Lake Camp has storage capacity for approximately 308,720 litres of diesel fuel in tanks contained within a lined secondary containment berm.

Lac de Gras Camp

Lac de Gras Camp is located near the southeast end of Lac de Gras at Kilometre 350 of the winter road (Figure 2.2-3). During the 2001 operating sseason full time staffing levels in camp ranged from 30 to 49. The camp typically opens in late-December and closes in mid-April (approximately 109 days in 2001).

The camp has maintenance facilities for winter road equipment, housing for winter road staff and fuel storage. In addition to camp accommodations, other buildings at the camp include a large equipment storage/shop building and four small storage buildings. The camp is not set up to provide sleeping accommodation for truck drivers, although they can obtain meals and use the sanitary facilities while overnighting in their trucks. The camp currently operates without a water licence, as the peak full-time occupation is below the limit of 50 personnel.

Lac de Gras Camp provides services for drivers traveling on to Lupin and Jericho. Drivers bound for Diavik or EKATI™ are generally not permitted to stay at Lac de Gras Camp. Instead, they are required to overnight at their destinations. In 2001, typically 17 – 32 trucks per day stopped at the Lac de Gras Camp. Timing of the trip from Lac de Gras Camp to the Lupin Mine is such that trucks will stop at Lac de Gras Camp on both the northbound and southbound trips. The average number of full-time and transient personnel serviced by the camp per day was 79 for the 2001 season.

The water supply is drawn from Echo Lake, a small lake near the camp. Water usage is reported to be 5.7 m^3/day. Factoring transient personnel truck drivers into the population, consumption is 120 L/occupant·day. No problems have been reported with the water system.

Domestic sewage is discharged into a lagoon constructed adjacent to the accommodations camp. The lagoon is reported to be 31.0 m x 29.3 m x 2.3 m deep (2,100 m^3). With water usage of 5.7 m^3/day, the lagoon has 368 days of storage. Lagoon effluent is pumped out in the summer and dispersed in a nearby wetlands area. Every three years the sludge is cleaned from the lagoon and buried. The lagoon is located approximately 90 m from Echo Lake.

Lac de Gras Camp generates approximately 6.4 m^3/day of solid waste. This is currently incinerated. Approximately 3,600 litres of waste oil and 225 kg of used batteries are generated each year. These wastes are shipped off-site to approved disposal facilities.

Lac de Gras Camp has a storage capacity of 480,000 litres of fuel in steel tanks on a prepared pad enclosed by a secondary containment berm.

2.2.4 Repeater Stations

Three un-manned repeater stations, located at Charlie's Hill, Mackay Lake, and the south end of Contwoyto Lake, boost the effective range of the portable radios used by all commercial users of the winter road (Plate 2.2-9). They enable drivers and security personnel along the route to contact each other, any of the camps, or the dispatch centre in Yellowknife.

Each station is equipped with a 30 m (100 foot) communications tower, a small diesel-fired generator to provide power to the station, and a 900 litre (200 gallon) above-ground storage tank. During the operating season short, seasonal access roads connect each site to the winter road.

2.2.5 Sand/Gravel Borrow Pits

A total of 29 sand and gravel pits have been identified during the period that the winter road has been in service (Plate 2.2-10). Available records suggest that granular material has been extracted from 22 of these. A summary of past gravel use is presented in Table 2.2-4. Twenty-one pits are identified in the present reference system. Four pits have been restored and abandoned (three in the NWT and one in Nunavut) and four are currently inactive but have been reclaimed.

Table 2.2-4
Summary of Gravel Pits Used to Service the Winter Road

New Pit Number	Old Pit Reference	Description	Location		Area (ha)	Volume Extracted (m^3)
			Chainage	NTS Map No.		
1	28	Dome Lake	27.8	85I/14	0.8	15,780
1A	Dome	Dome Lake Waste Rock Dump		85I/14		0
2	27A	S. End of Waite Lake	33.7	85I/14	3.1	432
3	27	N.End of Waite lake	41	85I/14	0.5	7,488
4	26	Gravel Pit Lake South	93	85P/06	4.9	4,387
5	25	Gravel Pit Lake North	97.7	85P/06	4.9	196
6	24A	Long Lake	125.1	85P/07	7.1	708
7	24C	Drybones Lake	140.5	85P/08	2.1	3,212
8	22/23	S. End of Lockhart Lake	165.4	85P/09	0.5	6,011
9	21	Portage on Warburton	220.9	75M/14	3.1	0
Released	19	S.W. End of Lockhart Lake		85P/09		2,737
Inactive	17A	Sand Bar in Warburton Bay		75M/12		0
Inactive	17	On Portage #17 Old or 48 New		75M/14		1,200
Inactive	15	1 km N. of Mackay Lake		76D/08		2,508
9A	12A	E. Side of Gravel Pit Lake		75C/05		3,104
Released	12	on Old Portage 12		76D/08		16,584
10	11	S. of Lac de Gras	332.9	76D/08	4.0	53,150
10A	12	S. of Lac de Gras		76D/08		0
11	10	Portage 55 N. end Lac de Gras	340.9	75D/08	0.5	17,030
12	9	Island N. of Portage 56	367.2	75D/09	4.5	5,431
13	8	N. End of Portage 57	388.1	75D/09	1.8	48,854
14	6	N. End of Portage 59	397.3	75D/16	3.4	6,616
15	New	S. End of Portage 60	403.3	75D/16	1.8	0
16	5	Centre of Portage 60	403.7	75D/16	1.3	15,189
17	2	N. End of Portage 63	423.3	76C/13	5.5	9,188
18	1A	S. End of Contwoyto Lake	458.2	76F/04	11.0	61,798
Released	24B	On Long Lake North		85P/07		0
Inactive	Lockhart	At Lockhart Lake Camp		86P/09		229
Released	1	On Portage 64 (Nunavut)		76F/04		0
				Totals	**60.8**	**281,833**

Available records indicate that about 280,000 m^3 of sand and gravel has been extracted for use on portages or at camps to date. Considering the length of embankment and partial embankment portages, this equates to an overall average fill thickness of about 0.5 m. The useful material remaining in the pits has not been quantified. Most of the pits have been developed in terrain where natural sand and gravel of glaciofluvial origin is present on surface. Typical landforms are eskers, outwash deposits and kames.

Bedrock has not been quarried for pad construction material to-date. Approximately 108 m^3 of waste rock from the abandoned Dome Mine has been used (current Pit 1A). The selective development of rock quarry sites is considered to be a potential supplemental source of fill materials for future construction.

2.2.6 Annual Winter Road Construction Methods

2.2.6.1 Ice Crossings

Ice thickness is the limiting factor that determines when the winter road can be opened to truck traffic. Ice growth is highly dependent on air temperature and snow cover, therefore, snow removal to enhance ice growth is the clear priority during the winter road opening phase.

Early season ice growth is monitored by coring holes in the ice to determine ice thickness using a helicopter for access (Plate 2.2-11). Once a trail is opened, continuous ice thickness surveys are carried out using Ground Penetrating Radar (GPR). The GPR antennas are towed behind either a light truck or an amphibious tracked carrier (Plate 2.2-12). There are typically two crews operating GPR equipment, one in the south and one in the north. The techniques employed to clear snow from the ice differ between the south and north sections of the route.

South Section

South of Lockhart Lake, tree cover and topographic features (i.e. hills) combine to substantially reduce drifting snow. This portion of the route also has many smaller lakes and ponds that do not develop thick ice naturally. Therefore, clearing the snow from the ice is particularly critical along that portion of the route.

The choice of vehicle and operating method on early season ice is also a critical consideration (Plates 2.2-13 and 2.2-14). ARDCO's are relatively light vehicles (5,500 kg to 6,400 kg GVW) equipped with plows that have large tires and thus apply low ground pressure. Traditionally these vehicles have been used to clear the ice in the southern section of the route. With the recent increase in traffic and several recent warm winters, even lighter equipment has been sought. Sno Cats (6,300 kg GVW), or light, track-mounted vehicles, equipped with plows, have been used selectively during the past two seasons. This equipment exerts low ice pressure but is relatively slow compared with plows mounted on all terrain vehicles such as the ARDCO.

Experience has shown that clearing the ice alone does not necessarily ensure that ice thickness objectives can be met early enough in the operating season. Flooding the ice surface to supplement natural ice development began during the 2000 operating season. During this year virtually all lakes in the southern portion of the route were flooded to enhance capacity and improve surface conditions. The flooding process is presently a labour intensive activity, employing manually operated power augers and manually deployed, gasoline powered pumps (Plates 2.2-15 and 2.2-16). When there is no traffic on the winter road, the full width can be flooded. When flooding occurs concurrently with traffic, half the width of the winter road is flooded at a time, with traffic redirected to the opposite half of the winter road. To date, confining the flooding to half the winter road width has been a challenge for the maintenance crews. As the season progresses, the objective of flooding shifts from developing ice to a maintenance activity, repairing cracked areas. Graders are used to smooth the ice surface following flooding. As the ice thickens, graders and plow trucks are also used to widen and maintain the winter road along the southern portion of the route.

The past three seasons have been the warmest winters on record in Yellowknife (EBA 2001a). The 2001 season was coupled with particularly heavy, early-season snowfall. Opening the south portion of the winter road was a particular challenge. The practice to-date has been for the winter road crew to stay in Yellowknife, and travel back and forth on a daily basis for the initial part of the winter road construction season. Options are being examined to move the crews north, into the camps, earlier in the season.

North Section

The north section of the route has a colder climate and generally larger waterbodies, with a much higher potential for snow drifting. The natural development of thick ice has generally not been a limiting factor for opening this section of the winter road early in the season. The focus along this part of the route is to open the winter road effectively so that the snow is cleared and remains cleared. If the winter road is opened only to partial width, there is a risk that wet cracks will develop at the snow banks along the sides of the winter road, freezing the snow banks in place. If the winter road is too narrow, it is prone to drifting in. Therefore, it is better to not even attempt to open the winter road until the manpower and equipment are available to open it to the full width.

Light equipment, such as Sno Cats are not well suited to opening the full width of the winter road. A grader is typically used to pioneer a single lane-width road with a light pass that does not build up significant snow banks. Approximately 0.61 m to 0.66 m (24" to 26") of ice is required to support a Cat 14G grader.

A grader working with two plow trucks has been found to be the most effective way to open the winter road once ice thickness has reached a safe threshold. This configuration of equipment can open 12 to 15 km of winter road per day. However, about 0.74 m (29") of ice is required to support the plow trucks, which weigh approximately 11,000 kg (23,500 lb.) each. With less ice, a grader working alone can open about 3 km of winter road per day. An advantage of having a grader working with the plow trucks is that a grader can travel slowly, if necessary, whereas plow trucks can not. Therefore, a grader is used on portages and ponds where protruding rocks are suspected. The removal or marking of troublesome rocks along the route facilitates the use of plow trucks.

Productivity is influenced by air temperature. Snow is harder to push when it is warmer and productivity decreases. Therefore, cold weather is desirable not only from the point of view of building ice, but also with respect to the behaviour of snow.

Trucks equipped with snow blowers are also used, but are not very efficient for opening the winter road because they are slow. They are effective at clearing drifted snow or widening the winter road, provided the banks have not frozen.

On ice, road location and width vary somewhat from year-to-year. Widths measured for this study ranged from 25 to 50 m and averaged 40 m. This is wider than is required for safe operation, but is done to allow flexibility for flooding, maintaining the driving surface, and to reduce the potential for rapid in-filling by drifting snow.

Road crews are working near the upper limit of what the ice will support, throughout the winter road opening period. Consequently, the risk of ice failure is highest at that time. Sno Cats and graders working in the early season are now equipped with "stingers", which are steel pipes projecting out from the vehicle. The intent of the stingers is to slow down the drop of the equipment through the ice, to give the operator an opportunity to escape safely.

The above procedures are applicable to the vast majority of the ice crossings. There are, however, isolated locations where flowing water requires site-specific attention. The flowing water can be due to either currents or streams below the ice, or overflow. The preferred approach is to avoid these areas once they have been identified. However, this is not always possible. Through trial and error, the operators have developed techniques to deal with site-specific problems. These techniques are currently being documented (EBA 2001b in prep.).

2.2.6.2 Portages

Portages are rough and narrow as the winter road is opened at the beginning of the season. A pad of natural snow and ice is progressively built over the existing ground surface on portages while the winter road is in operation. The existing ground surface may either be granular embankment, natural ground or graded esker. The ice pad is typically built up using a water truck and grader with a drag. However, there are locations where fills of up to 1.8 m are required. In such instances a loader or truck may be used to bring in additional snow to supplement the natural snow already present. This supplemental equipment cannot be used in the early season, when ice thicknesses are marginal.

Maintenance of portages along the southern portion of the route typically consists of periodic grading, surface flooding, and sanding of hills and difficult curves (Plate 2.2-17). Embankment portages north of the treeline typically require little maintenance and are not prone to snow drifting because they are elevated above existing tundra. If snow does accumulate and snow banks develop along the sides of these portages, the snow banks are sloped to promote the formation of long, thin drifts, which are not a significant obstacle to traffic or wildlife.

The few partial embankment portages north of the treeline are prone to snow drifting along those portions that are essentially at grade. At these locations, there is a requirement to push the snowbank back, away from the winter road (Plate 2.2-18). This reduces the potential for the portage to become blocked by snowdrifts, in a manner analogous to the wide ice roads. The snow banks are pushed up steeply to promote the formation of short snowdrifts with a vertical face. It takes steep-sided drifts a longer time to grow into the winter road. Snow banks on portages are typically pushed back with small dozers.

2.2.7 Annual Schedule and Traffic Volumes

The historic operating period for the winter road, dating to 1983, is summarized in Table 2.2-5. The number of loaded trucks travelling the winter road since 1996 has also been included. Prior to 1995, the primary winter road user was Echo Bay. Their annual requirements were less than 1,000 loads for the Lupin Mine. During this time the operating window was not determined by climate but rather by the time required to move the supplies. The winter road was no longer maintained as soon as the last load was delivered, irrespective of the weather conditions. Since 1995, ice road requirements have seen a rapid increase following the construction and operation of the EKATI™ Mine. This occurred at a time when the region was experiencing unusually warm winters. The operating window during this period (1995 – 2000) is considered to reflect current climatic realities.

Climatic records from 1944 to 2000 have been analyzed in order to establish a realistic winter road operating window for the current decade. The opening date is controlled by a combination of early winter air temperature and snowfall on the southern section of the winter road. The closing date is controlled by the thaw of portages during the long, sunny days in April. These conditions are reflected in meteorological data recorded by Environment Canada at Yellowknife as discussed in EBA (2001a). All of the data have been examined to establish an appropriate correlation between a realistic operating window and the regional climate.

A Freezing Index, expressed as degree-days below 0°C, for the key five winter months of November to March, inclusive, is shown in Figure 2.2-4. This parameter is a measure of annual winter severity for those months that directly affect the winter road season. A "best fit" trend line to the winter Freezing Index determined for all Yellowknife historical data (Figure 2.2-4) shows a clear winter warming trend (retrogressive reduction in Freezing Index) similar to that observed in the mean annual air temperature data presented in EBA (2001a.) There is a reasonable correlation between the five-month winter Freezing Index and the actual operating window for the six-year period, 1995 to 2000, shown in Figure 2.2-5. A "lower bound" fit to the data has been chosen to provide conservatism for planning purposes.

Table 2.2-5
Winter Road Historic Operating Window

Year	First Truck	Last Truck	Operating Days	Loads	Source	Comments
2001	5-Feb	15-Apr	70	8090	Nuna	Max. allowable Fuel load 137,000 lbs (Super-B)
2000	1-Feb	5-Apr	65	3959	Nuna	Max. allowable Fuel Load 125,000 lbs (B-Trains)
1999	28-Jan	31-Mar	63	1861	Nuna	
1998	19-Jan	4-Apr	76	2533	Nuna	Max. allowable loads B-trains 82,000 lbs
1997	21-Jan	15-Apr	85	3512	Echo Bay	
1996	15-Jan	15-Apr	91	1996	Echo Bay	
1995	25-Jan	13-Apr	79		BHP 1995 EIS	
1994	18-Jan	3-Apr	76			
1993	2-Feb	1-Apr	59			
1992	28-Jan	22-Mar	54			
1991	23-Jan	13-Mar	50			
1990	1-Feb	22-Mar	50			
1989	14-Feb	7-Apr	53			
1988	12-Feb	9-Apr	57			
1987						No Data (1987)
1986	14-Jan	1-Apr	78			
1985	22-Jan	7-Apr	76			
1984	30-Jan	8-Apr	69			
1983	17-Feb	14-Apr	57			
		Average	67			

Extrapolation of the trend line to the end of the decade (2010) suggests that the winter Freezing Index may decline to 3,010 C degree-days. That Freezing Index will produce a median operating window of 78 days as determined from the correlation shown in Figure 2.2-5. This is considered an appropriate median operating window over the period of anticipated maximum traffic (Section 2.3.1) that takes into account the projected climatic warming trend. Utilizing the correlation from Figure 2.2-5, the coldest winter on record (1967) would have had an operating window of approximately 105 days and the warmest winter on record (1999) would have had an operating window of 62 days. The weather trends suggest that it is unlikely that a winter as cold as 1967 will return and that winters as warm as 1999 should be expected. Therefore, for planning purposes, a realistic range for the operating window is believed to be 60 to 90 days with an estimated median of 78 days.

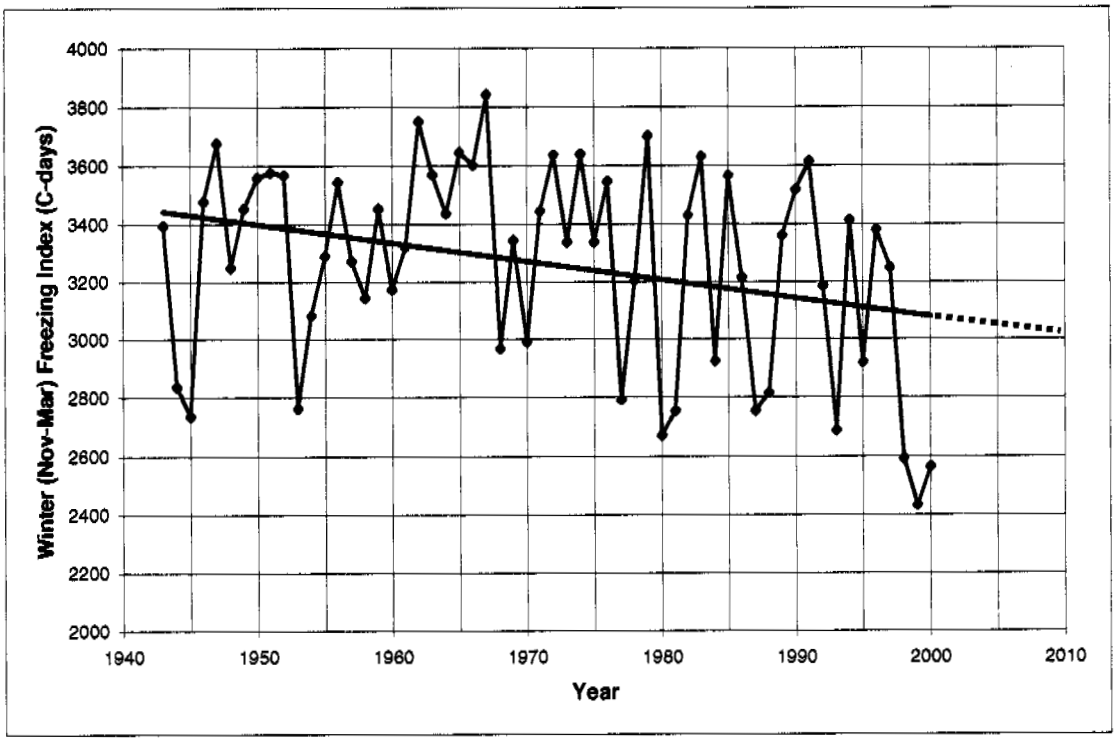

Figure 2.2-4 Freezing Index for the Months of November to March, Yellowknife Historic Data

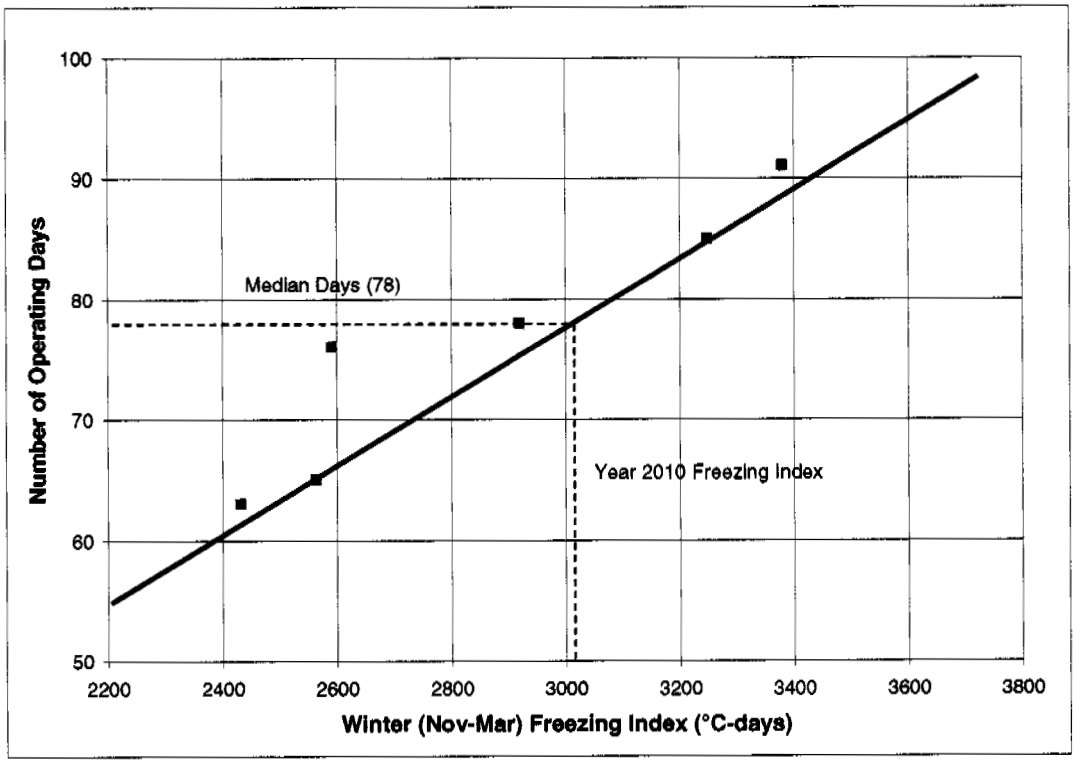

Figure 2.2-5 Relationship Between Number of Operating Days versus Freezing Index (Lower Bound Limit)

2.3 Future Plans for the Winter Road

2.3.1 Traffic Projections

The mining projects that have been identified as placing demands on the winter road into the foreseeable future are the following:

- Lupin Gold Mine
- EKATI™ Diamond Mine
- Diavik Diamond Mine
- Snap Lake Diamond Project
- Jericho Diamond Project
- Various exploration projects.

Each project is in a different stage of planning, construction, or operation. Some projects have expansion plans and all have closure plans. Each mine, or mine proponent, has provided their best available estimates of winter road usage for the life cycle of their mine, based on their currently proposed development schedules. The projected traffic frequency has been identified as one of three components; fuel supply, annual resupply of other consumables, and construction materials. The resulting traffic projections are shown by year in Figure 2.3-1, including actual load counts for the years from 1996 to present.

The total projected annual load reaches a peak of just under 12,000 in 2010 and remains stable through to 2015. The load volume then drops substantially as EKATI™ mine enters its closure and reclamation phase. A steep increase in total loads is experienced in 2004 that is attributable to planned construction of the Snap Lake Project. That project is currently in the regulatory permitting phase. Thus the timing of this next increment of volume is dependent on approvals.

A design traffic volume of 12,000 loads per year has been selected as the basis for planning future winter road upgrades. This design condition has been compared with daily cumulative traffic volumes experienced on the winter road during the past two operating seasons (2000 and 2001) in Figure 2.3-2. In a typical year, traffic volumes increase slowly at the beginning of the season, ramping up to a consistent traffic build-up that can be represented by a linear relationship with time.

Traffic volumes tend to tail off towards the end of season, as trucks are sometimes restricted to night-time use to reduce the risk of damage to the portages. The average daily throughput of trucks during the stable mid-season increased from 71 in year 2000 to 154 loads per day in year 2001. To meet the objectives of a 12,000 load season, the average daily throughput will need to increase to 167 loads per day. This target daily throughput was met or exceeded on 9 days during the 2001 season, when the maximum daily loads recorded reached 197. On many occasions, it was not exceeded because of the lack of available trucks to fill the allocated departure slots.

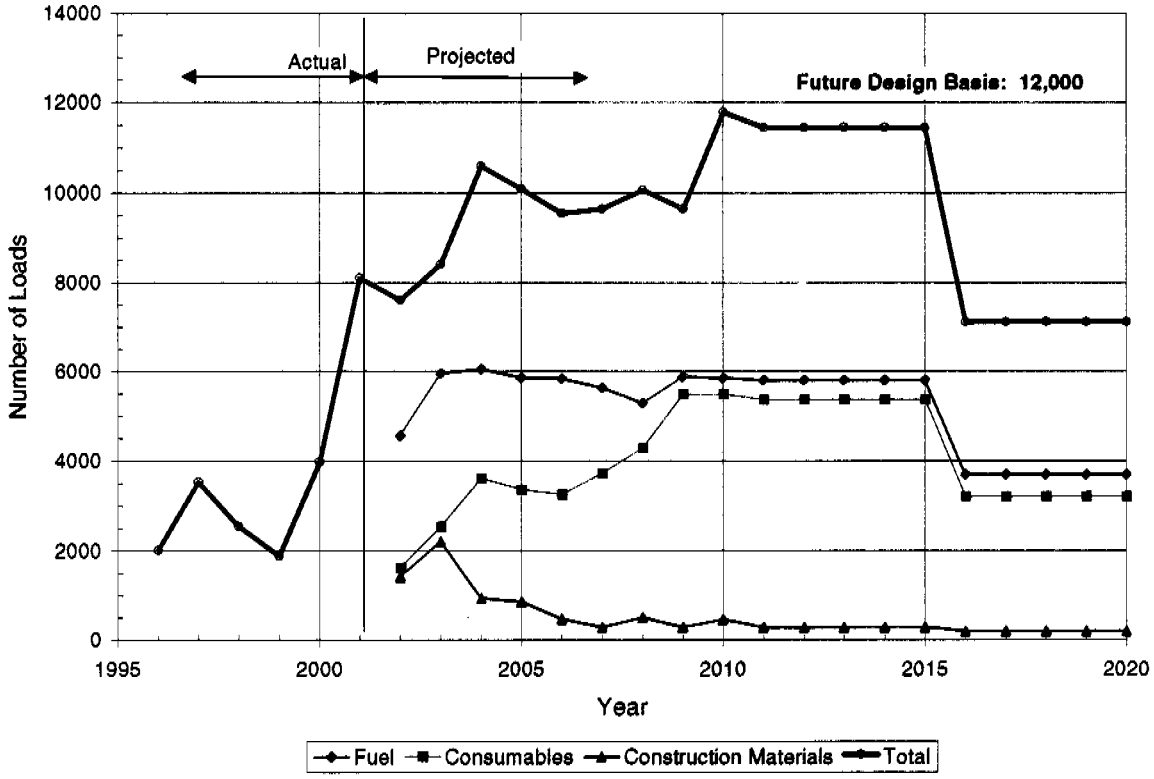

Figure 2.3-1 Historic and Projected Traffic Volumes for the Winter Road

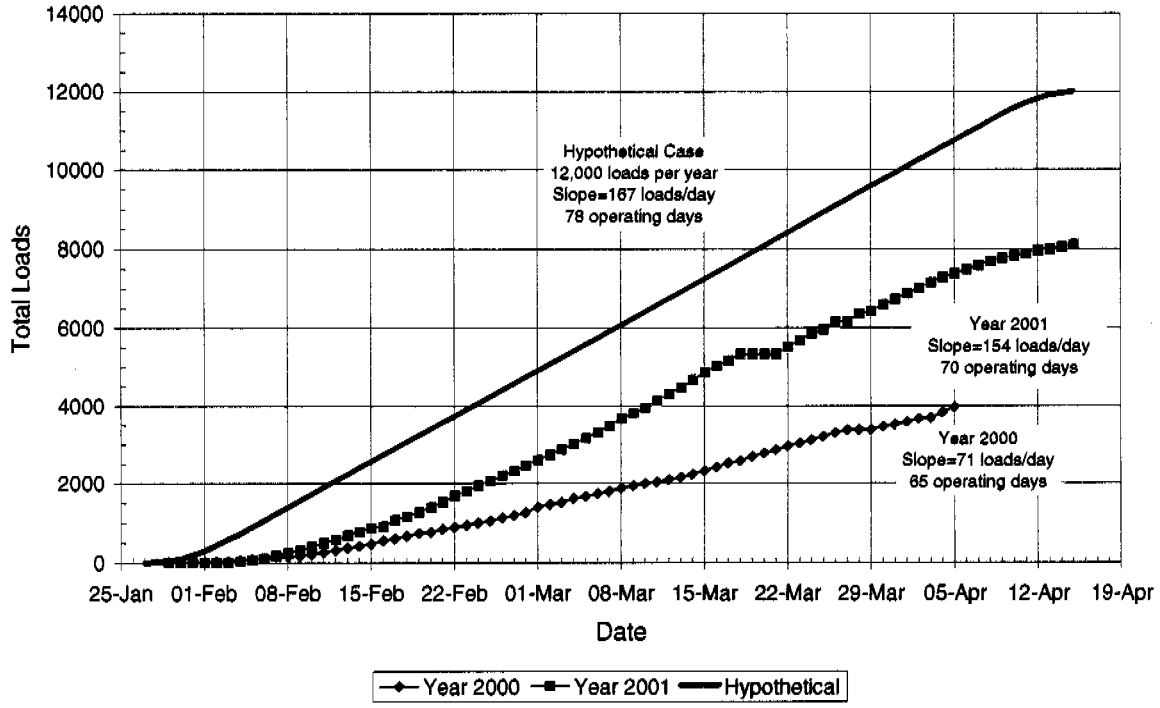

Figure 2.3-2 Cumulative Traffic Volume Projections from 2000 – 2001 and Design Load

The winter road throughput objective shown in Figure 2.3-2 required to meet the design 12,000 load season over a projected median operating year of 78 days is considered feasible, but will present a number of challenges. Operating efficiency and traffic management practices must continue to improve while the safety of those who work on the winter road remains uncompromised and can always be improved.

2.3.2 Future Plans for Camps and Related Infrastructure

2.3.2.1 General

Presently all camps operate without a water licence, as they are intended to be occupied by fewer than 50 full-time personnel. Truck drivers are not considered in the camp personnel count because they are transient and do not occupy camp beds. In the future, if it appears that full-time occupancy at either Lockhart Lake or Lac de Gras camps is likely to exceed 50 personnel, application(s) for necessary water licences will be made as required.

Daily water usage for all camps has been estimated using a consumption amount per occupant of 150 L/occupant·day. This value is mid-range of normally accepted values (Salvato 1982). It is slightly greater than present consumption values for all camps, with the exception of Dome Lake Camp. Current water consumption values provided for Dome Lake Camp seem to be anomalous.

A summary of current and projected volumes of various parameters is presented in Table 2.3-1.

Table 2.3-1
Projected Camp Usage

	Dome Lake Camp		Lockhart Lake Camp		Lac de Gras Camp	
Year	2001	2010	2001	2010	2001	2010
Occupancy*	20	35	235	294	79	44
Water Use	6.8 m^3/d	5.25 m^3/d	36 m^3/d	44.1 m^3/d	5.7 m^3/d	6.6 m^3/d
Solid Waste	1.3 m^3/d	2.3 m^3/d	15 m^3/d	21.8 m^3/d	6.4 m^3/d	4.5 m^3/d
Waste Oil	1,000 l	1,200 l	3,600 l	4,000 l	3,600 l	3,600 l
Other Hazardous Waste	135 kg	164 kg	225 kg	250 kg	225 kg	225 kg

* Includes transient truck drivers

2.3.2.2 Occupancy Predictions

Camp occupancy predictions have been compiled using traffic projections. Assumptions used include:

- Loads are hauled during a 78-day window.
- The overall average speed limit on the winter road is 25 km/hr, and it is respected.
- Driver's hours of duty regulations are observed.
- There is no change in the general usage of the camps.
- Present practices are followed.

- All trucks destined for projects north of Lac de Gras Camp stop for a rest period at Lockhart Lake Camp northbound and southbound.
- All trucks bound for Snap Lake stop for a rest period at Lockhart Lake Camp either northbound or southbound.
- All trucks bound for Lupin and Jericho stop for a rest period at Lac de Gras Camp.
- All trucks bound for EKATI™ or Diavik do not stop for a rest period at Lac de Gras Camp.

2.3.2.3 Dome Lake Camp

Occupancy
As Dome Lake Camp is used for winter road personnel only, and does not provide services to truck drivers, the future occupancy will depend on operations requirements only. Dome Lake Camp is expected to have an occupancy of 35 personnel in the peak traffic year, 2010.

Water
Water usage in 2010 is estimated to be 12 m^3/day. Current per-occupant water consumption at Dome Lake Camp (341 L/occupant·day) is considerably higher than in the other camps. This is probably partly due to the smaller occupancy of the camp, with a certain base-load of water being required for camp operations, regardless of the occupancy. However, present water consumption rates are considered to be anomalous and it may be possible to reduce water consumption in the future without compromising camp operations. Using a per-occupant consumption of 150 L/occupant·day provides a daily water usage estimate of 5.25 m^3/day in 2010. This value is below current usage.

Sewage
The sewage pit has recently been expanded.[3] The lagoon is not large enough to effectively hold the full season's sewage without some seepage losses during the winter season. Overflow is possible towards the end of the winter. This is more likely to occur as camp occupancy increases with increased winter road maintenance requirements.

Ideally, the pit would be sized to hold the entire season's sewage. However, as the pit is a seepage pit in granular soils that are probably permafrost free, it will not overflow, provided the sewage input, minus seepage, is less than the capacity. To ensure that the risk of overflow is minimized, further expansion of the disposal pit may be required in the future. The sewage level in the pit will be monitored and the pit would be enlarged if necessary.

[3] Questionnaire from road supervisor.

Solid Waste
Dome Lake Camp is projected to generate approximately 230 kg/day in 2010[4], or approximately 2.3 m^3/day at a density of 100 kg/m^3.

The incinerator presently on site has a capacity of 64 kg/hour. This system provides sufficient capacity to handle the solid wastes generated throughout the planned operating period.

Hazardous Waste
Hazardous waste volume generated is a function of maintenance operations. Dome Lake Camp will remain solely for winter road operations and maintenance personnel, thus hazardous waste generation is expected to increase with an increase in staff. The occupancy increase is expected to be 50%, however, the projected increase in hazardous waste generated will be lower, since not all personnel will be devoted to winter road maintenance operations. Hazardous waste generated is anticipated to increase by 20%. As a result, Dome Lake Camp is projected to generate approximately 1,200 litres of waste oil and six (164 kg) used batteries in the peak year of 2010. These materials will continue to be shipped to approved disposal/recycling facilities in southern Canada.

Fuel
Fuel usage will be a function of winter road operations and maintenance requirements. Fuel requirements in 2010 are projected to be approximately 20% higher than present usage.

2.3.2.4 Lockhart Lake Camp

Occupancy
Lockhart Lake Camp is projected to have a total daily occupancy of 294 in 2010. This includes camp staff, winter road maintenance crew, security staff and transient truck drivers.

Water
Lockhart Lake Camp is expected to use 44.1 m^3/day in 2010 at per-occupant water consumption rates of 150 L/occupant·day.

Sewage
The current lagoon is not large enough to hold the total volume of sewage generated in a single winter operating season. In some recent years, sewage overflow has occurred towards the end of the annual winter road season. This situation is likely to occur more frequently in the future as camp occupancy increases with increasing winter road maintenance requirements.

[4] Solid waste generation rates are based on 1996 NWT communities average generation rates.

Ideally the lagoon should store the entire season's sewage with some capacity to spare. As camp occupancy and water usage rise, the lagoon will need to be enlarged to effectively handle the projected increases in effluent volume. Lagoon levels will be monitored regularly, annual summer inspections will be carried out, and plans will be prepared for future expansion as necessary.

Solid Waste
Lockhart Lake Camp is projected to generate approximately 2,180 kg/day of solid waste in the peak year, 2010. The associated volume produced will be approximately 21.8 m^3/day.

Hazardous Waste
Hazardous waste volume generated is primarily a function of maintenance operations. As Lockhart Lake Camp has a high transient population, hazardous waste generation is expected to increase only in proportion to the number of operations and maintenance staff. The staff occupancy increase is projected to be approximately 17%. However, the increase in hazardous waste generated will be less than that, since not all staff will be devoted to road maintenance operations. The volume of hazardous waste generated is expected to increase by 10% by 2010. Thus, it is expected that Lockhart Lake Camp will generate approximately 4,000 litres of waste oil and 250 kg of used batteries and oil filters in 2010. These wastes will continue to be shipped to approved disposal/recycling facilities in southern Canada.

Fuel
Fuel usage will be a function of winter road operations and maintenance requirements. Fuel requirements in 2010 are projected to be approximately 20% higher than present usage.

2.3.2.5 Lac de Gras Camp

Occupancy
Lac de Gras Camp is projected to have a total daily occupancy of 44 personnel in 2010. This includes camp staff, winter road maintenance crew, security staff and transient truck drivers.

Water
At per-occupant water consumption rates of 150 L/occupant·day, Lac de Gras Camp is expected to use 6.6 m^3/day in 2010.

Sewage
The lagoon at Lac de Gras Camp has adequate capacity to handle sewage produced through the entire season, including projected future demand.

Solid Waste
Lac de Gras Camp is projected to generate approximately 450 kg/day of solid waste in 2010, representing a volume of approximately 4.5 m^3/day.

Hazardous Waste
The volume of hazardous waste generated increases in proportion to the number of operations and maintenance personnel, and not to the total camp occupancy. Personnel occupancy is not expected to increase, thus, the volume of hazardous waste generated is expected to remain the same as 2001 levels. Lac de Gras Camp is projected to generate approximately 3,600 litres of waste oil and 225 kg of used batteries and oil filters in 2010. Even though total camp occupancy is expected to decline, the staff complement is expected to remain about the same. These materials will continue to be shipped to approved disposal/recycling facilities in southern Canada.

Fuel
Fuel usage will be a function of winter road operations and maintenance requirements. Fuel requirements should be approximately the same in 2010 as in 2001.

2.3.3 Portage Upgrades

Portage upgrades in the form of either embankment construction or minor realignments have been undertaken in the past. Embankments have been constructed over about 27% of the overall portage length. Partial embankments cover about another 50%. Previous upgrades have been completed on somewhat of an *ad hoc* basis, with limited capital budget and typically only as time permitted at the end of the season.

The past approach to upgrades has fulfilled basic requirements to date. For the most part, today's portages are appropriate for past traffic frequencies, particularly after they are improved following the initial opening of the winter road. From the winter road builder's and maintainer's point of view, the greatest difficulty with the portages in their present form is protruding rocks. This impediment is being dealt with in the same way as past upgrades, gradually and as time permits.

As traffic volumes increase, operation of the winter road will need to be optimized. Upgrades to portages will be one facet of this optimization. The *status quo* will not suffice for continued safe operations at the projected design traffic frequency. Portage upgrades would be intended to achieve the following:

- improved safety
- security of supply, with less winter road closure risks due to accidents
- earlier opening because available equipment and forces could focus on time-critical ice crossings
- reduced overall cycle times by expansion to allow two-way traffic
- reduced annual maintenance costs to both trucks and winter road maintenance equipment
- reduced environmental risks through reduced potential for roll-overs
- reduced drift accumulation, hence quicker opening following storms.

The requirements of each portage were reviewed to develop a systematic approach to proposed upgrading. The requirements were then categorized as being of high, medium

or low priority. The proposed upgrades have been categorized as either upgrades or realignments in Table 2.3-2. Upgrades refer to the placement of additional embankment material and/or portage widening. In addition to achieving the objectives set out above, it is anticipated that this will go a long way toward alleviating the problem of protruding rocks. Realignments would involve finding a new route to replace the existing portage and then building a granular embankment to current standards.

Table 2.3-2
Summary of Proposed Portage Upgrades

Portages	High Priority		Medium Priority		Lowest Priority	
Proposed Upgrades/Realignments	**Number**	**Length (km)**	**Number**	**Length (km)**	**Number**	**Length (km)**
Below Treeline Upgrade	4	9.4	19	19.0	9	7.3
Above Treeline Upgrade	3	8.8	9	8.1	7	4.3
Below Treeline Realignment	4	7.4	8	3.1		
Above Treeline Realignment			1	4.7		
Totals	11	25.5	37.0	34.9	16	12.0

The following assumptions were made for the purpose of quantifying the implications of the proposed upgrades summarized in Table 2.3-2.

- Upgraded portages or realigned portages would have a cleared road top of 10 m and a cleared tree-to-tree width of 15 m.
- Embankment side-slopes would be at 2 horizontal to 1 vertical.
- Portages that are graded eskers would receive a nominal, average thickness of 0.1 m of granular material.
- Portages presently classified as embankments would receive an average thickness of 0.3 m of additional granular material.
- Portages presently classified as partial embankments would receive an average thickness of 0.6 m of additional granular material.
- Portages that are to be realigned would receive an average thickness of 0.9 m of granular material.
- There would be no fill material placed on beaches or in lakes.

Note that the assumptions are used only to develop estimates. Not all portages will require this amount of fill to meet the objective. Also note that the plans presented remain conceptual. All future portage upgrades will ultimately be completed at the discretion of the Joint Venture.

Minor upgrades can be completed either before or after the primary trucking season when the tundra is frozen. For larger upgrading activities, one proposal (J. Zigarlik 2001 pers. comm.) is to locate equipment and stockpile granular material during the winter,

then return to the site to complete the work in the summer. This would require a temporary camp or daily commutes by aircraft.

The maximum amount of granular material required would be 420,000 m^3 if all of the proposed upgrades were carried out in accordance with the assumptions stated above. While the total quantity of granular material available in pits is not known, it is believed that available quantities are limited, at least along the southern portion of the route. Therefore, it should be anticipated that the majority of the granular material along the southern portion of the route will have to be produced by quarrying and crushing bedrock. This does not present a technical or logistical constraint because potentially suitable quarry sites are numerous along the route. Quarried products are likely to be more resistant to erosion during runoff and may therefore be operationally superior to the generally sandy material that has been extracted from pits in the past. Eskers are more prevalent along the north half of the route. Thus, existing or new pits can likely meet the future requirements for granular material in this area. Sensitivities to the development of any new borrow pits in esker terrain are recognized and will be thoroughly evaluated prior to application for a new quarry permit.

2.3.4 Ice Crossing Operations

A new set of operating guidelines for ice crossings is currently being developed by the Joint Venture and will be in place for the 2002 season (EBA 2001b in prep.). The revised guidelines will document acceptable practice for safe operations over lake ice. The guidelines will address the following principal elements of the operation:

- Allowable load/ice thickness relationships that take into account the type of trucks currently using the winter road.
- Integration of operating experience with current analytical predictive capability.
- Rationalization of speed restrictions and truck spacing.
- Mitigation measures for secondary effects such as cracking and blowouts that can affect safety of the operation.
- Early season winter road opening and route location.
- Snow management.
- Surface maintenance by flooding.
- Ice condition monitoring.

The process was initiated at the beginning of the 2001 winter road season. Engineers knowledgeable in ice mechanics worked with the winter road contractor to document their collective experience pertinent to operations over the ice crossings along the winter road.

Operation of the ice road has many interdependent variables that require field decisions that impact the safety of winter road users and throughput of the winter road. Critical field decisions that must be made during the course of the operating season include:

- safety of the winter road equipment operators during the critical opening phase.
- acceptable ice thickness for initiating trucking operations.

- acceptable ice thickness for full loads.
- acceptable ice thickness for overweight, mid-season loads.
- local speed restrictions for regions of fractured ice.
- moving to night-time travel restrictions.
- traffic suspension for emergencies.

The intent of the ice guidelines currently in preparation is to provide the necessary technical guidance required by operations personnel to make these critical decisions. Accurate and up-to-date ice loading guidelines are essential to aid in managing the increasing traffic frequency predicted.

Guidelines for vehicle operation over lake ice have been published by the GNWT Department of Transportation (1996). Although these are updated periodically, the procedures for determining acceptable ice thickness for loaded vehicles still refer to research published by Gold in 1971 (Gold 1971). The methodology developed by Gold for practical determination of ice capacity remains sound, however the nature of the vehicles driving on ice has changed substantially in the intervening 30 years. The Gold formula was developed for 3-axle logging trucks and gravel trucks operating over ice less than 1 m in thickness. The modern duel-trailer B-train fuel haulers that are the prime users on the winter road, spread their load over seven axles (or eight axles in the case of Super B-trains). These long trucks substantially reduce the stress exerted on the underside of the ice sheet, when compared with typical three-axle gravel trucks of the same gross vehicle loading. Work to-date has shown that allowable gross vehicle loads can be increased by approximately 50% for comparable ice thickness over those determined by the GNWT guidelines without compromising safety, provided appropriate controls are exerted over vehicle configuration and speed.

Speed restrictions must be adopted and enforced to limit damage to the ice sheet by the hydrodynamic wave that is set up in the water below the ice. Studies have shown that there is a "critical speed" at which amplification of deflection and stress occurs that is dependent upon speed and water depth. Ice deflection measurements carried out on the winter road at Gordon Lake by Sandwell (1995), showed that for water depths less than 10 m there was a high probability that the posted speed limit will be at or near the critical speed. Experience with operation of the winter road has confirmed that critical speed effects can have unpredictable consequences along shorelines of the many shallow lakes and at locations where the current alignment crosses a shallow sub-surface bar or shoal. The ice can be unstable in these regions, as the pressure from the hydrodynamic wave is concentrated, fracturing the ice. These regions of broken ice, termed "blowouts", often do not heal as repetitive traffic continuously pulses the ice sheet from below.

A bathymetric survey of portions of the winter road centreline was completed in April 2001 using a through-the-ice radar system. The survey line will be precisely located for plotting in a Geographic Information System (GIS). The data will characterize locations along the current route (2001) on lake ice that are particularly susceptible to speed-related damage. The objective is to optimize future route location over lake ice and to review the current approach to setting speed limits. One option being considered is to

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adopt a variable speed limit that depends on conditions which could increase safety and, at the same time, reduce overall cycle time. Ice-related parameters pertaining to future winter road operations are being documented in EBA 2001b (in prep.).

2.3.5 Traffic Management Practices

Traffic management has many controllable components, which together represent the most significant factor that determines throughput of the winter road. The current system of winter road rules and traffic management has evolved during past years in response to increasing traffic demands. Improvements will continue to be required in order to meet design traffic projections (Section 2.3.1).

Traffic management affects the following inter-related winter road operational parameters:

- Safety, as reflected in the numbers of accidents, associated delays and winter road closures.
- Cycle time required for a round trip to deliver the supplies to the respective mines.
- Capacity utilization, as determined by meeting the truck dispatch objectives.

The following identifies the potential improvements in each of the above parameters that are being examined for future implementation.

2.3.5.1 Safety

Safety is a prime consideration for the Winter Road Joint Venture Operating Group, their contractors, and the winter road users. The requirement for improved driver education has been identified and it has been suggested that all drivers on the winter road be required to participate in a more formal orientation session, analogous to the types of safety orientations all personnel are required to attend upon arrival to most mine sites. The orientation would result in certification as a winter road operator.

It is essential that all commercial users on the winter road have effective communications with other traffic. Communications were improved in the 2001 season with the requirement that all trucks be equipped with radios programmed to a dedicated frequency. Options for further improving communications along the winter road are being evaluated.

Drivers need to be able to easily communicate their location on the winter road. This will be enhanced with improved and permanent signage at all portages and establishment of a system of kilometre post markers. In addition, temporary signage that alerts drivers to dangers such as maintenance operations like flooding will be improved. Signage for winter road conditions requiring particular attention, such as blind curves and hills are being provided.

Speed limits will be reviewed from an ice behavior perspective and with respect to operational feasibility. This is a complex and potentially controversial issue that must

carefully consider elements of safety, enforcement, environmental protection, and value-added to the operation. The role of the winter road security policing function should be modified to more of a safety support function that the drivers view as a benefit, rather than strictly as an enforcement agency to be avoided.

The interaction of truckers with light vehicle traffic belonging to the general public can pose a safety hazard, particularly early in the season when portages have not been fully prepared. A system for restricting public use with a checkpoint in the early part of the season, and more education of the general public concerning the hazards related to using the winter road, is being considered by the Joint Venture.

2.3.5.2 Cycle Times

Cycle times have economic implications for both the end users of the winter road and the respective trucking companies. A decrease in cycle time reduces the total number of trucks required to complete the annual haul. From the point of view of operators contracted to haul on the winter road, cycle times are directly tied to their operating costs.

Cycle times are dependent on the average speed along the route. Speed over ice is a significant operational parameter. Improvements to portages to permit two-way traffic throughout will reduce delays on the southbound trip Improvements will also reduce the need for speed reductions at presently difficult areas where sight distances are limited. Improved alignments on land and ice to avoid obstacles will also help contribute to higher overall average speed.

2.3.5.3 Capacity Utilization

Other infrastructure upgrades will also be needed in order to meet forecast increases in traffic volumes. There were over 5,000 unused departure slots during the 2001 operating season, excluding weather-related delays and other winter road closures. The number of available trucks will need to increase, as well as storage and parking facilities. In the 2001 season, infrastructure in Yellowknife and points south was challenged to meet demand when the winter road was operating at capacities over 160 loads per day. In particular, there was a shortage of suitable temporary parking for trucks waiting to go on the winter road. In addition, fuel needed to be hauled directly from southern refineries as local fuel supplies became depleted by the demand.

The Ingraham Trail connection to Tibbitt Lake also represents a limiting constraint. Some drivers have expressed the opinion that this segment poses a significant safety risk. In the short term, a reduction in the speed limit for commercial traffic may be required. In the medium term, the GNWT will be encouraged to support future upgrading of the Ingraham Trail to meet the projected needs of the winter road.

2.3.6 Reclamation Planning

Reclamation planning represents an integral component of a sound environmental management system for any development. The Joint Venture is committed to achieving a number of goals for the progressive reclamation of abandoned portage alignments and the eventual reclamation of the entire winter road and associated facilities. The goals include:

- providing conditions for the natural re-establishment of indigenous vegetation and productive habitat for wildlife
- terrain stability enhancement
- protection of lakes and streams.

In addition to the Joint Venture's goals, the Licence of Occupation and Land Use Permit for the winter road specify reclamation conditions that must be met by the licensee. These conditions include, from the Licence of Occupation:

> *"The licensee shall remove from the licence area all buildings, machinery, equipment, materials, fuel drums or other storage containers upon the expiry of the licence, unless otherwise directed by the Director."*

From the Land Use Permit:

> *"The Permittee shall complete all clean-up and restoration of the lands used prior to the* expiry date of this permit."

Progressive reclamation will be undertaken for any existing portages abandoned as a result of the establishment of new portage alignments.

During the final abandonment phase, fill embankments, borrow pits, and camp sites will be re-contoured and scarified as required to ensure surface stability and to facilitate the re-establishment of native vegetation.

With the application of the broad suite of available reclamation measures, the Joint Venture is confident that reclamation goals for the winter road can be effectively achieved.

3.0 ENVIRONMENTAL PROTECTION AND MANAGEMENT

3.1 Approach to Environmental Management

The Joint Venture is committed to constructing, operating and maintaining the winter road in a safe and environmentally responsible manner. Inherent in this commitment is a desire to continuously improve the operation of the winter road. The environmental record of the winter road over the past 20 years is sound, but there is room for improvement, particularly in light of the steadily increasing levels of commercial traffic that the road is servicing.

Continuous improvement is a process of using available information and experience to refine management policies and field practices to make the most appropriate decisions that define how the winter road will be constructed, operated and maintained in the future. Environmental management of the winter road has continuously improved over the past 20 years as the operation of the winter road has changed. Initially the winter road serviced one mine, with a throughput of approximately 700 truck loads. In comparison, in 2001, total throughput was 8,090 truck loads. The environmental management system must continue to evolve with the continued future operation of the winter road.

Currently the Joint Venture is working towards formalization of the existing environmental management system. The environmental framework for managing the winter road has been relatively informal in the past. Formalization will result in a clearer, more concise, and integrated approach to documenting the way in which the winter road is operated. This Project Description provides preliminary direction on the approach that will be taken by the Joint Venture. Formalization of the environmental management system will also provide a mechanism to ensure that all of the appropriate plans, procedures, and policies have been developed and implemented to address potential environmental effects. It is intended that the international standard, ISO 14001 will be used as a guideline to formalize the environmental management system for the winter road.

The existing framework for environmental management consists of:

- Applicable Echo Bay, BHP Billiton and DDMI policies.
- Regulatory instruments that define environmental terms and conditions. These instruments include the Licence of Occupation (LO), the leases for Lockhart Lake and Lac de Gras camps, various Quarry permits, and the Land Use Permit that authorizes activities at Dome Lake Camp and any active quarry.
- An integrated Spill Contingency Plan. The Winter Road Spill Contingency Plan was extensively updated this past year to reflect the substantial increase in the volume of traffic using the winter road that is being experienced as a result of growing diamond mining exploration and development activities in the Lac de Gras region.

- Winter Road Use agreements signed by all commercial users, that acknowledge acceptance of the rules and responsibilities set by the Joint Venture to promote a safe and environmentally sound operation.
- Agreements signed by contractors working on behalf of the Joint Venture to operate the maintenance camps, provide dispatch services, and maintain the winter road right-of-way. These agreements outline the requirements of the contractor(s) to ensure that the intent of terms and conditions in the applicable regulatory instruments are fulfilled.
- "Winter Road Usage Rules" that must be agreed to and signed by all commercial drivers as a condition of traveling on the winter road. These rules include specific requirements that the drivers must follow to minimize potential environmental effects.
- Security and winter road maintenance personnel with environmental responsibilities as part of their job description. As an example, all Security personnel receive training as first responders to an incident involving a spill on the winter road.

Although the terms of some of the regulatory instruments may change as a result of the re-permitting process, a sound foundation already exists for ongoing environmental management of the winter road.

This section focuses on the known environmental effects associated with the winter road operation and how these issues are currently addressed. Issues that may arise in the future because of proposed operational changes are also discussed. A number of issues that may require changes to current environmental management practices have been raised in discussions with project stakeholders during the development of this Project Description. These issues are addressed as appropriate and will be integrated into the updating and formalization of the environmental management system.

3.2 Traffic Management

The traffic management practices used to date to maintain acceptable standards of transportation safety along the winter road were described in Section 2.2. Strict adherence with these procedures by commercial operators has contributed directly to enhanced environmental protection. Simply stated, safe transportation and effective winter road management operations result in reduced risk of traffic accidents, spills of fuel and/or other products and incidents involving wildlife collisions. Slower speeds, particularly along portages, where wildlife tend to congregate, pose a less threatening situation for wildlife and one which can be more readily accommodated by the species frequenting the winter road corridor during the winter, such as caribou, wolves, foxes, wolverines and some small furbearers.

To date, the Joint Venture has managed changes in the volumes of commercial winter road traffic through the application of a conservative approach. As a result, speed limits have been lowered, transportation traffic is carefully scheduled and spaced, heavy and wide loads are moved at night, and double-tracking has been installed on many of the larger lakes to facilitate safe traffic movement.

Some of the more pertinent winter road regulations (Echo Bay 2000) that must currently be followed include:

Speed Regulations

- 10 km/hr on portages, small lakes (<2 km in length or posted as a small lake) and when going on and off all lakes
- loaded speeds of 20-35 km/hr
- empty speeds of 35-40 km/hr
- strict enforcement of speed limits.

Right-of-Way on Lakes

- Northbound loaded trucks have the exclusive right-of-way and southbound trucks must yield. Trucks moving both north and south must slow down to 10 km/hr.
- Loaded southbound trucks must yield to empty southbound trucks by slowing down to 10 km/hr and passing trucks must slow down to 15 km/hr.

Right-of-Way on Portages

- Loaded northbound trucks have the exclusive right-of-way and empty southbound trucks are not to enter portages when loaded trucks are already on the portage.
- Both northbound and southbound drivers are to call in their location and number of trucks in their convoy before entering a portage.
- Progress call-ins are required halfway through portages longer than 1 km.

Load Limits

- Load limits (weights) are specified and varied based on ice and winter road conditions.
- Lighter loads are required at the start of the season to help develop the ice.

Convoy and Vehicle Spacing

- No commercial vehicles are permitted to travel alone.
- Convoys consisting of 2–4 vehicles are dispatched at intervals of 20 minutes as instructed by Dispatch.

Spill Reporting

- All spills are to be reported immediately to the Winter Road Operator (Echo Bay) and then to the 24-hr NWT Spill Line.

Drugs and Alcohol

- Use prohibited and enforced.

The Joint Venture is committed to the process of continuous improvement for all aspects of winter road operations. This commitment will be formalized through the

Environmental Management System that will be applicable to all commercial users of the winter road in the future.

3.3 Air Quality

Exhaust emissions from transport trucks travelling on the winter road and the mobile equipment used to construct and maintain the winter road represent the main sources of emissions related to the operation of the winter road. Dust is not generated because of snow and ice cover on the winter road surface.

Previous environmental assessments for the EKATI™ Mine (BHP 1995), Diavik Diamonds Project (DDMI 1998), EKATI™ Mine expansion (BHP 2000) and the Snap Lake Project (De Beers 2001) considered air emissions related to winter road operations as a component of their cumulative effects assessments. Each evaluation considered the winter road to be a minor source of air emissions, including greenhouse gases, during the approximately three month winter period that the road is operational.

Over the next 20^{+} years, traffic volumes on the winter road are projected to increase from the year 2001 level of 8,090 loads to a maximum of 12,000 loads/year by about 2010. Thereafter, traffic loads are predicted to decline as mines begin to gear down and transportation demands are reduced (Section 2.3.1).

Experience from southern Canada indicates that greater volumes of truck traffic on other Canadian highways have not caused exceedences of regional ambient air quality objectives (BHP 2000). As a result, vehicle emissions related to winter road operations are not expected to have a measurable effect on the air quality of the winter road corridor or surrounding region.

3.4 Terrain and Vegetation

As previously indicated, most of the winter road (87%) is located on frozen lake surfaces. The remaining 13% or 73 km of the winter road is comprised of 65 overland portages of varying lengths, extending from the boreal forest of the Taiga Shield Ecozone around Yellowknife to the barrenlands of the Southern Arctic Ecozone from Mackay Lake north to the Lupin Mine (EBA 2001a).

Within the boreal forest portion of the corridor, the original tree cover along some of the portages was cleared along the immediate route to allow the seasonal construction and operation of the winter road. In addition, aggregate borrow sites have been established to supply sand and gravel for the upgrading of approximately 20% of the portages and to develop base pads for three existing and one former winter road maintenance camps.

The establishment of the existing winter road has resulted in the clearing of approximately 55 hectares of boreal forest and the direct loss of approximately 14 hectares of terrain and vegetation distributed along the portages of the winter road route. In addition, 64 hectares have been used for sand/gravel borrow pits and camp footprints have altered a further 10 hectares.

To safely accommodate future traffic increases, the Joint Venture is proposing to widen, realign and further upgrade a number of the portages. These proposed modifications will necessitate further, but limited tree clearing and the infilling of additional terrain and associated vegetation along selected portages of the winter road route. Table 3.4-1 summarizes the upgrading activities currently under consideration. These proposed upgrades are preliminary and will be refined over time as planning proceeds.

Table 3.4-1
Summary of Proposed Portage Upgrades

Portages	High Priority		Medium Priority		Lowest Priority	
Proposed Upgrades/Realignments	Number	Length (km)	Number	Length (km)	Number	Length (km)
Below Treeline Upgrade	4	9.4	19	19.0	9	7.3
Above Treeline Upgrade	3	8.8	9	8.1	7	4.3
Below Treeline Realignment	4	7.4	8	3.1		
Above Treeline Realignment			1	4.7		
Totals	11	25.5	37.0	34.9	16	12.0

The primary issues associated with the proposed winter road upgrading activities on the terrain and vegetation of the winter road corridor are related to:

- effects of additional vegetation clearing
- footprint effects due to infilling of terrain/vegetation.

The Joint Venture recognizes that the continued safe management and operation of the winter road under higher traffic loads will result in some additional, localized impacts on terrain and vegetation. However, the Joint Venture is committed to minimizing the effects of proposed upgrades, particularly in environmentally sensitive or culturally important areas.

To assist in the planning and effective implementation of future upgrades, during the summer of 2001, work was begun on the development of a high-resolution digital baseline map of vegetation units and terrain features for all portages along the winter road route. Data generated from the airborne mapping program will be used to identify and quantify the vegetation and terrain characteristics of the corridor, including important habitats and sensitive areas which should be avoided or protected. The baseline data will also be used for progressive reclamation planning as required for existing abandoned portage alignments and for the eventual final abandonment of the winter road in the longer-term future.

As stated previously, to maintain safe operations and to prevent or minimize damage to the vegetation and terrain in portage areas, the winter road operator typically officially closes the winter road to commercial and other traffic for the season by the end of March or early April, depending on prevailing conditions. Unfortunately, however, the

general public is not currently restricted in their use of the winter road after it has been officially closed for the season. The net result is that incidents involving rutting and gouging of terrain and vegetation have occurred. Aerial and ground reconnaissance observations made during the spring of 2000 (D. Chubb 2000 pers. comm. 2000) indicate that these types of problems have generally been limited to some of the south-facing portages between Tibbitt and Gordon lakes.

To enhance protection for the vegetation and terrain along the winter road corridor, beginning next winter, the Joint Venture intends to establish a check-point to control third party access to the winter road during periods when it is unsafe, or when the environment may be susceptible to physical damage. Such occasions include early in the season when the winter road is under construction and late in the season during warm periods, when the winter road bed may be actively thawing. In addition, at the end of the commercial trucking season, typically late March to early April, the winter road will be officially closed in a manner that will effectively limit further vehicle access.

3.5 Aquatic Life and Habitat

The Environmental Setting Report (EBA 2001a) describes the fisheries resources found in the larger lakes traversed by the winter road and the historical/ongoing importance of these resources to the Aboriginal people and other resource harvesters who access lakes for fishing from the winter road.

The construction and operation of the winter road has the potential to affect the aquatic life and habitat of lakes and streams traversed by the winter road in two primary ways. These are:

- the introduction of harmful substances (petroleum products, chemicals, sediments, sewage effluent and animal wastes)
- direct physical effects on lakeshore and other riparian habitats.

Each of these issues will be briefly reviewed, along with the mitigation measures being employed or proposed to continue to minimize potential negative effects related to these concerns.

3.5.1 Introduction of Harmful Substances

The introduction of potentially harmful substances due to accidental spills into lakes and streams, represents a continuing public concern related to the operation of the winter road. Diesel fuel and other petroleum products represent approximately 60% of the bulk consumables transported by truck to the mines each winter. Other products transported by truck that could cause harmful effects if spilled into water include: ammonium nitrate, glycol, lime and small quantities of acids, salts, sodium cyanide and organic emulsifiers.

The key strategy employed by all commercial interests using the winter road has, and will continue to be, to prevent accidents from occurring, some of which could lead to spill incidents. All commercial users of the winter road are required to strictly comply with the Winter Road Rules and Regulations (Echo Bay 2000).

Independently contracted winter road security personnel diligently enforce the requirements 24-hours per day. The requirements specify speed limits for the various conditions encountered along the winter road, right-of-way rules for traffic on lake surfaces and portages, load limits, vehicle spacing, and other specifications to optimize traffic safety and minimize the risk of accidents occurring which could result in spills.

A review of the historical spill record (RWED 2001) on the operation of the winter road from 1983 to the end of March 2001 illustrates the success of the traffic management program to date in minimizing spill incidents. A summary of the database search for truck spills on the winter road is presented in Table 3.5-1.

The records indicate that of the 38 reported truck spill incidents that have occurred since 1983, approximately 80% were spills of diesel or other petroleum products and most of the remainder involved cement or ammonium nitrate. Most of the petroleum-related spills were caused by leaks from the fuel tanks of the trucks involved, and three of the incidents involved tanker rollovers. Approximately, 34% of the spill incidents have occurred on the frozen surface of lakes and/or other waterbodies where immediate clean-up was possible.

According to the spill records, to date, there have been no significant spills of petroleum products into any waters along the winter road corridor where fish or other aquatic resources have been affected. In all cases, the winter conditions, which generally facilitate the containment and recovery of spilled products, combined with effective response from the spill clean-up teams, were successful in preventing the occurrence of potentially harmful effects to the aquatic environment.

The records also indicate that the number of spill incidents per year has not increased as a result of the higher levels of commercial vehicle traffic that have developed since the mid-1990's. Given the high priority that the Joint Venture places on diligent traffic management, operations safety, and the strong commitment to continued improvement of all aspects of the winter road operations, similar results can be expected in the years to come even with the increasing traffic loads.

Other substances that can be introduced into the aquatic environment include sediments from terrestrial sources (Section 3.4), camp sewage effluents and animal wastes left on lake ice following the harvesting of wildlife by the general public.

Table 3.5-1 Truck Spill Record for the Tibbitt-Contwoyto Winter Road

Year	Day	Commodity	Amount Spilled (L or Kg)	Cause	Spill on Ice/Water	Spill ID #	Status
1983	05-Mar	diesel P-40	13,000	vehicle overturned	Yes	83016	Open+
	13-Mar	diesel	2273	vehicle overturned	No	83019	Open+
	20-Mar	diesel	>5	vehicle overturned	Yes	83021	Open+
1984	15-Feb	diesel P-50	16,164	vehicle overturned	No	84019	Open+
	21-Dec	diesel	>5	other transportation	No	84126	Open+
1985	None	–	–	--	–	–	
1986	04-Feb	diesel P-40	180	vehicle overturned	No	86004	Closed
	10-Mar	diesel P-40	1800	vehicle overturned	No	86022	Closed
	21-Mar	diesel	>5	vehicle overturned	Yes	86024	Open++
1987	17-Jan	Gasoline	>5	collision	No	87009	Closed
1988	21-Mar	diesel P-40	3637	other transportation	Yes	88027	Open
1989	15-Jan	diesel	454	pipe leak	Yes	89003	Closed
	27-Feb	diesel P-40	682	vehicle overturned	No	89020	Open
	24-Mar	diesel	90	other transportation	Yes	89031	Closed
	31-Mar	diesel	227	vehicle overturned	No	89034	Closed
1990	25-Jan	Diesel	270	vehicle overturned	Yes	90009	Open
1991	05-Feb	diesel	45	other transportation	No	91013	Closed
1992	22-Feb	diesel P-50	50	leak	No	92023	Closed
1993	21-Feb	diesel P-50	454	vehicle overturned	No	93017	Closed
	18-Mar	diesel P-50	>5	other transportation	No	93027	Open
	24-Mar	cement	800	vehicle overturned	No	93033	Closed
1994	05-Feb	diesel/cement		other transportation	Yes	94025	Closed
1995	19-Jan	Diesel	90	tank leak	Yes	95005	Closed
1996	27-Feb	cement	80,000	vehicle overturned	No	96030	Open
	06-Mar	kimberlite	91	other transportation	No	96036	Closed
	11-Mar	portland cement	50 Kg	other transportation	No	96037	Closed
	10-Mar	cement	10 Kg	vehicle overturned	No	96040	Closed
1997	None	--	--	--	--	--	
1998	10-Feb	diesel	5,000	vehicle overturned	No	98015	Closed
	23-Feb	oil / antifreeze	125 / 23	other transportation	Yes	98025	Open++
	16-Mar	diesel	4,000	vehicle overturned	No	98036	Closed
1999	None	–	–	--	–	–	
2000	17-Feb	ammonium-nitrate	12,000	leaking container	Yes	00033	Closed
	03-Mar	diesel	15,000	vehicle overturned	No	00048	Open+++
	30-Mar	hydraulic fluid	45	blown line	No	00107	Closed
2001	25-Feb	diesel	300	collision	Yes	01051	Closed
	28-Feb	diesel	<300	leaking tank	No	01059	Closed
	28-Feb	ammonium-nitrate	750 kg	1t bag fell from trailer	No	01058	Closed
	01-Mar	ammonium-nitrate	100 kg	1t bag fell from trailer	No	01061	Closed
	24-Mar	diesel	<200	trailer valve leak	Yes	01087	Closed
	05-Apr	diesel	50	truck-leaking tank	No	01103	Closed

Source: RWED Environmental Protection Service 2001

Notes:

+ Spill report file is lacking sufficient information to determine of spill was officially closed by inspectors.

++ Spill report files indicate spill is recommended to be closed but has still not been officially closed.

+++ Spill report files indicate clean-up is required.

All spills prior to 1996 are suspected to be closed by DIAND inspector.

Each of the three maintenance camps at Dome Lake, Lockhart Lake and Lac de Gras generate domestic sewage during the 3-4 month camp operating period. The existing sewage disposal facilities at each of the three camps are as follows:

- At Dome Lake Camp domestic sewage is directed to an on-site leaching pit and the contents of the pit are allowed to leach into the ground below.

- At Lockhart Lake Camp domestic sewage is initially directed to a small settling tank to provide primary screening prior to discharge to an on-site retention lagoon. Once a year the liquid contents of the lagoon are discharged to the adjacent land, which drains towards Lockhart Lake. This operation is currently approved for a 49-person camp, and the expectation is that a specific water licence may become necessary in the future as demands on the camp increase.

- At Lac de Gras Camp domestic sewage is directed to an on-site retention lagoon and the liquid contents are discharged once per year to the adjacent land, which drains towards Lac de Gras. During the winter of 1999/2000, the lagoon at Lac de Gras Camp overflowed at the end of the season. The Joint Venture operators are presently examining the longer-term needs of this camp for sewage handling and disposal.

The indirect introduction of sewage effluent in compliance with NWT guidelines for sewage handling to the three respective waterbodies adjacent to the existing camps may contribute to localized areas of nutrient enrichment. However, since the adjacent receiving waterbodies are relatively large and low in nutrients (oligotrophic), any possible effects on the aquatic environment and fish of these waterbodies would be expected to be localized and limited.

Similarly, it has been a common practice for public users of the winter road to leave in place the entrails and other animal wastes resulting from the harvesting of wildlife, particularly caribou. Although these remains serve as a food source for carnivores and scavengers, remains left on the ice sink into the lakes during spring break-up. These wastes become a food source for fish, and represent a source of nutrient enrichment in the receiving waterbodies.

This situation occurs naturally throughout northern Canada, but the general public should be encouraged to follow responsible harvesting practices, including the removal of these wastes from lake surfaces.

3.5.2 Physical Effects on Aquatic Habitats

The annual construction of the winter road is carried out by experienced northern construction contractors following the conditions of the existing DIAND Licence of Occupation, Land Use permits and NWT Department of Transportation guidelines for the construction, maintenance and closure of winter roads (DOT 1993). These requirements are intended to assist construction contractors to build and operate the

winter road in a manner that minimizes potential adverse effects on the environment, including waterbodies.

As indicated in Table 3.4-1, in the future, a number of portage upgrades or realignments are proposed to optimize operations safety, while continuing to accommodate the projected increase in commercial traffic using the winter road. A number of existing granular fill embankments will also be enhanced by widening or lengthening and new embankments will be constructed.

All future upgrades to portages will be planned and constructed to prevent or minimize possible effects on fish habitat. Granular materials will not be directly deposited into waterbodies frequented by fish or sensitive foreshore riparian areas that may constitute a component of important aquatic habitat. However, preliminary reconnaissance-level investigations conducted to date have identified a number of portages in the barrenlands portion of the winter road route where granular material has been placed directly within the high water mark of some lakes or foreshore areas as part of earlier portage embankment construction (D. Morantz 2001 pers. comm.). Although these surveys suggest that effects have been localized and minor, site-specific aquatic field work was undertaken during the summer of 2001 to further assess possible effects and proposed mitigation strategies.

Following construction, an important condition of winter road operations is the requirement to suspend overland travel of equipment or vehicles during periods when rutting or gouging of thawing terrain may occur. Rutting or gouging can cause undue land disturbance, which has the potential to release sediments to adjacent waterways and damage foreshore (riparian) areas at the entry and exit points to lakes and at stream crossings.

Experience with winter road operations to date indicates that this problem has occurred in some areas of the southern portion of the winter road corridor in the spring of the year, after the winter road has been officially closed to commercial traffic and other users by the winter road operator. In particular, some of the south facing portages between Tibbitt Lake and Gordon Lake present the highest risk for terrain damage because these portages are among the first to thaw. Based on reconnaissance observations made during the spring of 2000 (D. Chubb 2000 pers. comm.), rutting and gouging of terrain appeared to be generally limited to portages south of Gordon Lake. The size of the vehicle tracks observed suggested that the majority of the damage resulted from light (4 x 4) vehicle traffic. Unfortunately, the general public is not currently restricted in their use of the winter road after it has been officially closed.

The Joint Venture is committed to working with the regulators to close the winter road to light vehicle access when the winter road is not open to commercial traffic. Closing the winter road addresses public safety concerns during construction and after the winter road season, when ice conditions may not be safe. This measure will also limit damage to wetland and riparian areas that has been previously caused by inappropriate use of the winter road after the commercial trucking season has ended.

3.6 Wildlife and Habitat

3.6.1 Winter Road Effects on Wildlife

The Tibbitt to Contwoyto winter road is not unique in the NWT. In addition to seasonal winter roads constructed by the mining industry, the GNWT has been building and maintaining more than over 1,200 km of such temporary highways for many years for the benefit of communities normally accessible only by air. Despite this considerable history, little monitoring or assessment of the effects of winter roads on wildlife has been undertaken.

Some of the wildlife responses to the Tibbitt to Contwoyto winter road evident at this time have been shaped by animal habituation and learning. After more than 20 years of operation, the winter road, it's associated activities and consequences, have become integral to the lives and habitat of wildlife species living in and moving through the area. Scavengers such as wolverines, foxes and ravens seem to have learned that the winter road is an annual event and that food will be associated with it if caribou and, for some species, people are present.

The following discussion of wildlife issues takes into account the improvements in traffic management and ice-crossing operational procedures proposed by the Joint Venture to accommodate the forecast increases in traffic over the foreseeable future while maintaining high standards of safety and environmental protection.

3.6.2 Summary of Wildlife Issues

The primary wildlife species of concern are those with ranges of activity that encompass the winter road, species that are active during the winter and species that are important to the people of the area. Species that are active during the operational period include barren-ground caribou, wolves, wolverines, foxes and the high-value furbearers, lynx and marten. Grizzly and black bears, which hibernate during the winter months are also addressed because they become active in the spring and may be attracted to residual food wastes left behind following winter road closure. Contamination of water by industrial products is a potential concern for aquatic species such as mink and muskrat and for waterfowl; however, there is currently no evidence of significant adverse effects.

The structure of the winter road, the habitats it traverses, patterns and intensity of use by wildlife, and patterns and intensity of vehicle traffic all play major roles in determining the extent to which the winter road may affect wildlife (Jalkotzy *et al.* 1997; Underhill and Angold 2000). The winter road has the potential to affect wildlife by acting as:

- a travel corridor
- a seasonal barrier or filter if wildlife movements across the winter road are blocked completely or selectively

- a mortality sink if animals die as a result of their attraction to the winter road area, e.g., collisions, increased hunting by humans, or attraction and habituation to human food and garbage.

Wildlife may respond to the winter road, traffic on the winter road and camp infrastructure in the following primary ways:

- move away from the winter road
- increase activity and energy expenditure near the winter road
- delay crossing or fail to cross the winter road
- reduce use of habitats adjacent to the winter road
- be injured or killed by collisions with vehicles
- be killed as a result of hunting and trapping along the winter road
- be attracted and become habituated to food wastes at camps and along the winter road
- be contaminated by pollutants such as hydrocarbons in water (aquatic species) and/or by consuming vegetation that has been contaminated.

Although there have been no documented significant adverse effects on wildlife to date, potential issues arising from the winter road and projected increases in traffic and use are discussed. The issues are common to most species and are classed as direct habitat loss, disturbance, mortality, habituation and attraction, and bioaccumulation of contaminants. The objective of present and future wildlife management activities on the winter road is to continue to mitigate potential negative effects on wildlife in the following ways:

- minimize the loss of habitat and reduction of habitat effectiveness (i.e., wildlife use of a previously important habitat declines not because of habitat loss but because of the disturbance caused by traffic)
- minimize direct mortalities due to collisions with vehicles
- minimize disruption of wildlife movements across the winter road
- minimize attractants at camps through responsible waste management and effective environmental awareness programs
- minimize and eliminate contamination of habitat by industrial products
- encourage regulatory agencies to monitor and control harvesting activities.

3.6.3 Direct Habitat Loss

Roads eliminate the habitat upon which they are constructed. However, because most (87%) of the winter road is located on frozen lakes, terrestrial habitats have only been altered along the approximately 73 km of portages linking the waterbodies. In total, about 55 ha of tree cover has been cleared in the forested areas of the winter road, creating a series of discontinuous linear forest openings. At locations where portages

have been built up or levelled using gravel, and at the three original winter road camps, habitat has been lost or altered into another form of habitat. About 14 ha of habitat has been padded with sand and gravel, 64 ha is taken up with sand/gravel pits, and camps have alienated a further 10 ha. Padded portages and gravel pads are analogous to natural features such as eskers, kames and gravel bars on stream floodplains. In summer such habitats may attract caribou seeking insect relief, bird species that select dry or gravelly sites for nesting and ground squirrels for burrows.

Over the years a number of glacio-fluvial deposits along the corridor have been used as sources of sand and gravel. It is likely that some of these sites have served as denning habitat for grizzly bears, wolves, foxes and ground squirrels. Any new sources of fill material being considered for the proposed upgrades in future will be assessed for their use and importance to wildlife and other values before finalizing the selection of acceptable sites.

The winter road may represent a habitat loss to caribou if, during operation, caribou are impeded from using the large lakes along the corridor as travel routes or escape terrain from wolves. Portages will alter existing foraging habitat in a minor way by favouring successional species characteristic of disturbed areas. Observations by First Nations and local users suggest that, when present, caribou continue to use the lakes adjacent to the winter road. Losses of foraging habitat at portages are minor and may be partially offset by use of successional vegetation.

Wolves have been observed using road corridors preferentially as travel routes (Thurber *et al.* 1994), as have wolverine (V. Banci 2001 pers. obs.). It is unlikely that wolves and wolverines would be deterred from their traditional movement corridors.

Some marten habitat may have been lost at portages established in treed habitats, but these constitute very small linear areas adjoining large openings (lakes). Marten avoid areas without cover, and so portages on naturally occurring habitat fractures are probably adopted by marten as home range boundaries (Buskirk and Ruggiero 1994). Future winter road upgrading, particularly the widening or possible realignment of selected portages within forested areas of the corridor would cause additional but limited habitat changes for marten and other wildlife associated with these areas.

3.6.4 Indirect Habitat Effects Due to Forest Fires

Caribou winter distribution along, and their subsequent responses to the winter road, is influenced by factors not related to the winter road, such as the distribution of burnt areas, foraging areas with adequate lichen, areas that have been overgrazed and snow depth. Documenting these factors and gaining a better understanding of their inter-relationships would help in monitoring the winter road and differentiating possible road-related effects from natural factors. This is an area where scientific knowledge and traditional knowledge can be used in tandem. For example, Dogrib elders have said that caribou do not migrate through an area that has been recently burnt because they

need to smell food in the distance (Dogrib 1998). The elders have also said that lichens are the most important food source for caribou in winter (Dogrib 1999).

Within Canada's boreal forest, fire is the most important cause of largely natural disturbance in the boreal forest (Johnson 1992). Fire appears to be occurring more often annually and burning increasingly larger areas since fire records have been kept (Weber & Flannigan 1997).

Fire plays a crucial role in maintaining habitat diversity for caribou (Rowe and Scotter 1973; Johnson and Rowe 1975; Schaeffer and Pruitt 1991). It was once believed to be detrimental because it destroyed the slow-growing lichens considered as the primary caribou food. These lichens can take a minimum of 30 years to recover (Cumming 1992). However, there is dispute over what constitutes recovery, and lichen re-establishment does not always lead to caribou recovery (Lutz 1956). Many authors now believe that although short term effects are negative, fire is beneficial to caribou in the long-term (Davis and Franzmann 1979; Johnson and Row 1975; Kelsall *et all.* 1977, Klein 1979, Klein 1982).

3.6.5 Disturbance

The effect of a road on wildlife can be much greater than simply the amount of habitat lost. In the case of the winter road these effects are minimized because of the short annual operating period. Displacement associated with disturbance may have physical and physiological effects that can act at the level of individuals, groups or populations. Animals displaced from important habitats may sustain increased energetic costs that can directly influence their own health and survival, their offspring and their populations (DDMI 1998). They may also face the risk of reduced security and increased predation. Movement patterns can be disrupted by traffic-related disturbance. This can result in the dissection of home ranges and potentially of populations. Disturbance associated with a road can affect wildlife as follows:

- Animals could suffer physiological stress by attempting to cross the road when traffic is present.
- Animals may at times refuse to cross the road, which could result in their displacement from important foraging or security habitats on the other side of the road.
- Animals may reduce their use of habitats adjacent to the road because of disturbance from traffic.

Caribou

BHP (1995), Jalkotzy *et al.* (1997), Axys and Penner (1998) and BHP (2000) have reviewed the extensive literature dealing with caribou responses, including those of Bathurst caribou, to development and associated roads. In summary, observations show that caribou are adaptable and if not impeded will continue to behave normally without negative effects on population levels.

Studies of caribou responses to permanent roads in considerably more developed areas during sensitive periods such as calving are not directly applicable to assessing the effects of a winter road in caribou winter range. However, observations of caribou during more sensitive periods can provide insight on how caribou might respond to the winter road if they were stressed. For example, cows with calves in the Prudhoe Bay oil field were known to react relatively strongly to disturbance and to avoid active all-weather roads for up to three weeks after giving birth (Dau and Cameron, 1986; Cameron *et al.* 1995; BLM 1997). Calving, post-calving or insect harassment do not occur during the period of construction and operation of the winter road, although caribou may encounter the winter road during late pregnancy.

Previous studies indicate that the physical presence of roads does not generally appear to be a deterrent to caribou. Experience at EKATI™ supports this finding, at least during the spring and fall migrations (BHP 2000). Results from BHP Billiton's ongoing Wildlife Environmental Monitoring Program indicate that caribou have habituated to roads, traffic and other general human activities in the vicinity of the EKATI™ Mine (BHP 2000). The location and structure of roads are important determinants of individual caribou response. Roads that form a vision barrier because of height have the potential to hide predators and can deter caribou from crossing (Roby 1978). During winters with high snow levels, elevated snow banks resulting from ploughing could potentially impair vision and deflect the movement of caribou along some parts of the winter road.

The initial response of wildlife to moving vehicles is flight. Such responses increase energetic requirements and produce a corresponding decline in fitness (Axys and Penner, 1998). As wildlife habituates to traffic, flight reactions decline in frequency and intensity. There are few documented experiences with winter roads and barren-ground caribou. On the extreme end of caribou response to roads, woodland caribou in northeastern Alberta crossed all-weather roads far less often than expected during all periods except calving (Dyer 1999). The highest traffic levels (600 to 800 vehicles per day) were recorded during late winter. By comparison, for the winter road, up to 300 truck/day are predicted to be transitting north or south when traffic volumes reach their currently predicted peak volume of 12,000/day. In the Alberta situation, there was also no evidence of habituation and lessening of responses to the roads, and caribou were more wary of roads in open habitats than those in closed habitats. However, it should be noted that these woodland caribou populations have contended with extreme levels of harvesting and disturbance on a year-round basis and are in decline.

Also in northeastern Alberta, a woodland caribou was observed to increase its rate of speed significantly in response to loud noise disturbance from seismic exploration, less so if its movement was impeded by deep snow (Bradshaw *et al.* 1997). Bradshaw *et al.* (1997) concluded that disturbance can have significant energetic consequences on caribou when considering the balance between energy expenditure and forage availability in variable winter conditions. While traffic noise on the winter road is not comparable to that of seismic detonations, the results suggest that caribou under conditions of stress in winter are vulnerable to adverse energetic consequences from disturbance.

In another study, Burson *et al.* (2000) reported that numbers of caribou and other species observed along the road corridor through Denali National Park, Alaska, remained unchanged from 1973 to 1997, despite an increase in annual tourist visitations from about 45,000 to 350,000, with corresponding increases in traffic. In addition, the caribou were observed at similar distances from the road, and adverse behavioral responses to traffic (e.g., running from vehicles) were noted in less than 1.3% of the observations. The increased traffic apparently did not cause significant changes in abundance, distribution or behavior of caribou and other species in the park road corridor. The Denali Park road is in use during snow-free seasons.

Few data exist on the traffic thresholds caribou will tolerate before changing their normal behaviour. At the Kuparuk oilfield near Prudhoe Bay, traffic volumes in excess of 10 to 15 vehicles per hour were reported to reduce the ability of calving and post-calving caribou to cross roads (Curatolo and Murphy 1986; R. Shideler, pers. comm., in BHP 2000). Although most groups did eventually cross the roads, the energetic cost resulting from delayed movement is unknown. The traffic volume on the winter road is expected to increase to 6-12 trucks per hour. Although this is within the range that affected calving and post-calving caribou at Prudhoe Bay, an important difference is that the Bathurst caribou near the winter road will be on their winter range when they are known to be least sensitive to human disturbance.

The effects of traffic disturbance on caribou have been successfully mitigated at many developments, including the EKATI™ Mine (BHP 2000) and the Prudhoe Bay oil field (BLM 1997). The mitigation measures employed at EKATI™ are detailed in BHP Billiton's Operating and Environmental Management Plan (BHP 1998). These include the monitoring of caribou distribution and movement and the control of traffic (i.e., caribou have the right-of-way) when caribou are near or about to cross the road. Similar measures have been implemented for the current winter road.

Most of the expected interactions among caribou, the winter road and associated traffic will be on winter ranges. During the winter period the Bathurst herd occupies large areas, travelling in small groups within this range, rather than as a directed migratory movement. Groups tend to coalesce in late winter (April and May) before initiating the spring migration, which takes place at the time that winter road use has been terminated. Except for general areas of occupancy, it will be difficult to determine specific caribou crossings of the winter road in mid-winter. The primary mitigation strategy is to allow caribou the right-of-way when they are encountered on the winter road or are about to cross it. If necessary, traffic will be stopped to allow groups to cross the winter road or move into adjacent habitat. These measures will serve to minimize energetic disturbance and collision mortality. In areas of known caribou distribution, ploughed snow banks will be winged back to facilitate caribou passage as necessary.

Wolves, Wolverines, Foxes

Wolves are relatively sensitive to human activity (Weaver *et al.* 1996) and display higher levels of avoidance than many other species such as caribou. In Alaska, gray wolves avoided oil field access roads open to public use, yet were attracted to a gated

pipeline access road and secondary gravel roads with limited human use (Thurber *et al.* 1994). Studies in Ontario and the north-central United States demonstrate a strong inverse relation between road density and wolf populations (Thiel 1985; Paquet and Hackman 1995).

Wolverines have relatively low demographic resilience and may be even more vulnerable to population perturbations than grizzly bears (Weaver *et al.* 1996). Major highways can be barriers to movement and may become imposed home range boundaries. Studies in southeast British Columbia suggest that females may avoid areas of intensive land use and human activity (Krebs 1998). Other studies have found no avoidance of areas of activity such as heavily used logging roads (E. Lofroth 1999, pers. comm.).

Given their linear nature, roads cross environmental and topographical contours and can link a range of different habitats, facilitating movement through otherwise unsuitable landscapes (Underhill and Angold 2000). Because wolves and wolverines frequently use roads as travel routes, it is unlikely that the winter road has served as a significant barrier to or displaced wolves or wolverines from important habitats. Since the distribution of both species during the non-denning period is a function of the distribution of their prey, potentially adverse consequences of traffic on the winter road can be prevented by ensuring movements of caribou are not impaired. Habitat loss and disruption related to the winter road are unlikely to constitute substantive negative effects. Mortality from hunting and habituation to human food and garbage along the winter road and at camps pose greater potential risks for wolves and wolverines than does disturbance. Foxes are extremely tolerant of disturbance and are most likely to become habituated to human food and garbage.

Bears

There is some evidence that bears in their dens can be disturbed by human activity, leading to den abandonment, cub mortality and decreased survival (Goodrich and Berger 1994). Linnell *et al.* (2000) reported that grizzly bears might abandon dens in response to activity within 1 km, and especially within 200 m, but that responses were variable. However, Reynolds *et al.* (1986) found that no bears deserted their dens despite seismic activity within 800 m and the passage of a supply train within 100 m. Results are too few to generalize. The amount of snow cover available for insulation and the proximity, type and duration of activities may be factors contributing the disturbance of bears in dens (Blix and Lentfer 1992). Considering the length of time the winter road has been in operation, any bears denning adjacent to the winter road will have become habituated to traffic noise, and future disturbance is unlikely to be a concern.

Furbearers

Research in the boreal forests of Alaska, Yukon and NWT has shown that lynx tolerate moderate levels of snowmachine traffic through their home ranges, readily cross highways and may establish home ranges adjacent to roads (Mowat *et al.* 1999). Lynx are also regularly seen along roadsides in the north (Mowat *et al.* 1999), including the

Ingraham Trail and southern positions of the winter road, and may use these habitats for hunting. Marten are creatures of the forest and avoid areas without cover (Buskirk and Ruggiero 1994). They may use the winter road as a home range boundary, but it is unlikely that traffic along the relatively short and discontinuous openings in the forest cover at portages would bisect their home ranges. Disturbance is, therefore, unlikely to be a significant factor for furbearers such as lynx and marten.

3.6.6 Mortality

Road Kills

The predominant factors that contribute to road-related wildlife deaths are traffic density, vehicle speed and road width. These factors directly affect the success, or otherwise, of an animal reaching the opposite side of the road. An increase in any factor reduces the probability of an animal crossing safely (Underhill and Angold 2000). An example of the significance of road kills is wolf deaths associated with highways in the Canadian Rocky Mountains. This has become a major mortality risk for wolves in this area, and increased road development and human settlement may be threatening the security of recently recovered populations (Paquet 1993). All wildlife species active during the winter are potentially at risk of being killed by traffic along the winter road, especially when traffic volumes are at their seasonal peak. However, unlike a public highway, traffic density and speed on the winter road are strictly controlled to ensure safe operations and traffic can be delayed or halted if wildlife is present in the roadway.

Speed and traffic spacing restrictions are among the most important conditions imposed on commercial traffic using the winter road. Traffic speeds are monitored on a 24-hour basis by mobile, radar-equipped security personnel. In addition, similar to the traffic management policies employed at the EKATI™ Mine, wildlife on the winter road has the right-of-way, and vehicles are required to stop if necessary to ensure safe transit by caribou, canids and other wildlife active during the operational period.

However, notwithstanding the diligent application of the existing Winter Road Policy, Rules and Procedures (Echo Bay 2000), a few incidents involving collisions with wildlife have occurred over the years. In March 1999, five caribou were killed by a grocery (meat) truck on a portage near Gordon Lake (RWED records). In 1996, a wolverine was killed by a pick-up truck (relayed to V. Banci). Various people have also reported some foxes being killed in collisions. Systematic documentation of wildlife-related incidents including road kills associated with winter road traffic has not been undertaken to date. More rigorous reporting on behalf of resource agencies and the road operator would be useful to assist with environmental management-related activities.

Attraction and Habituation

Wildlife species, particularly carnivores and omnivores, are attracted to locations of human activity to feed on food wastes or to seek shelter in man-made structures. Species of potential concern are foxes, wolverines, wolves, grizzly and black bears. Conflicts with foxes and wolverines can be expected at the road maintenance camps

and throughout the road route. Because of their association with caribou during winter, wolves are more likely to be encountered in forested areas below the treeline.

The maintenance camps servicing the winter road are operated in compliance with all applicable legislation and the waste handling and management practices employed are designed to minimize the attraction and potential habituation of wildlife to these sites. Nevertheless, concerns related to potential attraction and habituation of wildlife remain and continue to be actively managed. The following reviews some of the experience gained from other North American studies and the existing winter road, and the Joint Venture's approach to managing these issues.

Bears emerging from hibernation may be attracted to poorly maintained camps and become habituated to human food and garbage after winter road closure. As a result, they may also display nuisance behaviour elsewhere in their range. Typically, habituated bears are destroyed. The health of grizzly and black bears may also be compromised through direct injury from broken glass and sharp objects, the consumption of toxic plastic and petroleum products, and tooth damage and decay (Smith and Lindsey 1989).

Improper handling of food and wastes has, at times, resulted in incidents of wildlife habituation. Ravens are commonly present wherever trucks pull over to rest (Banci 2001, pers. obs.). In the past, wolverines were fed by personnel at the Lac de Gras and Lockhart Lake winter road camps and subsequently became nuisances (RWED records). The attraction of wolverines to camps continues to be a concern, with a reported ten wolverines removed from the Lac de Gras area between 1998 and 2001 (IEMA 2001). Wolverines in the Lac de Gras area were relocated due to nuisance problems at the BHP Billiton Misery site, the Diavik construction camp, and the Lac de Gras winter road camp. A grizzly bear at the Lockhart Lake Camp was destroyed in the summer of 1999 because of habituation to improperly stored waste (RWED records). There have also been instances of people feeding foxes at the camps, despite strictly enforced policies to prevent such activities from occurring.

The continued development and implementation of improved waste handling and management practices to minimize the possibility of attracting wildlife to the winter road maintenance camps is a top priority for the Joint Venture.

Grizzly bears in Yellowstone National Park have learned to rely on spring carrion found on ungulate winter ranges near human facilities such as roads and recreational developments (Green *et al.* 1997). Black bears have also used this food source, but in different areas and at different times (Green *et al.* 1997). In the case of the winter road, bears may be attracted to the corridor after closure to feed on caribou gut piles and carcasses left from the winter harvest that become available when the snow and ice melt. This consistent and predictable source of food may have been beneficial for bear survival in the vicinity of the winter road over the years. However, this could become a potential mortality sink if hunters access these areas because they know bears will be present.

Hunting

Although public harvesting activities are beyond the scope of the Joint Venture, the use of the winter road by hunters in trucks and on snowmachines represents the greatest source of human-induced mortality for caribou, wolves and wolverines. Most harvesters are from the Yellowknife area (including Dettah and N'dilo). Hunter harvesting is a major cause of mortality for the Bathurst herd, most of which is carried out when caribou are on their winter range.

Over the years, caribou harvesting has been concentrated primarily around the Gordon Lake area, followed by Drybones Lake and the area near the beginning of the winter road (EBA 2001a). There has been little public use of the winter road for wildlife harvesting north of Gordon Lake and minimal use of the area above the treeline (RWED records). In general, Brown Lake is the northern limit of travel by recreational hunters (J. Sangris 2001, pers. comm.).

It is unlikely that hunting pressure on caribou will increase as a direct consequence of improvements to the winter road and increased commercial traffic volumes. As in the past, caribou will continue to be hunted along the winter road corridor when they are present in the vicinity of Yellowknife. During such times, wolverines, wolves and other furbearing animals may also be subject to increased hunting pressure.

The winter road has provided trappers with access into more remote areas along the corridor. As there are no registered traplines in most of the NWT, there is no limit on the number of trappers that can harvest in an area. The Yellowknives Dene have identified this as an issue in the past (F. Sangris 2001, pers. comm.). Over-harvest may become a concern again if markets improve and pelt prices for lynx and marten reach levels similar to those in the mid-1980s. Further discussion on this subject is provided in Section 3.7.

Mortality Sinks

Wolverines have been harvested along the winter road during the seasonal caribou hunts (D. Cluff 2001 pers. comm.) and have been known to travel considerable distances to feed on carcasses and gut piles left by human hunters, making them easy targets. The implications of such a harvest on regional wolverine populations are difficult to determine and remain unknown at this time.

Because wolves are always associated with caribou, they can also be subject to high levels of harvesting. The implications of the current wolf harvest are not known. However, wolf populations have greater reproductive potential and ability to withstand such losses than do wolverines.

3.6.7 Spills and Contamination

The Yellowknives Dene and Lutsel K'e Chipewyan (community discussions, March 2001, see Section 4) have raised concerns about oil spills from commercial trucks, from private vehicles and the lasting effects of contamination from historical mines at Gordon

Lake. Whether any contamination from past activities remains in soil, water, vegetation, fish and wildlife is unknown. Currently, the greatest potential for spills, during winter road operation is of petroleum products, in particular diesel.

As indicated in Section 3.5.1, preventing accidents that may result in a spill of oil or other product has, and will continue to be, the key strategy employed by all commercial interests using the winter road. Spill containment, recovery and disposal in accordance with regulatory requirements and the Winter Road Spill Contingency Plan (Echo Bay 2001) will continue to be the primary measures employed to minimize possible effects of such spills on the terrain, vegetation and wildlife resources of the corridor area.

Based on the historical spill record presented in Table 3.5-1, of the 38 reported truck spill incidents that have occurred since 1983, approximately 66% took place along overland portages and the remainder on frozen waterbodies. In all cases, the spill response and clean-up measures employed were effective in minimizing possible harmful effects on the aquatic and terrestrial resources in the spill areas.

Aquatic wildlife species such as mink, river otters and waterfowl are top trophic level species that can readily bioaccumulate environmental pollutants and are considered to be sensitive indicators of ecosystem health (Environment Canada 2000; Gilbertson 1990). Yellowknife Dene elders have suggested that mink populations at Gordon Lake have declined, and that this is due to contamination (March 2001, community discussions). Gilbertson (1990) also suggested that the continued presence of bald eagles, another consumer of fish, was an indication of healthy aquatic systems. Issues regarding changes in the distribution of river otters, mink and eagles, and potential accumulations of toxins in tissues of these species, have been raised by the Yellowknives Dene. The Joint Venture recognizes the public concerns regarding this issue and remains strongly committed to spill prevention, responsive and effective clean-up and continued consultations with stakeholders to address any outstanding concerns.

3.7 Harvesting / Land Use

The Yellowknives Dene and the North Slave Metis have documented their concerns about the winter road in project development, environmental assessment, scoping and land-use planning processes over the past decade (Yellowknives 1997; North Slave Metis Alliance 1999). These concerns include:

- improved access to traditional Dene and Metis hunting grounds and fishing areas
- effects of the winter road corridor on caribou movements and migration
- more hunting by people who may have limited skills or equipment to hunt
- overall increased hunting pressure on caribou resulting from increased access to traditional hunting grounds
- unnecessary killing or wounding of caribou, and meat wastage
- how the public uses and occupies lands adjacent to the winter road.

Yellowknives Dene elders have stated that the winter road follows a traditional route through important trapping and hunting areas and that they were not consulted when it was first constructed (Yellowknives 1997). In discussions with the Joint Venture in 2001, they raised the issue of realigning the corridor and recommended improved consultation and their involvement in future corridor planning and development.

The North Slave Metis (1999) have expressed concerns about the cumulative impact of multiple developments and their long-term effect on hunting. They have observed changes in caribou migration, such as avoidance of wintering areas like Gordon Lake in recent years. The Metis have expressed concern that potential long-term changes in caribou migrations may result in longer, fewer and more-expensive hunting trips. They also view a decline in caribou health and numbers in the area as a potential effect on the Metis connection to the land and their traditional value of sharing. he North Metis Alliance (1999) has recommended the need for increased policing by government and regular monitoring of the winter road by the Joint Venture.

Inuit from the West Kitikmeot have expressed little concern about the effect of the winter road on caribou movement (Ferguson, Simek & Clark 1999). They see the need to strike a balance between preserving the caribou herds and the jobs arising from mineral development in the region (Nunavut Planning Commission 1998).

The Yellowknives Dene and North Slave Metis have both advocated that they be directly involved in public monitoring of the winter road. They further recommend that resources be increased so that public monitoring is effective. A management program for the winter road is in place, although the success of winter road regulations in protecting wildlife and habitat has not been rigorously evaluated. RWED runs hunter check-stops on the winter road at times of high hunting pressure. A mobile hunter/angler check-stop was run in late March 2001 (D. Cluff 2001 pers. comm.). Truckers have been asked to report truck-caribou conflicts and assist RWED to identify unusual activity they may observe such as meat wastage or animal harassment.

The process of identifying issues and concerns is continuing. Several concerns were expressed to the Joint Venture by individuals and communities during the preparation of this Report. Issues raised at discussions with residents of Lutsel K'e and N'dilo are summarized as follows:

<u>Monitoring & Policing</u>

- a need to monitor vehicles and drivers to ensure compliance with regulations
- a need to monitor wildlife movements and distribution
- a need to include First Nations people in monitoring
- a recommendation to combine wildlife monitoring and policing of winter road regulations
- concern about contamination of water resulting from fuel spills, both small spills left by parked vehicles and large spills caused by trucks falling through the ice
- trucks stopping and resting on ice, leaving fuel slicks behind

- drivers feeding wildlife at rest stops so that they can take pictures of them
- improper handling of garbage at camps
- a person who changed the oil in his pickup truck on lake ice and dumped the oil there (not associated with the Joint Venture)
- fishing and recreational camps built by the public without authorization.

Potential Impacts on Wildlife

- changes in caribou migration and distribution might occur because of the winter road
- caribou and other wildlife might be deterred from crossing the winter road because of too much traffic
- caribou could be deterred by the exhaust smell from trucks
- potential for problems with muskox interaction with the winter road if the population continues to grow and spread
- a need to avoid Important caribou habitats, especially at Gordon Lake
- possible reduction in aquatic furbearers (mink) at Gordon Lake.

Hunting and Trapping Issues

- some hunters waste caribou meat
- increased trapper access to the populations of furbearers around mines and the winter road
- outfitters using the winter road to hunt wolves and bringing foreign hunters to hunt along the winter road and outside of their guiding areas
- poachers who hunt wolf and caribou on the winter road at night
- strong support for 24-hour hunting check stations for private vehicles coming on and off the winter road
- arranging checkpoints in conjunction with the Aboriginal communities
- concerns about potential overharvesting of caribou and carnivores.

Employment & Human Safety

- human safety concerns – trucks crossing thin ice on creeks and rivers and at shallow lakes
- constructing the winter road without applying traditional knowledge; local trappers and hunters know where the dangerous ice is
- employment issues – should hire local people for building roads, as heavy equipment operators and as truck drivers
- driver frustration over the demands being made on them; drivers not following regulations as a result
- portages that are too narrow for the trucks.

3.8 Archaeological Resources

Archaeological sites are protected by law. In the Northwest Territories, new regulations were enacted on June 15, 2001. These regulations provide greater protection for archaeological artifacts and sites and require that archaeological investigations be conducted under permit. Section 5 of the new NWT Archaeological Sites Regulations stipulates that:

> *"No person shall excavate, alter or otherwise disturb an archaeological site, or remove an archaeological artifact from an archaeological site, without a Class 2 permit"*

Section 10(a) of the Territorial Land Use Regulations that apply on Federal Crown Lands states that:

> *"No permittee may, unless expressly authorized in writing by an inspector, conduct a land use operation within 30 metres of a known or suspected archaeological site or burial ground."*

Section 16 states that:

> *Where, in the course of a land use operation, a suspected archaeological site or burial ground is unearthed or otherwise discovered, the permittee shall immediately, a) suspend the land use operation on the site, and b) notify the Engineer or Inspector of the location of the site and the nature of any unearthed materials, structures or artifacts.*

Archaeological regulations and guidelines are also included in Article 33 of the Nunavut Land Claims Agreement. Based on this agreement, the Nunavut Archaeological and Palaeontological Sites Regulations, enacted on June 15, 2001, provide comparable protection for the archaeological resources and heritage sites of Nunavut.

The Joint Venture is committed to ensuring that archaeological and traditional sites are protected and to minimizing future impacts. Although no comprehensive archaeological survey had been conducted specifically along the winter road corridor prior to 2001, it is known that some sites have been disturbed by past activities. This may include burial sites such as those reported by the Yellowknives Dene to be located near Lockhart Lake Camp. During the summer of 2001 the Joint Venture began to determine the impacts which may have occurred and to record archaeological sites that are on or near the winter road so that additional protective measures can be implemented if required.

Since specific archaeological investigations were not undertaken prior to the establishment of the first winter road to Lupin It was anticipated that some archaeological sites located along this route may have been disturbed, destroyed or buried under fill. However, despite any past potential impacts, the acquisition of significant new archaeological data through post-development archaeological field investigations conducted in the summer of 2001 should prove invaluable.

The results of the 2001 archaeological field program are currently being evaluated and documented (Bussey 2001 in prep.). The following is a brief description of the techniques employed during the 2001 summer field program. The first step involved a helicopter reconnaissance to permit low-level examination of each portage. This, in conjunction with topographic map interpretation, allowed the identification of areas with sufficient archaeological potential to justify ground reconnaissance including elevated, relatively well-drained and level terrain adjacent to water. In addition, aerial reconnaissance identified areas with bedrock exposures or limited landforms, such as knolls, that justified more intensive investigation. The traditional knowledge provided by the Aboriginal assistants proved beneficial and assisted in the discovery of a number of archaeological and traditional sites.

Ground reconnaissance was conducted in all areas judged to have moderate or greater archaeological potential and covered all facilities associated with the winter road, including camps, pull-outs and gravel pits. Since some of the areas examined had experienced surface disruption, either in the form of land modification or loss of vegetation, some of the archaeological sites may not have been visible on the surface or were so deeply buried that they could not be located using standard archaeological techniques. Deeply buried sites are effectively protected from disturbance and were beyond the scope of this archaeological inventory. Thus, the initial emphasis during ground reconnaissance was on surface examination. This was achieved by conducting a series of foot traverses across landforms with potential. If exposure was not sufficient on such landforms, subsurface testing was undertaken. Testing involved shovel excavation of 40 cm^2 units. The deposits were hand- or trowel-sorted and significant, representative artifacts encountered during testing were collected.

The initial objective was to locate as many archaeological sites as possible. Site locations were identified using geo-referenced maps and hand-held GPS. Site data are being compiled for the National Site Inventory, and maps of intact site areas will be produced. Any evidence of destroyed sites was noted and recorded for inclusion in the National inventory if they can be confirmed to be relatively near their original point of deposit. Archaeological remains associated with filled areas were identified as site locations, and archaeological material was collected where appropriate.

Once the total number of archaeological sites has been determined and a preliminary assessment made of their status (size, condition and content), the best procedures for mitigation will be identified. All archaeological sites found within the winter road or associated development areas were considered to be threatened and thus required assessment through subsurface testing and/or surface examination. The preferred mitigation option from an archaeological perspective is usually avoidance, but that was not always possible in this case because a number of sites had already been affected. Destroyed and intensively disturbed sites will not likely require further investigation, but sites with buried deposits or undisturbed surface areas will either be protected from further damage or be mitigated.

Protection could involve avoidance through limited facility relocation, staking/fencing or capping (burial under fill). When these protection options are not feasible or desirable,

mitigation usually consists of subsurface excavation and/or surface collection, which together are referred to as systematic data recovery.

An advantage of archaeological investigations in an area that had already been developed is that the boundaries of the area of concern were well defined. However, in the future, new gravel pits, winter road realignments or other developments may be proposed. The Joint Venture is committed to ensuring that any new terrain that could be affected by proposed winter road-related activities will be assessed for archaeological deposits before any development activity is initiated.

The archaeological study of the winter road is expected to contribute significantly to the archaeological database and will assist in the mitigation of past impacts. It will also contribute to the understanding of the types of impact that can occur at different types of archaeological sites because of winter road activities. The archaeological study will therefore also be of benefit to future road studies in the NWT and Nunavut.

3.9 Socioeconomic Implications

This section provides an overview of the effects of winter road operations on the northern economy. It summarizes the number of jobs created each year to construct and operate the winter road, the number of northern hires, highlights of employment characteristics and camp life. Also included is a summary of the estimated contribution of the winter road and the mining activities that it services to the northern economy. This section further identifies documented issues and concerns related to the winter road and describes how it is expected to sustain and enhance ongoing benefits to the northern economy in the future.

3.9.1 Existing Winter Road Business and Employment Opportunities

Increasing demand for construction and operating supplies for new and existing mines over the last two decades has increased the complexity of winter road operations and the subsequent availability of related seasonal employment and contracting opportunities in the Slave Geologic Province.

Since 1982-83, Echo Bay Mines Ltd. has operated the winter road and dedicated supervisory personnel to its operation. During the early years, winter road construction and maintenance was managed by Echo Bay. In 1997-98, the company publicly tendered the winter road construction and operations, awarding a five-year contract to Nuna Logistics.[1] In response to increasing demand at that time, security was increased; dispatch and maintenance shifts were doubled and winter road hours of operation were extended around the clock.

In 1999, security services for the winter road were publicly tendered. Northern-owned and operated SECURECheck was awarded a five-year contract and provided security

[1] Nuna Logistics is a 51% Inuit-owned company . The five-year Nuna Logistics Winter Road contract ends in 2003.

in 2000 and again in 2001. The number of security personnel was doubled in 2001 because of the two-fold increase in traffic over the previous year (to 8,090 loads from 4,000 loads).

The two main winter road service camps are at Lockhart Lake and Lac de Gras. Camp facilities include 49 and 47 beds, respectively, for staff and contract security accommodation, a helipad, landing strip, fuel storage tanks, meal service, first aid station with RN on duty, dispatch/communication and docking facilities. A smaller, 30-bed maintenance camp is also located at Dome Lake.

In 2001, 156 employees and contract workers were required to construct and maintain the winter road. Of these workers, 43% were northern hires. One worker was full-time and the rest were seasonal. Employment opportunities arising from the camp operations include management, administration and supervisory, purchasing and logistics, warehouse personnel, foremen, licenced heavy duty mechanics, heavy equipment operators, welders, janitorial and catering staff, registered nurses, dispatchers, flood labourers and security personnel. With the exception of caterers and flood workers, most camp personnel are on a three-weeks-in, one-week-out shift rotation schedule. The original Dome Lake and Lockhart Lake camps were replaced in 1999 and 2000, and the existing Lac de Gras Camp will be replaced within the next few years. The camps are comfortable and include leisure and recreational facilities.

Many of the management and supervisory personnel for the winter road have direct and long-term experience in its construction and operation and have contributed to the development of high standards of performance. These standards are fully documented in Echo Bay publications:

- Operator Agreement
- Winter Road Spill Contingency Plan
- Highway and Winter Road Drivers' Policy and Procedures Manual
- Compliance with National Safety Code Procedural Format.

Camp and winter road personnel, including equipment operators and security personnel, are provided with orientation sessions to introduce them to the work environment and are trained in first aid, spill and emergency incident response.

Annual construction and operating costs are variable and may range from $10,000 to $11,500 per km, contributing up to $5.7 million to $6.5 million annually to the regional economies. Payroll for the five-year construction and operation contract awarded to Nuna Logistics in 1997-98 is estimated at about $2.0 million annually, with approximately 40% directed into the northern economy. With regard to supplies and services, 95% of support items are purchased in Yellowknife.

Concerns about employment and business opportunities generated by the winter road related to the northern economy are not well documented. However, the GNWT has questioned whether the expansion of the existing winter road network represents a

practical, long-term approach to meeting the government's objective of fostering increased and sustained mineral development in the Slave Geologic Province. The GNWT has suggested that the *status quo* may not be sufficient to optimize winter road operation and to this end has endorsed a strategic initiative to pursue future operating authority of the winter road. The Joint Venture, on the other hand, takes the position that responsibility for the winter road should continue to be managed as a private operation.

While the GNWT believes that it is better positioned to deal with winter road-related issues such as environmental concerns, enforcement, Aboriginal interests and traffic linkages to the Ingraham Trail (NWT Transportation 2000), the Joint Venture has a different perspective. In particular, it is important to note that the existing winter road and its operation represents a major achievement since it already successfully handles a higher volume of traffic than any other winter road in the world. The staff, experience and capacity needed to accomplish this critical annual undertaking has been built up over 20 years by the private sector. As a result, the Joint Venture believes that this capability could not be readily replicated by government.

3.9.2 Future Winter Road Business and Employment Opportunities

The Joint Venture recognizes the important role that the winter road plays in the local economies of Yellowknife, N'dilo and Dettah in terms of staging/marshalling and dispatching of the annual resupply of freight to the mines and mineral exploration activities in the Slave Geologic Province. With respect to future northern employment and business opportunities, the Joint Venture is committed to local purchase and northern employment practices. The Joint Venture recognizes that local business and the northern and Aboriginal labour force in the North Slave and West Kitikmeot are building capacity for economic opportunities. As existing contracts terminate, to the extent possible and without affecting the integrity of the winter road, construction and maintenance contracts will be unbundled and publicly tendered to provide improved opportunities for northern businesses with smaller capacity.

The Joint Venture is committed to continuing to implement the high standards of operation established by Echo Bay Ltd. As traffic demands on the winter road increase, the Joint Venture will review and update established policies and procedures to further enhance the safety and efficiency of the construction and operation of the winter road. Its firm commitment to safe operations will always receive the highest priority.

Further upgrades to the winter road will be required to ensure its ongoing ability and reliability to serve as a resupply corridor for mines and mineral exploration activities in the Slave Geologic Province and the West Kitikmeot. To this end, the Joint Venture is undertaking the necessary studies to examine and improve future capacity. The Joint Venture is committed to investment in upgrading, which will translate into future business and employment opportunities in the North Slave and West Kitikmeot.

3.9.3 Winter Road, Public Infrastructure and Services and Public Safety

The seasonal operation of the winter road affects public infrastructure from the 60th parallel north to Yellowknife. The Joint Venture supports the initiatives outlined in the GNWT's *"Investing in Roads for People and the Economy: A Highway Strategy for the Northwest Territories."* In particular, the Joint Venture acknowledges the need to accelerate the upgrading programs for Highway #3 between Edzo and Yellowknife and for the Ingraham Trail. A number of initiatives have been undertaken to improve the strain of winter road resupply operations on public infrastructure. In response to potential public safety concerns, the winter road operator has been proactive in avoiding potential conflicts and accidents by:

- posting speed limit reductions
- increasing distances between tractor-trailers
- restricting movements of wide loads to low-traffic periods
- arranging public information meetings with residents along the Ingraham Trail.

The Joint Venture recognizes that greater public and private demand for the winter road has increased the need for monitoring all activities on the winter road. The future maintenance and success of the winter road as an efficient resupply route will require a high degree of cooperation among the winter road users and other interested parties.

Rules of the winter road and penalties for infractions are well understood by the contractors and operators resupplying the mines and mineral exploration activities. Security personnel are trained in enforcement, and more security personnel have been hired in response to growing traffic loads on the winter road. The improvements in winter road safety and the environmental record speak to this issue. The record shows (Section 3.5) that despite the increased traffic volumes, fewer spill incidents have occurred in recent years than in the mid-1980s. The combination of more experienced truck drivers, effective traffic management and strict compliance with existing procedures are some of the more important factors contributing to the improved operational safety and environmental record.

The traffic linkages between the winter road and the NWT highway system, particularly the Ingraham Trail, remain both a public and private concern. From the private sector perspective, the Joint Venture will continue to support the upgrading of public roads by government.

3.9.4 Economic Contributions

Over the past 20 years, the winter road has provided an essential supply link for both operating mines and mineral exploration activities within a large area of the Slave Geologic Province in both the NWT and Nunavut. In this role it has made significant contributions to the economies of this region of northern Canada and nationally. These contributions are expected to continue to grow and change over time to meet the needs of the evolving mining industry in the region serviced by the winter road.

To gain an appreciation of the macro-economic implications of continued use of the winter road, modelling was undertaken using mine economic impact models developed by Ellis Consulting Services (ECS). The ECS models employed an input-output framework to generate estimates for Gross Domestic Product (GDP), labour, income, employment and government tax revenues. For this analysis only "direct" effects were estimated. Direct effects include all operating surplus, labour income and value-added benefits associated with the direct purchase of goods and services for each project evaluated. Indirect and induced contributions were not analyzed.

For the analysis, effects were estimated over the 20-year period from 2001 to 2020, long enough to reflect the medium and long-term economic effects of continued winter road operation. The mines/projects included in the analysis and the life-of-mine or activity time-frames for each project are summarized in Table 3.9-1. These projects were chosen because they are either operating, under construction or in the advanced permitting stages. The "exploration" category comprises the expenditures of all other known or projected mineral ventures in the region.

Table 3.9-1
Mines/Projects Included in Macro-economic Analysis

Mine/Project	Time Frame	Jurisdiction
Lupin Gold Mine	2001 - 2008	Nunavut
Jericho Diamond Project	2001 - 2008	Nunavut
EKATI™ Diamond Mine	2001 - 2014	NWT
Diavik Diamonds Project	2001 - 2020	NWT
Snap Lake Diamond Project	2001 - 2020	NWT
Ongoing Exploration	2001 - 2020	Nunavut
Ongoing Exploration	2001 - 2020	NWT

The predicted effects of the winter road on the GDP of the NWT, Nunavut and southern Canada based on the analysis is illustrated in Figure 3.9-1. Over the 20-year period, direct GDP is predicted to rise each year by an average of $1.2 billion in the NWT, $27 million in Nunavut and $309 million in the southern provinces. In total, the winter road and associated projects would contribute more than $31 billion (an average of $1.6 billion per year) to Canada's GDP. The effects of the winter road and associated projects on the economy of the NWT are expected to peak in 2008 to 2010, when they would contribute $1.9 billion, or 56%, of total GDP in the NWT (Figure 3.9-2). In Nunavut, peak impacts are expected in 2004 to 2006, when project-related developments will contribute an estimated $72 million, or 9% of the total territorial GDP.

The predicted effects of the winter road and associated projects on northern and national employment are summarized in Figures 3.9-3 and 3.9-4. In the NWT, the winter road and associated projects would directly contribute almost 43,000 person-years of employment – an average of 2,100 annually. The direct employment effects would peak at 14% of the total labour force, or one job in seven in the total NWT labour force. In Nunavut, it is estimated that almost 2,300 direct jobs would be generated over the 20-year period. Employment effects would peak in 2005, when the winter road and associated projects would generate 252 person-years of employment, or 3% of total employment in Nunavut.

The predicted effects of the winter road and associated projects on government tax revenues are summarized in Figures 3.9-5 and 3.9-6. The GNWT would receive more than $2.3 billion, the Government of Nunavut $77 million, the southern provinces $688 million and the Federal Government approximately $9 billion over the 20-year period. Total revenues to governments would peak during 2007 to 2012, when the greatest number of mines are predicted to be in operation.

As stated earlier, the macro-economic analysis did not include the indirect and induced effects that would be generated as economic "spin-offs" of the direct activities. The economic effect of the winter road and mining projects will therefore be even greater than that predicted by the modeling exercise. It is also of note that the number of associated mines/projects included in the analysis will, in all likelihood, increase over the 20-year study period. This will also increase the overall economic effects and benefits to the territories and provinces.

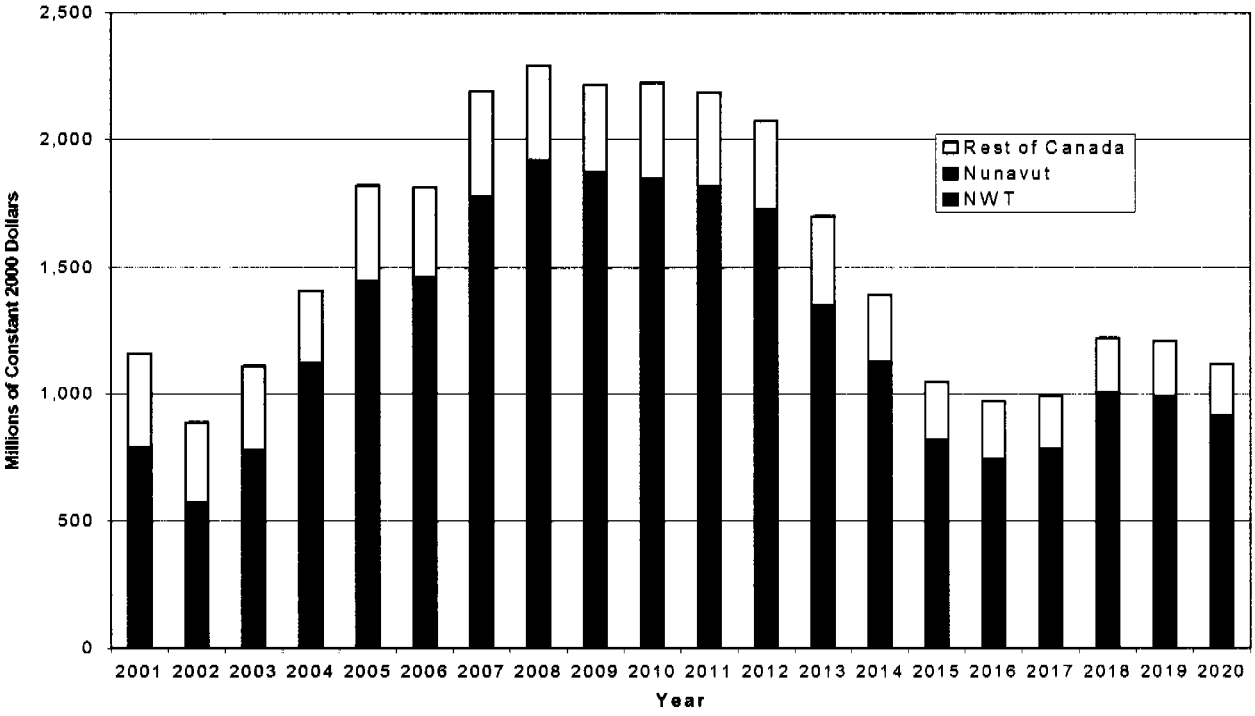

Figure 3.9-1 Annual Contribution of the Winter Road and Associated Projects on Gross Domestic Product (GDP) in NWT, Nunavut and Rest of Canada, 2001-2020

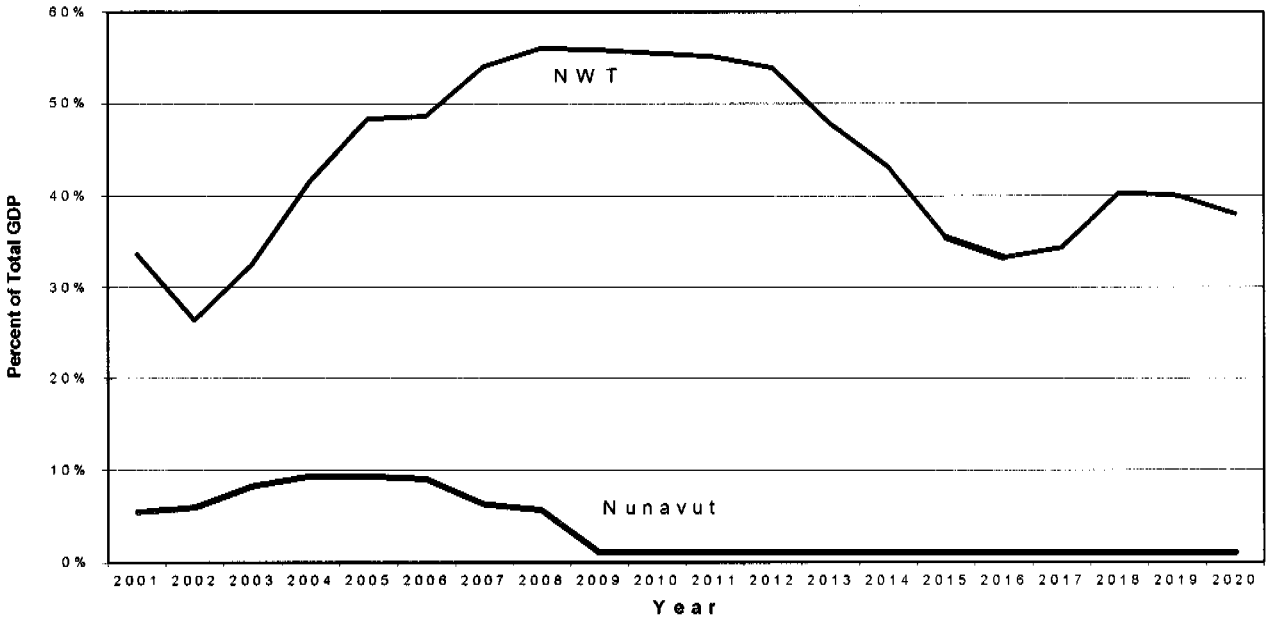

Figure 3.9-2 Contribution of the Winter Road and Associated Projects on NWT and Nunavut Gross Domestic Product (GDP)

The predicted effects of the winter road and associated projects on northern and national employment are summarized in Figures 3.9-3 and 3.9-4. In the NWT, the winter road and associated projects would directly contribute almost 43,000 person-years of employment – an average of 2,100 annually. The direct employment effects would peak at 14% of the total labour force, or one job in seven in the total NWT labour force. In Nunavut, it is estimated that almost 2,300 direct jobs would be generated over the 20-year period. Employment effects would peak in 2005, when the winter road and associated projects would generate 252 person-years of employment, or 3% of total employment in Nunavut.

The predicted effects of the winter road and associated projects on government tax revenues are summarized in Figures 3.9-5 and 3.9-6. The GNWT would receive more than $2.3 billion, the Government of Nunavut $77 million, the southern provinces $688 million and the Federal Government approximately $9 billion over the 20-year period. Total revenues to governments would peak during 2007 to 2012, when the greatest number of mines are predicted to be in operation.

As stated earlier, the macro-economic analysis did not include the indirect and induced effects that would be generated as economic "spin-offs" of the direct activities. The economic effect of the winter road and mining projects will therefore be even greater than that predicted by the modeling exercise. It is also of note that the number of associated mines/projects included in the analysis will, in all likelihood, increase over the 20-year study period. This will also increase the overall economic effects and benefits to the territories and provinces.

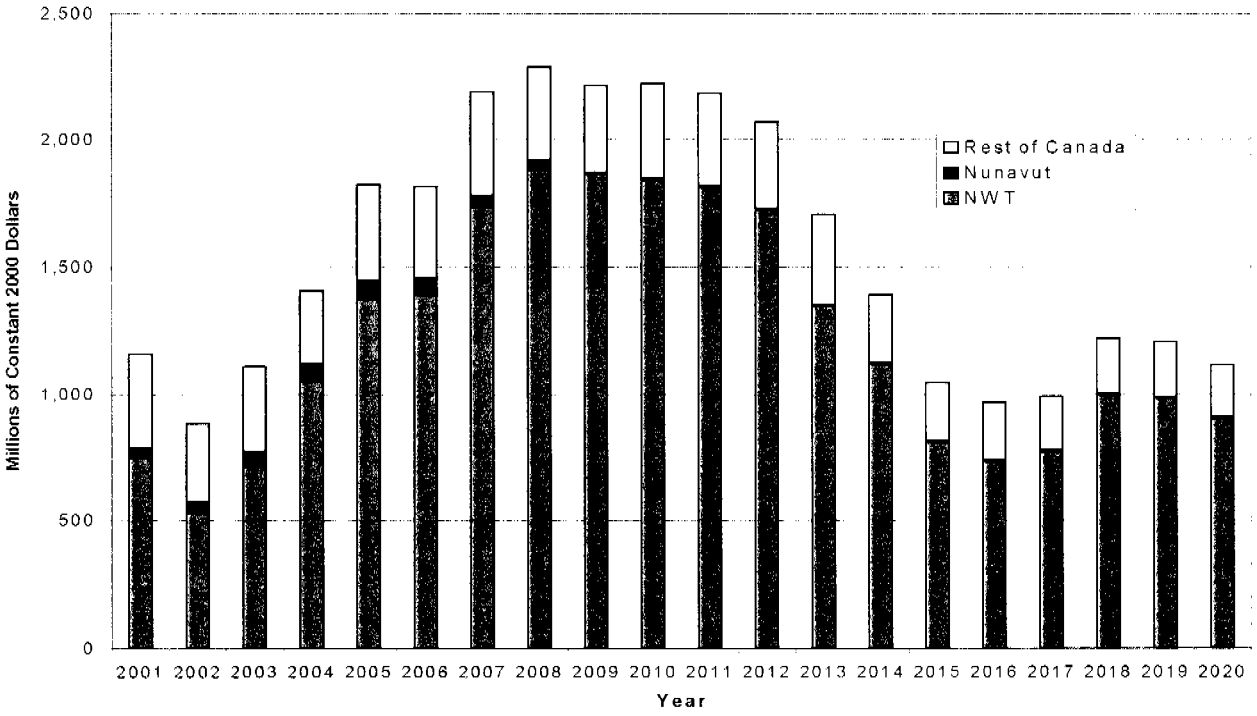

Figure 3.9-1 Annual Contribution of the Winter Road and Associated Projects on Gross Domestic Product (GDP) in NWT, Nunavut and Rest of Canada, 2001-2020

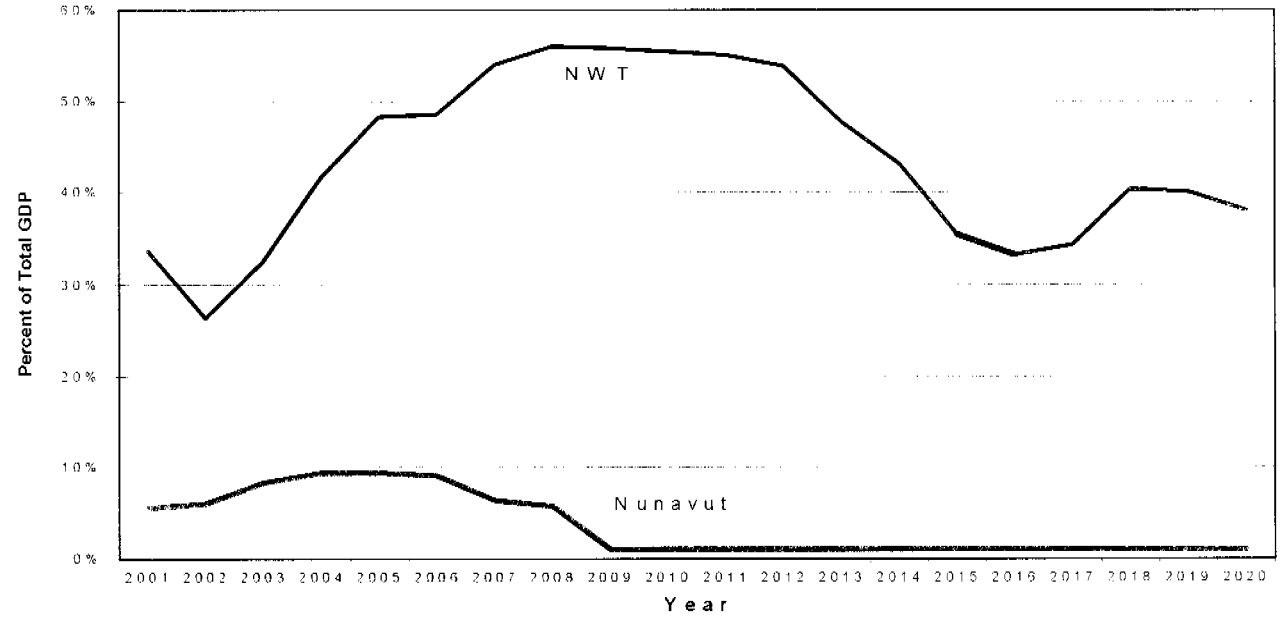

Figure 3.9-2 Contribution of the Winter Road and Associated Projects on NWT and Nunavut Gross Domestic Product (GDP)

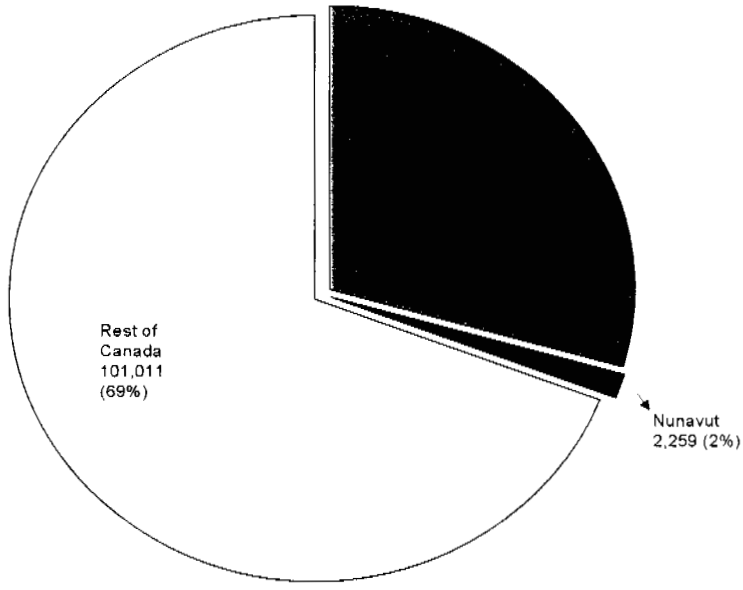

Figure 3.9-3 Contribution of the Winter Road and Associated Projects on Employment in NWT, Nunavut and Rest of Canada (Person-Years)

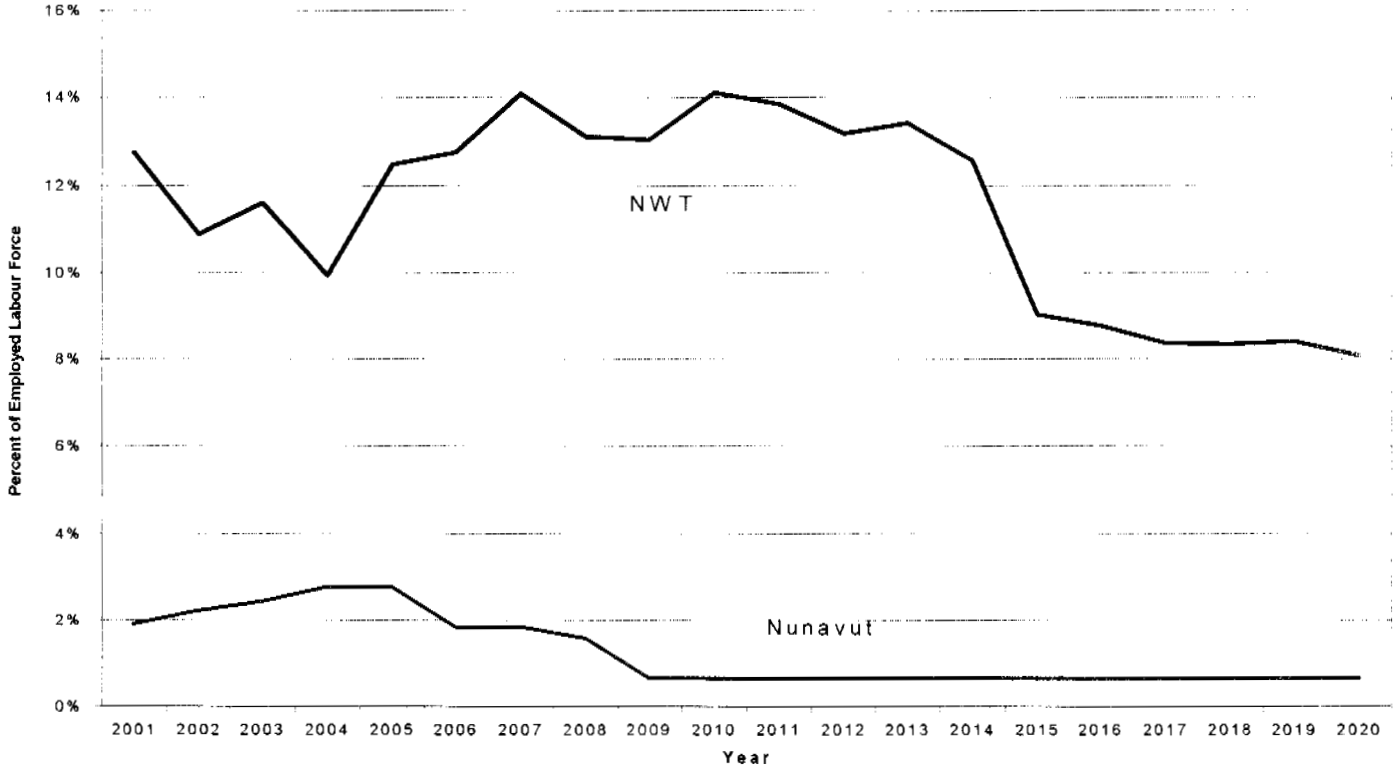

Figure 3.9-4 Contribution of the Winter Road and Associated Projects on Overall Employment in NWT and Nunavut

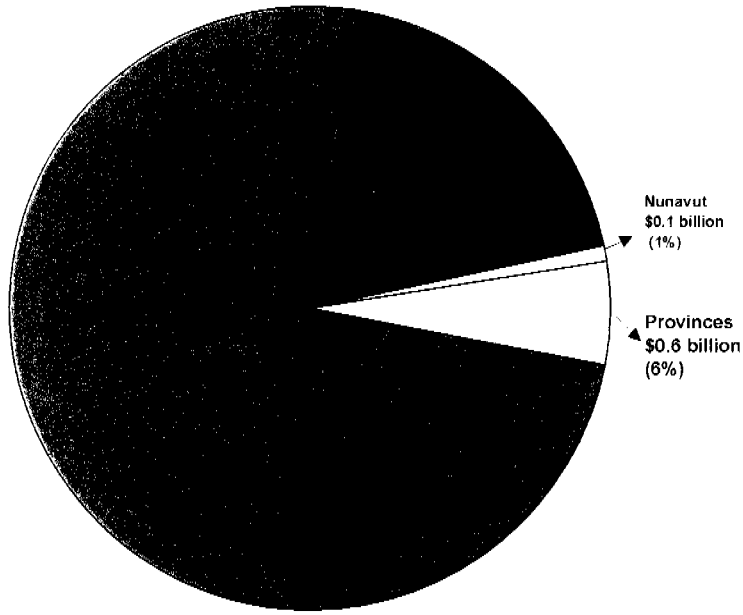

Figure 3.9-5 Government Tax Revenues Generated by the Winter Road and Associated Projects, 2001-2020 (Billions of Constant 2000 Dollars)

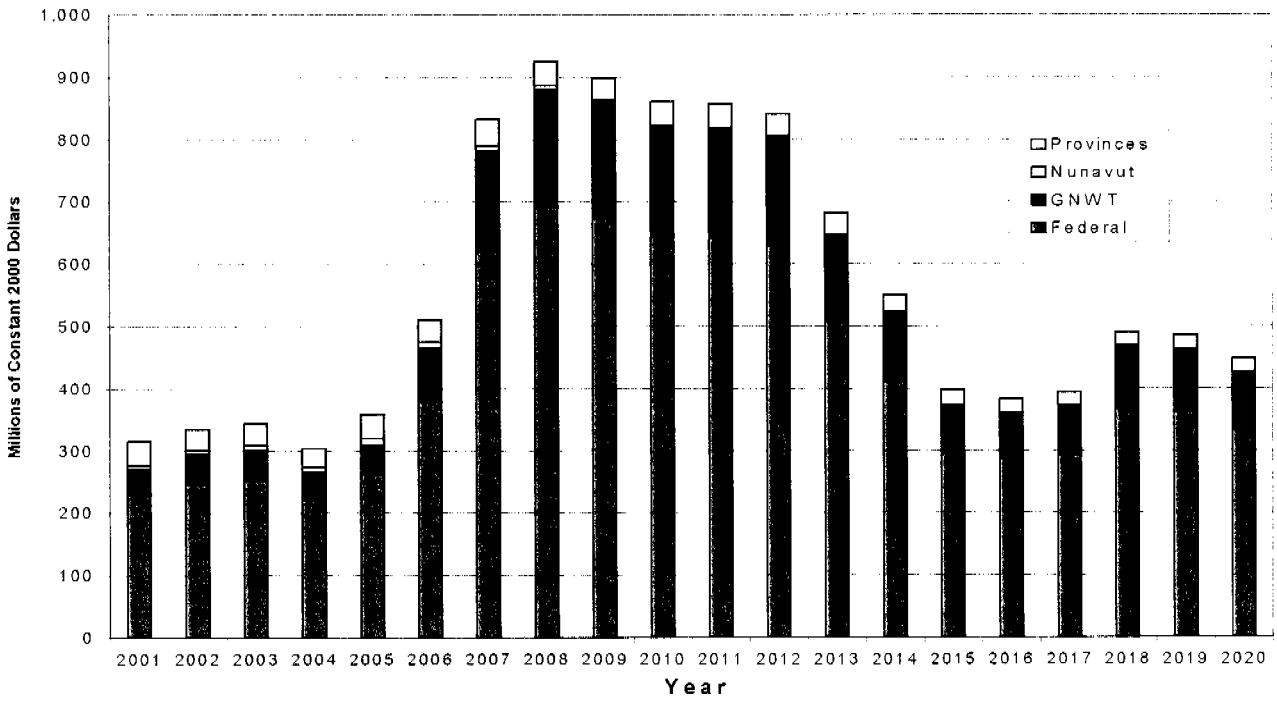

Figure 3.9-6 Effect of the Winter Road and Associated Projects on Government Tax Revenues

3.10 Cumulative Effects Considerations

3.10.1 General

Cumulative environmental effects can result from the combined effects of individual activities. These activities may represent a number of developments within a particular geographic area or a number of developments occurring over time. Although the residual effects of an individual activity may not be significant, the combined residual effects of several developments may be.

The issue of possible cumulative effects related to the development of diamond mines and associated infrastructure in the Slave Geologic Province has been the subject of three recent comprehensive environmental assessment and review processes:

- Federal Environmental Assessment Panel Review (EARP) of the Environmental Impact Statement for the NWT Diamonds Project (BHP 1995; EARP 1996)
- Canadian Environmental Assessment Agency (CEAA) Comprehensive Study of the Diavik Diamonds Project Environmental Assessment (DDMI 1998; CEAA 1999)
- Mackenzie Valley Environmental Impact Review Board (MVEIRB) review of the Environmental Assessment Report for Sable, Beartooth and Kimberlite Pipes (BHP 2000; MVEIRB 2001).

Each of these environmental assessment processes required that the existing winter road be considered as a component of their respective cumulative effects analyses. In general, these reviews all concluded that possible effects from the proposed projects in relation to other activities in the region, including the winter road, were unlikely to generate significant adverse cumulative effects (EARP 1996; CEAA 1999; MVEIRB 2001).

The comprehensive study report for the Diavik Project (CEAA 1999) identified the need for a framework for regional cumulative effects management to address future potential developments in the NWT. After accepting this recommendation, the Federal Ministers of Environment and DIAND jointly directed that such an assessment and management framework be developed. The Joint Venture is fully committed to participate in the development and implementation of this framework and has been actively involved in all related activities to date. It is anticipated that this management framework will assist in coordinating regional monitoring programs intended to improve the understanding of possible cumulative effects. It will also help in the development of "early warning" detection systems and the identification of additional mitigation measures for effective management of issues relating to cumulative effects.

3.10.2 Winter Road Cumulative Effects

Unlike an assessment for a new development project, the assessment for the winter road must recognize that the winter road has been in operation for more than 20 years, and that its presence and varying traffic volumes have already had physical effects on the environmental resources within the zone of influence of the corridor.

Wildlife responses to the winter road depend, in part, on whether or not the animals are resident, seasonally resident or migratory in their interactions with the winter road. Resident species are likely to exhibit some degree of habituation to activities associated with the annual construction and operation of the winter road and subsequent traffic volumes. Migratory birds are not to be exposed to disturbance from traffic, whereas the exposure of migrating caribou varies depending on their distribution on winter ranges and chronology of migration.

Within this context, the main question that needs to be examined in relation to possible future cumulative effects attributable to the winter road is:

"What will change?"

As stated in this Project Description, the Joint Venture proposes to continue to operate and manage the winter road much as it has in the past. However, it proposes to institute a program of improvements to the winter road itself and to the management procedures used to facilitate the safe and efficient movement of increased traffic volumes in the years ahead. As indicated previously, the number of commercial truck loads carried over the winter road during the operating season has increased from approximately 2,000 in 1996-97 to 8,090 in 2001 and is projected to increase further to about 12,000 loads by 2009.

The proposed program of physical and traffic management improvements is outlined in Section 2. The physical improvements include high, medium and low priority portage upgrades and realignments. Proposed traffic management changes include:

- instituting measures to optimize winter road opening and closing efficiency
- improved ice surface maintenance
- enhanced flooding practices
- improved traffic flow and cycle times.

Before implementing any of the proposed physical improvements to portages along the winter road route, site-specific environmental and archaeological studies will be undertaken to assist in identifying sensitive or critical habitats or areas of cultural resource potential that require protection. This will ensure that the effects of the work in each area are localized and minimized to prevent any significant project-related or cumulative effects.

The primary activities associated with the continued and increased use of the winter road that could contribute to the manifestation of cumulative environmental effects in the region relate to:

- physical improvements
- increased traffic volumes
- increased resource harvesting

Concern has been expressed by various stakeholders that traffic volumes along the winter road could eventually reach a threshold level that may result in measurable effects on wildlife active in the area during the winter operating period, particularly with regard to the Bathurst caribou herd. As indicated in EBA (2001a), the winter range of the Bathurst herd is generally south of the treeline, extending from the vicinity of Great Bear Lake through the Great Slave Lake region and southward as far as northern Saskatchewan. Within this broad area, the annual wintering areas are variable, but in most years some of the herd overwinters in the vicinity of the winter road.

The fall migration to the winter range is complete by the time the winter road is operational. During winter, caribou movements are localized and indeterminate and generally involve small groups of animals wintering near the winter road. Such groups may be subject to localized disturbance or disruption of movement patterns. Since most of the winter road consists of ice crossings, cumulative habitat effects remain insignificant.

With increasing traffic volumes over time and possible new mine developments, there are likely to be more interactions between caribou and vehicular traffic and associated increases in localized disturbance to caribou. The extent of interactions will depend on the late-winter distribution of caribou in a given year and the timing of spring migration. It should be noted that not all of the herd would be exposed to the winter road during migration because of it normally uses several migration routes in any given year (Section 3.6).

The concerted movement of caribou at this time typically coincides with the end of the winter road season. High traffic volumes could trigger physiological stress in caribou attempting to cross the winter road or could temporarily disrupt or deflect movements. Such effects could become cumulative when considered in conjunction with the herd's spring and fall movements through the mine areas in the Slave Geologic Province (EKATI™, Diavik, Snap Lake, Lupin) and ongoing harvesting activities, primarily in the winter range.

To minimize disturbance to caribou, the Joint Venture is committed to the policy that at all times, caribou (or other wildlife) will have the right-of-way, and vehicles will be required to slow down or stop to permit the free and unrestricted movement of caribou across the winter road at any location. In the event of a major migratory movement interacting with the winter road, all winter road traffic may be suspended until the movement has been completed. Similar restrictions on public use of the winter road would also be required if this measure is to be meaningful. With the diligent application of this traffic management strategy, the Joint Venture is confident that disturbance effects, including their possible contribution to cumulative effects on the Bathurst caribou herd, will be minimized.

Without proper mitigation, wolves, wolverines and foxes could also be exposed to increases in human interaction as the result of increasing traffic volumes over time and the potential for new mine developments. Increases in traffic result in an increase in activity at the winter road maintenance camps, primarily Lac de Gras and Lockhart Lake where truck drivers stop for their regulated eight-hour rest period. The most likely cause

of interaction relates to the attraction of wildlife to the camps and mines as food sources. The diligent management of food wastes will be critical to minimize the attraction of wolves, wolverines and foxes to the camps and mines. In their 2001 annual general meeting (IEMA 2001), the Independent Environmental Monitoring Agency for the EKATI™ mine highlighted concern for the potential cumulative environmental effect that the EKATI™ Misery Camp, the Diavik construction camp, and the Lac de Gras winter road camp may be having on the local wolverine population. The IEMA noted that ten wolverines have had to be relocated between 1998 and 2001 as a result of being attracted to the camps. The attraction of wolverines to these camps further amplifies the Joint Ventures identification of improved waste handling as a top priority for the winter road.

Another major annual activity associated with the winter road that may contribute to a possible cumulative concern relates to resource harvesting by the general public in the region. Information on historical and recent resource harvesting activities in the region and along the winter road corridor is presented in EBA (2001a). The total annual harvest of Bathurst caribou (including commercial harvest) is estimated to be between 14,500 and 18, 500 animals per year (Case *et al.* 1996). During years when part of the herd winters in the vicinity of the winter road corridor, much of this harvest is centred around the winter road. Most hunting is done from the southern end of the winter road from Tibbitt Lake to the Gordon Lake area and beyond to Brown and Drybones lakes.

Some hunting pressure is also directed toward wolves and wolverines who are generally associated with the movements of the caribou herd. In addition, it is known that wolverines in particular can be attracted from considerable distances to feed on caribou remains left by human hunters. When this happens, wolverines can become relatively easy targets for hunters. Although an increase in commercial winter road traffic will not cumulatively affect hunting pressure, human population growth arising from developments may result in a cumulative effect on caribou harvesting and mortality of carnivores associated with the winter road.

Currently, RWED officers patrol the winter road on a regular basis, usually twice per week and generally on weekends. In addition, hunter checkstops have been set up on the winter road in the past, and a mobile checkstop was implemented in 2001. However, notwithstanding current efforts to monitor and regulate harvesting activities along the winter road, many stakeholders believe that a higher level of effort is required to ensure that regulations are properly enforced and wastage is minimized. In addition, the Metis and Dene have advocated that their people become more directly involved in public monitoring of harvesting and other activities related to the winter road in the future.

The need to effectively monitor and regulate harvesting activities along the winter road will become increasingly important as the human population of Yellowknife and the nearby communities continues to grow. The Joint Venture recognizes that the winter road enables the general public to access and more efficiently harvest the wildlife resources in the vicinity of the winter road corridor. As a result, the Joint Venture is committed to supporting the development and implementation of a more

comprehensive monitoring and enforcement program to ensure that future harvest levels of wildlife are managed to acceptable and sustainable levels.

The primary responsibility for such monitoring and enforcement rests with GNWT-RWED.

3.11 Summary

Since 1982 when the winter road was first opened, it has functioned as a vital resupply link for the developing mining industry in the area of the Slave Geologic Province served by the seasonal road.

The environmental record of the winter road over the past 20 years has been good, primarily because construction, operations and maintenance and environmental management policies and practices have continued to improve as the operation of the winter road has evolved.

Based on current forecasts, the winter road has a foreseeable future life of 30 or more years. During this time-frame, the annual commercial traffic loads are forecast to continue to increase from the 2001 level of 8,090 truck loads to a peak of just under 12,000 in 2010, remaining stable to about 2015. Thereafter, the load volume is projected to drop substantially as EKATI™ enters its closure and reclamation phase.

To successfully manage the projected increases in traffic volume a number of upgrades and/or improvements will be needed in the future, as discussed in Section 2. These will focus on improvements in traffic management, safety of the crossings, portage reconstruction and improvements to support infrastructure. Concurrently, the environmental management system will continue to evolve to effectively manage projected changes related to the continued future operation of the winter road.

The potential environmental, cultural and socioeconomic effects and appropriate mitigation measures related to the existing winter road operation and proposed future upgrades/improvements have been reviewed throughout Section 3. Table 3.11-1 provides a summary of the potential effects associated with the future operation of the winter road and the proposed mitigation measures to be employed. With the diligent application of the mitigation measures proposed and the cooperation of the Aboriginal stakeholders, regulators and resource management agencies, and the general public, the Joint Venture partners are confident that the environmental, cultural and socio-economic issues related to the evolving winter road can continue to be effectively managed.

Table 3.11-1
Summary of Potential Effects
and Proposed Mitigation Strategies

Potential Effect	Proposed Mitigation Strategy
Air Quality	
- Air emissions	- None required as air emissions are expected to be minor, localized and transient
Terrain and Vegetation	
- Additional clearing of boreal forest	- Minimize tree clearance width at portages in the boreal forest
- Loss of habitat due to infilling	- Selection of route realignments to avoid environmentally sensitive or important areas - Minimize footprint
- Late season damage to terrain and vegetation	- Limit late season commercial operations - Closure of the winter road at end of operating season to limit 3rd party vehicle access - Progressive reclamation of abandoned portages
Aquatic Life and Habitat	
- Introduction of harmful substances due to spills	- Implementation of continuous improvements in traffic management to optimize safety and minimize spill incidents - Application of effective spill response and clean-up procedures
- Aquatic and riparian habitat destruction	- Maintain adequate setback distances for portage embankments at streams and lake shores - Closure of the winter road at end of operating season to limit 3rd party access
Wildlife	
- Direct habitat loss	- Minimize tree clearance width at portages in boreal forest - selection of route realignments to avoid environmentally sensitive or important habitats - Minimize footprint

Table 3.11-1 Continued

Potential Effect	Proposed Mitigation Strategy
- Disturbance of wildlife due to traffic - Traffic-related wildlife mortality - Attraction and habituation of wildlife to camps - Public wildlife harvesting - Spills and contamination of wildlife	- Application of traffic management practices, e.g. wildlife have the right-of-way - Minimize wildlife incidents through application of traffic management practices - Continuous application of effective waste management practices - Continued personnel education to prevent feeding of wildlife - Effective monitoring and enforcement by resource management agencies - Closure of the winter road at end of operating season to limit 3rd party vehicle access - Implementation of continuous improvements in traffic management to optimize safety and minimize spill incidents - Application of effective spill response and clean-up procedures
Archaeological Resources - Destruction of archaeological sites and artifacts	- Prevent and minimize future impacts by avoiding, protecting or conducting systematic data recovery of archaeological sites
Socioeconomic Issues - Business and employment opportunities - Public access and safety concerns	- Preferential northern hiring and local purchase provisions - Public information meetings, posted speed limits, restricted movements of wide loads to low traffic periods - Closure of winter road during unsafe periods such as during early season construction and at the end of the commercial operating period

4.0 SUMMARY OF CONSULTATIONS

The Tibbitt Lake to Contwoyto Lake Winter Road Joint Venture is strongly committed to effective, open and honest communications with all parties potentially affected by the operation of the winter road. Beyond a desire on the part of the Joint Venture to be a good neighbour, public consultation represents an important part of the endeavours conducted under the terms of the Mackenzie Valley Resource Management Act (MVRMA). Preparation of this section of the Project description Report has been guided by Section 3 of the MVRMA, which requires that consultation occur:

3a) by providing, to the party to be consulted,
   (i) notice of the matter in sufficient form and detail to allow the party to prepare it views on the matter,
   (ii) a reasonable period for the party to prepare those views, and
   (iii) an opportunity to present those views to the party having the power or duty to consult; and
3b) by considering, fully and impartially, any views so presented.

In addition to the MVRMA, the Joint Venture has made reference to guidelines such as those provided by the Mackenzie Valley Land and Water Board in their *Draft-Information Requirements for a Development Application to the Mackenzie Valley Land and Water Board – February 23, 2000*. In the draft guidelines, the MVLWB suggests that consultation should include:

a) Document the nature, dates and locations of consultation undertaken
b) List the issues raised by the stakeholders
c) Indicate how the issues are addressed in the application
d) State what land use permissions have been arrived at.

Consultations for the Project Description have been undertaken in a manner consistent with Section(s) 3a and 3b and points a-c of the draft guidelines. Based on the MVRMA and precedents set in court cases in jurisdictions such as British Columbia on what constitutes consultation, it seems clear that the point of consultation is to allow interested parties an opportunity to developed an informed opinion and to have their views fairly considered. Therefore, the Joint Venture's consultation efforts have sought to provide the local communities, Aboriginal people and the general public with appropriate information in a timely manner.

Sections 114 & 115 have further guided the Joint Venture's approach to consultation under the MVRMA. In S. 114(c), one of the purposes of a screening and an environmental assessment is to "ensure that the concerns of Aboriginal people and the general public are taken into account...". Section 115 sets out one of the guiding principles to be "the protection of the social, cultural and economic well-being of residents and communities in the Mackenzie Valley".

The Joint Venture has not specifically sought the permission of any stakeholders to re-permit the winter road as is suggested by point d) of the MVLWB draft guidelines. The

issue of consent is settled by reference to the definition of "consultation" found in S. 3 of the MVRMA. Based on this definition, the responsibility of the Board, having complied with (i) to (iii) of S. 3(a), is to fully and impartially consider the views so expressed. The strongest case on the question of consent is Delgamuukw which contains one line which suggests that consent may be required only in exceptional cases, and gives as examples hunting and fishing regulations which prohibit the exercise of an Aboriginal right without a conservation justification. Put simply, except in exceptional cases, consultation does not include the requirement of the consent of those who are being consulted. The consultation required under the MVRMA clearly is not such a case because Aboriginal title is not being infringed. The reason aboriginal title is not being infringed is because the winter road is, for the most part, an ice road constructed over the surface of frozen lakes for a brief 3 month period that ceases to exist in warmer weather. Title to the underlying water is clearly vested in Her Majesty in Right of Canada by virtue of Section 4 of the *Northwest Territories Waters Act.*

Consultation with stakeholders regarding the operation of the winter road is not new. Over the years, the individual mining companies that are end users of the winter road - Echo Bay Mines Ltd., BHP Billiton, Diavik Diamond Mines Inc, De Beers Canada, and Tahera Corporation, have carried out community consultation programs in relation to the environmental assessment and operation of their individual projects. Aboriginal and public comments in relation to the winter road are on the public record from the 1996 EARP review of the NWT Diamonds Project, the 1998 Diavik Diamonds Project CEAA Comprehensive Study, and the 2000 BHP Sable, Pigeon and Beartooth Environmental Assessment by the Mackenzie Valley Environmental Impact Review Board.

These reviews included the communities of Yellowknife, N'dilo, Dettah, Lutsel K'e, Rae/Edzo, Wha Ti, Wekweti and Gameti in the Northwest Territories and Kugluktuk, Cambridge Bay, Umingmaktok and Bathurst Inlet in Nunavut. Other stakeholders who have been regularly consulted include the Ingraham Trail residents, industrial and commercial interests, the Government of the Northwest Territories, the Government of Nunavut, the Government of Canada, Environmental Non-Government Organizations (ENGOs), and the general public that use the Ingraham Trail and the winter road for recreation.

The issues that have consistently been raised by the Aboriginal communities over the last six years concerning the winter road include: the potential effect on caribou, poor hunting practices, potential effects on archaeological and heritage sites, waste management, hydrocarbon spills and increased access to traditional lands by non-Aboriginal people.

The residents of the Ingraham Trail and the general public in Yellowknife have been and remained concerned about traffic volumes and the condition of NWT Highways 3 and 4. Safety of the public highway system has been the over-riding concern.

During the last year, consultation has entered a new phase because of the need to re-authorize the Land Use Permit for the Dome Lake Camp and aggregate quarry access, and to renew the Licence of Occupation for the winter road. The Joint Venture has gradually taken over the responsibility for running and permitting the winter road since

1997. In 2000, BHP Billiton assumed responsibility for community consultations and re-authorization of the Licence of Occupation, while Echo Bay continues to handle the existing land use permits and the operation of the winter road. This new arrangement began in November of 2000, when Echo Bay and BHP Billiton worked jointly to prepare the application for the extension of the existing land use permit for Dome Lake Camp and the quarries.

In order to make sure that no significant potential stakeholders were omitted from the consultation process, the Joint Venture partners performed a stakeholder analysis in November of 2000 to identify the potentially interested parties. The potential stakeholder groups consulted are illustrated in Figure 4.1-1. These groups can be broadly categorized as:

- Aboriginal groups with an ongoing land use interest in the land surrounding the winter road:
  - The core groups have active ongoing landuse along the winter road — Yellowknives Dene, Kitikmeot Inuit Association and North Slave Metis.
  - Groups with a sustained interest, but less ongoing use — Dogrib Treaty 11 and the Lutsel K'e Dene First Nation.
  - These are the same groups that were identified by EARP in 1995 as being potentially impacted by the then proposed development of the EKATI™ Diamond Mine.
- Businesses in the NWT and Nunavut, which have an interest either in mine re-supply and/or in resource development in the Slave Geologic Province Government agencies at the Federal and Territorial level (NWT and Nunavut) that may be deemed responsible authorities.
- Public interest groups such as the Ingraham Trail Residents Association that are potentially directly affected by traffic moving along NWT Highway 4 to the winter road.
- Environmental NGOs that have an interest in environmental issues related to the Slave Geologic Province. Preliminary discussions have been held with these parties through participation in the Cumulative Effects Steering Committee.

Communications in our consultation efforts have been via letters, phone calls, meetings and submissions, and tours of the winter road. Communications on the winter road have occurred with the Yellowknives Dene, the Kitikmeot Inuit Association, Lutsel K'e, North Slave Metis Alliance and the Dogrib of Treaty 11. Participation by the Aboriginal groups has varied but the Joint Venture has attempted to include Chiefs and Council members, committees including Wildlife/Lands and Environment Committees, and community members.

Table 4.1-1 provides a summary of all the meetings and other consultations held to date with the communities and their representatives. Copies of the correspondence, meeting notes and related documents are included in a report entitled *" Tibbitt to Contowoyto - Supplementary Public Consultation Report"* which accompanies this Project Description. Meetings have also been conducted with government agencies, including the Mackenzie Valley Land and Water Board (MVLWB), the Department of

Indian and Northern Affairs (DIAND) and the Government of the Northwest Territories (GNWT).

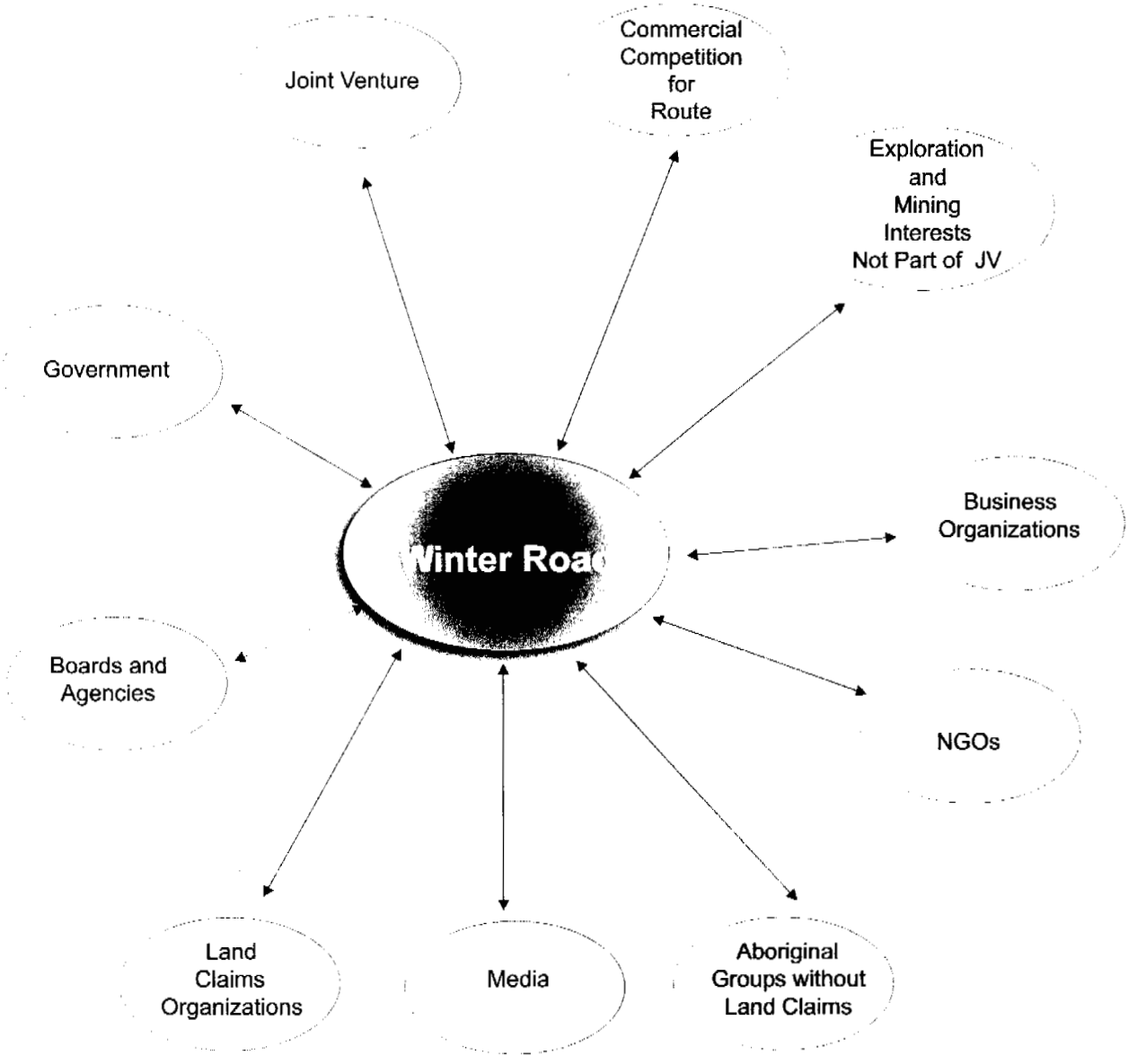

Figure 4.1-1 Tibbitt to Contwoyto Winter Road – Stakeholder Analysis

Information obtained from the consultations was recorded and has been used in the preparation of this Project Description Report. The records of these consultations are presented in the supplementary public consultation report. It is not the intent of this section to review all of the information obtained, but rather to consider some of the more important concerns or points raised by the Aboriginal groups and the general public. A brief discussion on how these potential issues have been dealt is briefly addressed in this section and under specific topics such as wildlife, archaeology and waste management elsewhere in the Report.

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  - These are the same groups that were identified by EARP in 1995 as being potentially impacted by the then proposed development of the EKATI™ Diamond Mine.
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The Yellowknives Dene and North Slave Metis have stated that they should be directly involved in monitoring of the winter road. While the Yellowknives Dene chose not to consult directly with the Joint Venture, they did work through Deton'Cho and EBA to identify the issues summarized in this Report. Some of the more important concerns to both groups relate to:

Monitoring and Policing
- improved monitoring of speed limits is needed
- the movement of wildlife should be studied
- increased number of spills
- drivers feeding animals at rest stops
- improper handling of garbage at camps may attract animals
- fishing camps built by the public without authorization

Impacts on Wildlife
- caribou migration may change
- caribou and other animals may not want to, or be able to cross the winter road because of increased traffic

Hunting and Trapping Issues
- some hunters are wasting caribou meat
- outfitters bringing foreign hunters to hunt wolves along the winter road
- poachers hunting wolf and caribou on the winter road at night
- would like to see 24 hour hunting check stations

Employment and Human Safety
- use the traditional knowledge of local trappers and hunters who know where the thin, dangerous ice is
- should hire local people to build winter roads
- portages are too narrow for the trucks

Residents of Lutsel K'e expressed their views on a number of issues, including:

- the potential effect of the winter road on caribou
- archaeological sites and graves
- spill management and
- participation in the management of the winter road

Since late 2000, a number of meetings have taken place with the Government of the Northwest Territories regarding the future of the winter road. Through these meetings the positions of both government and the Joint Venture have evolved. Currently, the range of topics being discussed by the GNWT and the Joint Venture include:

- The eventual change in landlords if the authority for land devolves from the Federal to the Territorial/Aboriginal levels of government.
- Ice Capacity – As a result of forecast increases in annual traffic loads on the winter road, the Joint Venture has initiated studies related to the capacity of the ice. GNWT

highway engineers are involved with the Joint Venture in the review of new ice capacity guidelines for controlled roads such as the Tibbitt to Contwoyto Winter Road.
- The proposed GNWT Highway Investment Strategy.
- Aboriginal Involvement – Government is concerned that a method be found to provide for regular Aboriginal involvement by the core and interested groups in the management of the winter road.
- Ingraham Trail – Residents are concerned with increased traffic and traffic flow on the trail.

In reviewing past operations and the projections of future needs for the winter road, the Joint Venture has tried to consider the experience of the operators, scientific and engineering data and the observations and experience of the Aboriginal people who still actively use the winter road corridor.

Issues related to wildlife and habitat, heritage and archaeological sites, materials management and the potential for the winter road to contribute to regional cumulative effects were considered as components of the environmental baseline field program conducted by the Joint Venture during the summer of 2001. These studies were undertaken in order to facilitate continuous improvement of environmental management practices associated with the winter road.

Members of the Yellowknives Dene First Nation, the Lutsel K'e Dene First Nation and the North Slave Metis Alliance participated in the 2001 baseline field studies. Deton'Cho Corporation, a company wholly-owned by the Yellowknives Dene, worked in association with EBA Engineering on the preparation of the Project Description and as such was involved in many of the consultation initiatives.

As previously discussed, the Land Use Permit facilitating the operation of the Dome Lake Camp and quarry access expired in June of 2001. Consultation for a new Land Use Permit continued through the expiration of the old permit. Following the submission of the new land use application by Echo Bay (re-approved effective August 30, 2001), the consultation effort has now focused on the ongoing operation of the winter road and the enclosed application for the renewal of the Licence of Occupation for the winter road.

On August 5, 2001 the Joint Venture partners – BHP Billiton, Echo Bay Mines and Diavik Diamond Mines (DDMI) jointly sent letters to the Yellowknives Dene, North Slave Metis Alliance, Kitikmeot Inuit Association, the Lutsel K'e Dene, and Dogrib Treaty 11, inviting them to join the Joint Venture's Winter Road Safety and Environment Committee. The current members of the committee include representatives from the environment departments of the end users. These include BHP Billiton, Echo Bay, DDMI, De Beers and Tahera. The committee provides policy advice on safety, waste management, winter road capacity and the environmental management of the winter road. The Safety and Environment Committee is where recommendations on the operation of the winter road that relate to the concerns that have been previously raised in the consultative process by the Aboriginal groups are dealt with by the Joint Venture.

By inviting the Aboriginal groups to sit on the committee, the Joint Venture has provided these parties with direct access to the winter road decision-making process.

The Joint Venture will continue to consult with potentially affected and interested parties, not only through the up-coming Licence of Occupation re-authorization, but also on an ongoing basis. The ultimate objective of this public consultation effort is to provide stakeholders with an effective way to have input regarding the safe, environmentally sound, and socially responsible operation of the winter road.

Table 4.1-1
List of Meetings and Other Forms of Consultation

Consultations – General Public

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
1/2/01	Meeting	Denise Burlingame BHP Billiton	Ingraham Trail Residents	For details of the discussions at this meeting please see Supplementary Consultation Report (SCR). SCR# 377	The meeting was called to order by David Wind. The purpose of the meeting was to discuss plans for the upcoming winter road resupply for the mines. Chris Hanks presented a brief background of the Tibbitt to Contwoyto winter road and circulated a fact sheet for the 2001 operation of the Lupin Winter Road. The meeting reviewed the upcoming winter road operations.
4/20/01	Presentation	Derek Chubb, BHP Billiton	Yellowknife Chamber of Commerce	SCR# 230	Held at the Yellowknife Inn on April 20, 2001. A Power Point presentation of the Winter Road Joint Venture re-permitting plan was given to the Chamber
4/23/01	Presentation	Derek Chubb, BHP Billiton	Deputy Mayor D. McCann, Yellowknife	SCR# 231	Presentation to City Council to update them on the winter road and the Joint Venture permitting process.
4/23/01	Public Meeting	Derek Chubb, BHP Billiton	Public Presentation	SCR# 232	This was a public presentation of the proposed Tibbitt to Contwoyto Winter Road. Eleven questions were raised and addressed: – questioning statistics and graph modeling, – increased Emergency Response & Training. to be done by whom, – public assess, – safety on road involving tourists, – dual licence for NT & NU? Cost saving? – what about all season road analysis? – studies on road demands?

Table 4.1-1 (Continued)

Consultations – General Public (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
4/23/01	Public Meeting	Derek Chubb, BHP Billiton	Public Presentation	SCR# 232	– how to extend window of use by all season road in parts? Aboriginal /Treaty 8 rights, decisions to be made with this group's input.

Dogrib First Nation

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/9/00	Letter	Hugh Ducasse, EBM	Grand Chief Joe Rabesca, DFN	SCR# 369	This letter contains information concerning Echo Bay intentions to renew their Land Use Permit for the operation of the Lupin Winter Road for the next two years. Written and/or verbal comments are to be made to EBM no later than November 27, 2000. This document reports that EBM has submitted an application for this purpose with the Mackenzie Valley Land and Water Board. Further, the community consultations will begin in the near future to discuss the long term permitting and operation of the winter road and EBM looks forward to the participation of the Dogrib First Nation in this process.
12/13/00	Newspaper	Chris Hanks, BHP Billiton	Richard Gleeson, Yellowknifer	SCR# 353	Dogrib's (Leon Lafferty, Grand Chief Joe Rabesca) want an all weather road to be launched from Rae through to the mineral rich Lac de Gras region rather then using the Lupin Winter Road route. Current mine life, in the area totals about 25 years of road use. In contrast, an all-weather road through the heart of the Dogrib region would be used by the various Dogrib communities forever.
1/12/01	Email	Chris Hanks, BHP Billiton	John Bekale, BHP Billiton	SCR# 330	John Bekale had lunch with Grand Chief Joe Rabesca, Chief Eddie, Paul Rabesca, Chief Charlie J. Nitsiza, Chief Archie Wetrade and Chief Joseph Judas. They all agreed with the community consultations so that they may be kept informed. BHP BILLITON agreed that YK Dene will assist with the monitoring of the winter road

Table 4.1-1 (Continued)

Dogrib First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
1/23/01	Letter	Chris Hanks, BHP Billiton	Ted Blondin, DFN	SCR# 258	This letter outlines the historic overview of the Lupin Road and clearly stating the Dogrib's connection with this winter road. In addition, the permitting process and the importance of understanding the Dogrib First Nation ideas on the future operation of the Tibbitt to Contwoyto Winter Road was stressed. This letter ended on a request to contact Chris Hanks when the Dogrib First Nation is ready to start preliminary discussions.
3/9/01	Hanks meeting notes	Chris Hanks, BHP Billiton	Chief Joe Rabesca, John B. Zoe	Present at this meeting were Chief Joe Rabesca, John B. Zoe, Chris Hanks and John Bekale. Entry from notes. SCR# 378	Chief Joe Rabesca told Chris Hanks and John Bekale that the Dogrib First Nations wanted to keep their participation with the winter road low-key at this time. He indicated that they were interested in economic opportunities related to the operation of the winter road. The Dogrib planned to work with the Yellowknives Dene First Nation. They asked Chris Hanks to mention to the Yellowknives Dene First Nations that the Joint Venture would not have a problem with the Dogrib and the Yellowknives Dene working together.
8/5/01	Letter	Ian Goodwin, BHP Billiton	Chief Joe Rabesca, DFN	SCR# 396	This letter consists of an invitation for the Dogrib First Nation to sit on the Tibbitt to Contwoyto Winter Road Joint Venture Committee on Safety and the Environment. Membership has now been expanded to include all Aboriginal groups who are interested in participating. Due to the direct land- based interest in the land through which the road passes the JV believes it is imperative that each Aboriginal Group appoint one member to the committee. This work is being done by the JV without the direction of government, in order to develop a more comprehensive environmental management planning system for the winter road. The Aboriginal groups requested to participate include; the Kitikmeot Inuit Association, Yellowknives Dene First Nation, North Slave Metis Alliance, Lutsel K'e Dene First Nation and the Dogrib Treaty 11.

Table 4.1-1 (Continued)

Kitikmeot Inuit Association

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/16/00	Letter	Hugh Ducasse, EBM	Jack Kaniak, KIA	SCR# 295	This letter states the First Nation Groups that have specifically been contacted (by letter & follow-up phone calls). This letter also states the JV's request for the term of the Land Use Permit to coincide with the expiry of the Licence of Occupation in April of 2003. Furthermore, this documents continues to encourage consultation and requests for additional information.
1/26/01	Letter	Chris Hanks, BHP Billiton	Charlie Evalik, KIA	SCR# 240	This letter provides a brief outline of the structure of the Joint Venture Management Committee, why it was developed and who are the Aboriginal stakeholders. Further, in this letter acknowledges he Inuit as current stakeholders within certain areas of the winter road and its right-of-way. Thus an invitation to meet and conult with the Joint Venture Group was requested.
2/19/01	Letter	Charlie Evalik, KIA	Chris Hanks, BHP Billiton	SCR# 254	This letter stated that the KIA are currently in a 90 day process of outlining, assessing and explaining what the future of the winter road means to the Inuit of the Kitikmeot Region. During the course of their assessment the KIA stated that the Joint Committee will be contacted by Mr. David Connelly of Royale Enterprises to arrange an initial meeting.
5/7/01	Email	Jack Kaniak, KIA	Derek Chubb, BHP Billiton	SCR# 302	Email from Jack Kaniak which was sent to Gary Potts, then forwarded to Derek Chubb by Gary Potts The following are some concerns raised by the KIA: – waste disposal and such, – if camps are moved what standards would the Joint Venture Group have to comply to? – if portages change has Archaeology been done?

Table 4.1-1 (Continued)

Kitikmeot Inuit Association (Continued)

8/5/01	Letter	Ian Goodwin, BHP Billiton	Charlie Evalik, KIA	SCR# 395	This letter consists of an invitation for the KIA to sit on the Tibbitt to Contwoyto Winter Road Joint Venture Committee on Safety and the Environment. Membership has now been expanded to include all Aboriginal groups who are interested in participating. Due to the direct land-based interest in the land through which the road passes the JV believes it is imperative that each Aboriginal Group appoint one member to the committee. This work is being done by the JV without the direction of government, in order to develop a more comprehensive environmental management planning system for the winter road. The Aboriginal groups requested to participate include; the Kitikmeot Inuit Association, Yellowknives Dene First Nation, North Slave Metis Alliance, Lutsel K'e Dene First Nation and the Dogrib Treaty 11.

Lutsel K'e Dene First Nation

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/9/00	Letter	Hugh Ducasse, EBM	Chief Felix Lockhart, LDFN	SCR# 370	This letter contains information concerning Echo Bay intentions to renew their Land Use Permit for the operation of the Lupin Winter Road for only the next two years. Written and/or verbal comments are to be made to EBM no later than November 27, 2000. This document reports that EBM has submitted an application for this purpose with the Mackenzie Valley Land and Water Board. Further, the community consultations will begin in the near future to discuss the long term permitting and operation of the winter road and EBM looks forward to the participation of the Lutsel' Ke Dene First Nation in this process.
11/16/00	Letter	S. Barry Lowe, EBM	Stephen Ellis, LDFN	SCR# 372	Responding to a request from S. Ellis to have 1:50,000 maps showing the Tibbitt to Contwoyto Winter Road right-of-way. The maps were sent by courier to attempt to deliver them to Lutsel' Ke for the following day.

Table 4.1-1 (Continued)

Lutsel K'e Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/27/00	Letter	Charlie Catholique, LDFN	MVLWB	SCR# 359	The Lutsel K'e Dene First Nation's Wildlife, Lands & Environment Committee invites EBM and Vince Steen to meet in their community. They have several concerns: a) their people not being hired; and b) caribou on the road.
12/6/00	Letter	Hugh Ducasse, EBM	Charlie Catholique, WLEC	SCR# 358	EBM is pleased to accept this invitation to come and meet with the Lutsel K'e Wildlife, Land and Environmental Committee on December 13, 2000 (as proposed). EBM acknowledges that some of the issues raised go "beyond the scope of the current land use permit".
12/13/00	Letter	Hugh Ducasse, EBM	Charlie Catholique, LDFN	SCR# 284	This letter proposes a meeting with the Lutsel K'e Dene First Nation over Dome Lake Camp for either January 8th or 10th, 2001.
1/21/01	Letter	Charlie Catholique, WLEC	Hugh Ducasse, EBM	SCR# 319	Thanking EBM for information requested info on Dome Lake Camp and Quarry Aggregate Access Land Use Application. Furthermore, it proposes a meeting date of February.9th, 2001.
1/29/01	Letter	Chris Hanks, BHP Billiton	Charlie Catholique, LDFN	SCR# 255	Winter Road Joint Venture Committee follow-up letter in answer to the Lutsel K'e Dene First Nation suggestion for a Feb. 9th, 2001 meeting. Chris Hanks requests that the meeting be on Feburary 13th, 2001 since Brenda Parlee had already booked BHP BILLITON in to meet and discuss the Sable, Pigeon and Beartooth Project. Therefore, the Dome Lake Camp and Aggregate Quarry Access Land Use Application can be added to the agenda and discussed.

Table 4.1-1 (Continued)

Lutsel K'e Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
2/14/01	Meeting Notes	Chris Hanks, BHP Billiton	Charlie Catholique, LDFN	Present were: Lutsel K'e Delegates - Charlie Catholique, Morris Lockhart, August Enzoe, Lawrence Catholique, Breanda Parlee, Joe Desjarlais, Anne Keenlyside, Joe Michel, J.B. Rabesca, Louie Abel, Jonas Catholique, Vicky Desjardais, Steve Ellis, Noel Abel, Phil Lyver, Liza Enzo, Bernadette Lockhart and Stanley Catholique. Winter Road Joint Venture Delegates were: Chris Hanks, Derek Chubb and John Bekale of BHP BILLITON plus Hillary Machtans of DeBeers. SCR# 376	The meeting started with a brief presentation of what the Joint Venture Committee is all about and who is involved. Issues raised: - enquired on who had current road, camp and security contracts for the road, - Nuna hiring outside of the NWT, - concerns over fuel storage and handling, - impact the road will have on the Caribou, - want their people involved in the environmental monitoring of the road, - review road effects on the land in June, - effects on water, - traffic speed upon portage approaches, - vehicles should not be left parked on the ice, - to lessen possible effects on fish and the water the road should be moved to a land route. - It was proposed to return in March to discuss the future environmental management of the winter road.
3/15/01	Winter Road Tour	Chris Hanks, BHP Billiton	Charlie Catholique, LDFN	Entry from notes. Notes are not included for reference. SCR# 380	Inspection Tour of the Winter Road (Yellowknife to Ekati). Stopped at Dome Lake Camp, Lockhart Lake Camp and Lac de Gras Camp.
6/15/01	Letter	Brent Murphy, EBA	Steve Ellis, LDFN	SCR# 365	A letter was sent to the Lutsel K'e Dene Band, by Brent Murphy of EBA, requesting the Band's assistance in acquiring two field assistants to assist with archaeology and wildlife field work. The duration of the work would be 3 weeks.

Table 4.1-1 (Continued)

Lutsel K'e Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
8/5/01	Letter	Ian Goodwin, BHP Billiton	Chief Archie Catholique, LDFN	SCR# 399	This letter consists of an invitation for the Lutsel K'e Dene First Nation to sit on the Tibbitt to Contwoyto Winter Road Joint Venture Committee on Safety and the Environment. Membership has now been expanded to include all Aboriginal groups who are interested in participating. Due to the direct land based interest in the land through which the road passes the JV believes it is imperative that each Aboriginal Group appoint one member to the committee. This work is being done by the JV without the direction of government, in order to develop a more comprehensive environmental management planning system for the winter road. The Aboriginal groups requested to participate include; the Kitikmeot Inuit Association, Yellowknives Dene First Nation, North Slave Metis Alliance, Lutsel K'e Dene First Nation and the Dogrib Treaty 11.

North Slave Metis Alliance

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/9/00	Letter	Hugh Ducasse, EBM	Clem Paul, NSMA	SCR# 318	This letter contains information concerning Echo Bay Mine's intentions to renew their Land Use Permit for the operation of the Lupin Winter Road. This document reports that EBM has submitted an application for this purpose with the Mackenzie Valley Land and Water Board. Further, the community consultations will begin in the near future and EBM looks forward to the participation of the North Slave Metis Alliance in this process.
11/28/00	Letter	Bob Turner, NSMA	Hugh Ducasse, EBM	SCR# 290	This letter is an invitation from the NSMA to meet with Echo Bay within the first two weeks of December to discuss the present operation of the winter road, its future operation and to the current land use of the Metis in this area.

Table 4.1-1 (Continued)

North Slave Metis Alliance (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
12/6/00	Letter	Hugh Ducasse, EBM	Robert Turner, NSMA	SCR# 374	This letter thanks the NSMA for their request to meet and discuss issues related to the operation of the winter road and the area through which it passes. The NSMA had wished to meet within the first two weeks of December, 2000. EBM proposes the date of December 12, 2000 for this meeting, if satisfactory to the NSMA.
12/12/00	Letter	Hugh Ducasse, EBM	Clem Paul, NSMA	SCR# 383	This letter asks the NSMA to review the attached minutes which were prepared by Chris Hanks, BHP Billiton.
1/18/01	Copy of Presentation	Derek Chubb, BHP Billiton	Bob Turner, NSMA	SCR# 252	This document is a copy of a presentation on the Winter Road presented to the North Slave Metis Alliance.
1/26/01	Letter	Chris Hanks, BHP Billiton	Clem Paul, NSMA	Clem Paul, Robert Turner, NSMA, Derek Chubb, Chris Hanks, BHP Billiton and Hillary Machtans, DeBeers, were in attendance. SCR# 239	Chris Hanks stated in this letter his notes from a January 18, 2001 meeting between the NSMA and the Tibbitt to Contwoyto Winter Road Joint Venture. Contained within this letter are the key issues and concerns of the NSMA and some solutions. Issues raised were: - squatters and illegal cabins near the winter road; - Metis business involvement; possible land use tied into a current TK project (Bob Turner agreed). The Metis were quite pleased that they were consulted at such an early stage. All were interested in developing a multi-Aboriginal stakeholders meeting. Clem Paul was pleased that the Metis were approached early and suggested the Joint Venture was proactive.

Table 4.1-1 (Continued)

North Slave Metis Alliance (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
5/28/01	Meeting Notes	Brent Murphy, EBA	Bob Turner, NSMA	Brent Murphy, Jean Bussey, John Clark, EBA Bob Turner, Kevin Kachkowski, NSMA Andrew Hammond, BHP Billiton SCR# 382	This meeting discussed: – winter road archaeology Program, – seeking NSMA involvement, – slide presentation on Ekati archaeology, – other Aboriginal groups involved, – Satellite map of winter road was discussed, – elder visits, – impact on land use, opens the country up, – caribou impacts?, – increased land use by other people. Jean Bussey invited NSMA elders to visit the Lockhart Lake Camp during the summer work program.
6/15/01	Letter	Brent Murphy, EBA	Bob Turner, NSMA	SCR# 367	A letter was sent to the North Slave Metis Alliance by Brent Murphy of EBA, requesting their assistance in acquiring two field assistants to assist with archaeology and vegetation mapping field work. The duration of the work would be 3 weeks for each individual.
5/29/01	Memo	Brent Murphy, EBA	Chris Hanks, BHP Billiton	In attendance: Bob Turner, Dennis Kachkowski of NSMA, Brent Murphy, John Clark of EBA, Jean Bussey of Points West Consulting and Andrew Hammond of BHP Billiton. SCR# 392	Summary of a meeting with the North Slave Metis Alliance concerning the Tibbitt to Contwoyto Lake Winter Road. – updating the NSMA on the status of the Project Description Report on the operation of the winter road; – planned environmental baseline programs for the summer of 2001; – the availability of field assistants to assist with this baseline work (specifically archaeology); and – to solicit concerns of the NSMA pertaining to the winter road and its continued operation.

Table 4.1-1 (Continued)

North Slave Metis Alliance (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
8/5/01	Letter	Ian Goodwin, BHP Billiton	Clem Paul, NSMA	SCR# 398	This letter consists of an invitation for the North Slave Metis Alliance to sit on the Tibbitt to Contwoyto Winter Road Joint Venture Committee on Safety and the Environment. Membership has now been expanded to include all Aboriginal groups who are interested in participating. Due to the direct land-based interest in the land through which the road passes the JV believes it is imperative that each Aboriginal Group appoint one member to the committee. This work is being done by the JV without the direction of government, in order to develop a more effective environmental management planning system for the winter road. The Aboriginal groups who requested to participate include; the Kitikmeot Inuit Association, Yellowknives Dene First Nation, North Slave Metis Alliance, Lutsel K'e Dene First Nation and the Dogrib Treaty 11.
08/17/01	Letter	Clem Paul,NSMA	Ian Goodwin, BHP, Kirk McLellan, EBM, Phillip du Toit, Diavik		Letter from the NSMA indicating their acceptance to join the Winter Road Venure Committee on Safety and the Environment.
12/12/01	Meeting Notes	Hugh Ducasse, EBM	Clem Paul, NSMA	December 12, 2000. Those in attendance: Clem Paul, Bob Turner, NSMA, Hugh Ducasse, EBM, Derek Chubb and Chris Hanks, BHP Billiton. See SCR Another meeting - Jan. 9, 2001, 1:30 P.M., in the NSMA Board Room. SCR# 285	This letter provides minutes of the NSMA, Echo Bay and BHP Billiton representatives. The NSMA have no concerns with the Dome Lake re-permitting of Land Use application plus no concerns over the permitting of the winter road. However, the NSMA have big concerns: – Environmental Management – Economic Opportunities, and – Ownership of the road.

Table 4.1-1 (Continued)

NWT Caribou Outfitters Association

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
2/23/01	Memo	Chris Hanks, BHP Billiton	Jim Peterson, Point Lake Lodge	SCR# 261	Jim Peterson was approached by Chris Hanks at a Colorado sportsman show to meet and discuss the permitting process and other stakeholders interests.
3/6/01	Letter	Chris Hanks, BHP Billiton	Jim Peterson, Point Lake Lodge	SCR# 260	This letter gives a brief overview of what the Joint Venture Committee wishes to do concerning the permitting of the winter road. The Joint Venture Committee wishes to consult with all stakeholders. If any member of the Outfitters Association are interested in meeting with representatives of the Winter Road Joint Venture Committee please contact Chris Hanks or Derek Chubb.
3/23/01	Questionnaire	Bob Stephens, Lutra Assoc	Gary Jaeb of True North Safaris	SCR# 363	Completed Tibbitt to Contwoyto Winter Road questionnaire.
3/23/01	Questionnaire	Bob Stephens, Lutra Assoc	Boyd Warner of Warner's Arctic Worrld	SCR# 234	Completed questionnaire by Mr. Boyd Warner: – continued access, – continue with no small load user fee.
3/28/01	Letter	Bob Stephens, Lutra Assoc	John Andre of Shoshone Wilderness Adventures	SCR# 364	Completed Tibbitt to Contwoyto Winter Road questionnaire.

Yellowknives Dene First Nation

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
11/9/00	Letter	Hugh Ducasse, EBM	Chief Rick Edijercon, YDFN	SCR# 368	This letter contains information concerning Echo Bay Mines intentions to renew their Land Use Permit for the operation of the Lupin Winter Road for only the next two years. This document reports that EBM has submitted an application for this purpose with the Mackenzie Valley Land and Water Board. Further, the community consultations will begin in the near future to discuss the long term permitting and operation of the winter road and EBM looks forward to the participation of the Yellowknives Dene First Nation in this process.

Table 4.1-1 (Continued)

Yellowknives Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
1/22/01	Letter	Chris Hanks, BHP Billiton	Chief Peter Liske, Chief Rick Edijercon, YDFN	SCR# 228	This letter gives a brief history of the need to permit the winter road, explains that the Joint Venture that was established to ensure the Tibbitt to Contwoyto Winter Road is permitted by the winter of 2003. Chris acknowledges the Dene history in connection with the area(s) and the winter road specifically. The importance of understanding the Yellowknives Dene First Nation's ideas/concerns on the future operation of the Tibbitt to Contwoyto Winter Road was also stressed in this letter. Chris requests that dates be arranged to begin consultations on the permitting of the winter road and its future management.
2/2/01	Phone Conversation	Chris Hanks, BHP Billiton	Darrell Beaulieu, Deton' Cho	Entry from notes. Notes are not included for reference. SCR# 379	Darrell Beaulieu indicated to Chris Hanks that the Yellowknives Dene First Nation had asked Deton' Cho to take the lead in discussions on the winter road.
3/5/01	Meeting Notes	Chris Hanks, BHP Billiton	Darrell Beaulieu, Deton' Cho	In attendance were; Jonas Sangris, Fred Sangris, Brent Murphy (EBA), Don Hayley. SCR# 253	This letter documents, as follow-up to a recent meeting, what specific issues were raised to ensure clarity between the participants. This letter is mainly a point by point recall (EBM) and Chris Hanks (BHP Billiton). of the issues raised and the answers provided. This meeting dealt specifically with the re-permitting project description for the Tibbitt to Contwoyto Winter Road. The Yellowknives Dene First Nation stated specific concerns pertaining to specific Dene who have outpost camps in the immediate area of the current winter road corridor. Other concerns were: - use Traditional Place names; - the use of Traditional Knowledge for shoals, current and general ice conditions/construction methods; - concern for spills & other environmental issues;

Table 4.1-1 (Continued)

Yellowknives Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
3/5/01					– effects on Hunters & Trappers; – heritage, burial and archaeology sites; – patrol, monitor & enforcement role wanted and – monitor wildlife harvesting in relation to increased accessibility. Ending – follow-up with community workshop, planning meetings and follow-up on the idea of developing a new environmental monitoring program.
3/15/01	Winter Road Tour	Chris Hanks, BHP Billiton	Jonas Sangris, Deton'Cho	Entry from notes. Notes are not included for reference. SCR# 381	Inspection Tour of the Winter Road (Yellowknife to Ekati). Stopped at Dome Lake Camp, Lockhart Lake Camp and Lac de Gras Camp.
3/26/01	Notes	Chris Hanks, BHP Billiton	Darrell Beaulieu, Deton'Cho	In attendance; Isadore Tsetta (Elder), Alexander Mackenzie (Elder), Fred Sangris, Jonas Sangris, Vivian Banci, EBA, Jean Bussey, EBA, Chris Hanks BHP Billiton and Brent Murphy, EBA. SCR# 304	At this meeting some of the issues raised were as follows: – political (land claims, etc.), – emphasis on ownership and safety issues, – MVLWB should not apply due to ongoing Land Claims, – current Regulatory Acts and permitting processes are discouraging junior mining companies/ exploration, – the current wnter road is part of their Land Claims process.
4/23/01	Press Release	Chief Richard Edijercon, YDFN	Joint Venture Winter Road Committee	SCR# 233	A publicly read statement (by a representative of the YDFN) indicating their belief that jurisdiction of the winter road should be based on Treaty Rights and is connected to current Land Claim negotiations. Read on April 23, 2001 at the Yellowknife Inn, Joint Venture Public presentation.

Table 4.1-1 (Continued)

Yellowknives Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
6/15/01	Letter	Brent Murphy, EBA	George Baird, YDFN	SCR# 366	A letter was sent to the Deton' Cho Corporation, by Brent Murphy of EBA, requesting the Band's assistance in acquiring five field assistants to assist with archaeology, wildlife, vegetation mapping, survey and aquatic field work. The duration of the work would be 3 weeks for four individuals and one person for 1 to 2 weeks.
7/17/01	Letter	Chris Hanks, BHP Billiton	Rachel Ann Crapeau, LDFN	SCR# 394	Requesting participation of the Yellowknives Dene First Nation (YDFN) in a site tour and review of summer scientific baseline work. This work, commissioned by the Joint Venture, included archaeological work. Chris states that at previous meeting elder's expressed concern over the need to protect and avoid archaeological site. In particularly grave sites. It is from this summer's archaeological field work that the Joint Venture respectfully requests that the Lands and Environment Committee reconsider their decision not to send any elders to review/inspect the archaeological work specifically relating to grave sites.
8/5/01	Letter	Ian Goodwin, BHP Billiton	Chief Rick Edijercon & Chief Peter Liske, YDFN	SCR# 397	This letter consists of an invitation for the Yellowknives Dene First Nation to sit on the Tibbitt to Contwoyto Winter Road Joint Venture Committee on Safety and the Environment. Membership has now been expanded to include all Aboriginal groups who are interested in participating. Due to the direct land based interest in the land through which the road passes the JV believes it is imperative that each Aboriginal Group appoint one member to the committee. This work is being done by the JV without the direction of government, in order to develop a more comprehensive environmental management planning system for the winter road. The Aboriginal groups requested to participate include; the Kitikmeot Inuit Association, Yellowknives Dene First Nation, North Slave Metis Alliance, Lutsel K'e Dene First Nation and the Dogrib Treaty 11.

Table 4.1-1 (Continued)

Yellowknives Dene First Nation (Continued)

Date	Type of Consultation	From	To	Meeting Record	Issue(s) Raised
7/17/02	Letter	Chris Hanks, BHP Billiton	Rachel Ann Crapeau, YDFN	SCR# 393	This letter is in follow-up to a meeting where Andrew Hammond stated that the Yellowknives Dene First Nation (YDFN), represented by Rachel Ann Crapeau, had declined an invitation to tour recent archaeological work on the Tibbitt to Contwoyto Winter Road baseline study. The most important aspect of this work included the location and marking of grave sites along the winter road corridor.

5.0 CONCLUSIONS

The winter road was first opened in 1982 to meet the annual resupply needs for the Lupin Gold Mine. During the 1990's the Canadian diamond mining industry centred in the Lac de Gras region was born and since then it has experienced rapid expansion. As a result, this industry has now become the predominant user of the winter road.

Over the years the annual traffic volume has changed to meet the growing mining industry needs, from approximately 700 truck loads in 1982 to 8,090 truck loads in 2001. The environmental record of the winter road during this time has been good, primarily because construction, operations and maintenance and environmental management policies and practices have continued to improve as the operation of the winter road has evolved.

The winter road is currently operated under a Licence of Occupation. The Lockhart and Lac de Gras camps are run under Land Leases. Dome Camp and the gravel quarries operate under a Land Use Permit. There is also a Quarry Permit for the gravel pits. The Department of Indian Affairs and Northern Development (DIAND) issued and administers the present Land Leases, Quarry Permit and the Licence of Occupation. The Mackenzie Valley Land and Water Board (MVLWB) issued the Land use Permit for Dome Lake Camp and the quarries. An application to renew that Land Use Permit is currently before the MVLWB. The Joint Venture has requested an interim renewal of the permit until April 2003 when the Licence of Occupation is up for renewal.

Renewal of the Licence of Occupation is necessary in order to operate the winter road in 2004 and future years. The present Licence of Occupation regulates the general route, operation, maintenance and clean up of the winter road. In addition to the current permits, the Joint Venture plans to apply for Type B Water for the Lockhart and Lac de Gras camps. While the camps currently meet the regulations, in the future, as the camps expand, a Water Licence will be required. This report has been prepared as part of the application process to re-new the Licence of Occupation, Type Land use Permit and Type B Water Licence in April 2003.

Based on current forecasts, the winter road has a foreseeable future life of 30 or more years. During this time-frame, the annual commercial traffic volume is forecast to continue to increase from the 2001 level of 8,090 truck loads to a peak of just under 12,000 in 2010, remaining stable to about 2015. Thereafter, the traffic volume is projected to drop substantially as EKATI™ enters its closure and reclamation phase.

To successfully manage the projected increases in traffic volume, a number of upgrades and/or improvements have been proposed to accommodate future needs. These focus on improvements in traffic management, safety of the crossings, portage reconstruction and improvements to support infrastructure. Concurrently, the environmental management system will continue to evolve to effectively manage projected changes related to the continued future operation of the winter road.

To assist in the effective planning and implementation of proposed future portage upgrades and for environmental management purposes the Joint Venture carried out a comprehensive field program during the summer of 2001. The program concentrated on the portages and included:

- low level digital mapping, ecological land classification and wildlife habitat surveys
- aquatic resources and habitat surveys
- archaeological investigations
- Engineering reconnaissance surveys of priority portages and camp surveys.

The primary environmental issues that are of greatest public concern relate to the potential spillage of petroleum products from transportation accidents and the potential effects of increasing future traffic volumes and camp activities on wildlife, in particular caribou, which winter in the region, wolves and wolverines.

Spill prevention and effective spill response and clean-up have always been and will remain a top priority for the operator of the winter road. Records indicate that there have been 35 reported truck spill incidents since 1983. Approximately 80% were spills of diesel or other petroleum products, while the remainder involved cement or ammonium nitrate. Approximately one-third of the petroleum product spills occurred on the frozen subsurface of lakes and/or other waterbodies.

In all cases, winter conditions, which generally facilitate the containment and recovery of spilled products, combined with effective clean-up response, have been successful in preventing potential harm to the aquatic environment. In addition, the record indicates that the frequency of spill incidents has not increased despite the higher volume of commercial traffic that has developed over the years. Given the high priority that the Joint Venture places on diligent traffic management, operations safety, and the strong commitment to continued improvement of all aspects of the winter road operations, similar success can be expected in the future to accommodate the projected increase in traffic load.

The protection and continued sustainability of the Bathurst caribou herd represents another top priority for the operator of the winter road. For as long as the winter road has been in existence, Bathurst caribou have wintered in a large geographic area generally south of the treeline, extending from the vicinity of Great Bear Lake through the Great Slave region and southward as far as northern Saskatchewan. Within this broad range, the annual wintering areas are variable, but in most years some of the herd overwinters in the vicinity of the winter road.

To protect caribou when they are near the winter road (and other wildlife found in association with caribou, such as wolves and wolverines), the winter road operations have maintained a policy that gives wildlife the right-of-way. As a result, few traffic-related wildlife incidents have occurred over the years. The continued application of this policy, combined with the Joint Venture's strong commitment to optimized traffic safety is expected to be similarly effective in minimizing future wildlife incidents.

The Joint Venture also recognizes that the winter road facilitates the harvesting of wildlife resources in the vicinity of the winter road corridor, although the management of these resources and associated harvesting activities are the responsibility of the Department of Resources, Wildlife and Economic Development (RWED). The Joint Venture is committed to supporting RWED and other stakeholders in the development and implementation of monitoring and enforcement programs designed to ensure that future harvest levels of wildlife are managed to acceptable and sustainable levels.

The winter road and the mining activities it services has and will continue to be important to the local economies of Yellowknife, N'dilo and Dettah, as well as the economies of NWT, Nunavut and Canada. In 2001, 156 employees and contract workers were involved in the construction and maintenance of the winter road. Currently, the winter road contributes from $5.7 million to $6.5 million annually to the economies of the NWT and Nunavut.

Over the next 20 years, the mining operations serviced by the winter road are projected to add approximately $1.2 billion per year to the economy of the NWT. Over the same period, these activities are predicted to contribute $27 million per year to the economy of Nunavut, and $309 million per year to the economies of the southern provinces. In total, operations that use the winter road for the next 20 years are projected to add $31 billion to the economy of Canada.

From an employment perspective, over the next 20 years the mining operations using the winter road are predicted to directly contribute about 43,000 person years of employment in the NWT and 2,300 person years of employment in Nunavut.

This Project Description Report draws on the experience of 20 years of successful operation of the winter road. In reviewing the past operation and the projections of future needs for the winter road, the Joint Venture has attempted to factor in the experience of the operators, scientific and engineering data and the observations and experience of Aboriginal people who still actively use the winter road corridor. It is the general conclusion of this review that with the sound application of environmental management practices and continuous improvement principles, the Tibbitt to Contwoyto Winter Road can continue to operate with minimal negative effects on the biophysical environment of the geographic area through which it passes.

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GLOSSARY AND ABBREVIATIONS

Adaptive management A formal process of formulating and continually improving resource management policies and practices by learning from the outcomes of operational programs.

Air contaminant Any solid, liquid, gas or odour, or combination thereof, which, if emitted into the air, would create or contribute to the creation of air pollution.

Alluvial Clay, silt, sand and gravel material deposited by running water.

Ambient air quality The surrounding air quality present at a particular site.

Anthropogenic Caused by human activity.

Archaeological excavation An area of ground systematically dug out to collect archaeological information and artifacts.

Archaeological significance A site's potential to provide new knowledge and, specifically, to contribute to the existing archaeological database.

Archaeological site A location exhibiting physical signs of past human use, typically greater than 50 years in age.

ASTt Arctic Small Tool tradition; an early Inuit culture (also called Pre-Dorset) characterized by use of distinctive small tools, usually of chert.

Basal till Unsorted glacial debris at the base of the soil column where it comes into contact with the bedrock below.

Baseline studies Initial scientific investigations that determine the present ecological state of an area and establish a basic reference necessary for further studies.

Bedrock The more-or-less solid, undisturbed rock in place either at the ground surface or beneath superficial deposits of gravel, sand or soil

Benthos Assemblage of animals living in or on the bottom sediments of a lake and dependent upon the decomposition cycle for most if not all of its basic food supply.

Biface A stone tool worked on both sides or "faces"; also referred to as a formed biface, projectile point, knife, etc., depending on degree of modification, shape, function and other factors.

Biodiversity An expression that describes the relative variety of organisms or species that exists within an ecosystem, on a local, regional or global scale.

B.P. Before present – used to refer to age of archaeological materials or cultures; is generally relative to 1950.

Burin A stone tool characterized by a chisel-like working edge produced by the removal of a specialized flake called a burin spall.

Camp An archaeological site containing cultural material suggestive of a variety of activities and/or containing structural or hearth remains.

Canadian Ambient Air Quality Objectives (CAAQO) The objectives and standards for permissible air pollutant concentrations in parts per billion.

Canadian dollar $ or CDN$

Carnivore A flesh-eating animal. In the context of this report, grizzly bears, wolverines and wolves.

Centimetre cm

Closed mat tundra A common eco-system type consisting of unbroken vegetated tundra with average soil and moisture conditions. The most common plants include low shrubs such as dwarf birch, Labrador tea, crowberry, bearberry and willow.

Committee of the Status of Endangered Wildlife in Canada (COSEWIC) A committee that produces the official list of Canadian endangered species.

Cubic metre m^3

Cumulative effects Changes to the environment that are caused by an action in combination with other past, present and future actions.

Day d

Degree °

Degrees Celsius °C

Demographics The analysis of factors such as births, marriages, diseases and other vital statistics, which allow the assessment of a population in a given area.

Department of Environment (DOE) The Federal Government department responsible for ensuring that the environment is properly protected and conserved.

Department of Fisheries and Oceans (DFO) The Federal Government department responsible for protecting and maintaining healthy aquatic environments.

Department of Indian Affairs and Northern Development (DIAND) The Federal Governmental department responsible for programs that support the needs and interests of First Nations in Canada.

Detritus or Debitage The unworked flakes discarded during the manufacture of stone tools.

Drumlin An elongate or oval hill of glacial drift material, commonly till, deposited by glacier ice and having its long axis parallel to the direction of ice movement.

Ecosystem A community of interacting organisms considered together with the chemical and physical factors that make up their environment.

Environment The components of the earth including land, water and air, and all layers of the atmosphere. Also all organic and inorganic matter and living organisms and the interacting natural systems of such, including the cultural, social and spiritual components.

Environmental Assessment Report (EAR) A report completed by the developer describing the development, impacted environment, potential environmental effects and proposed mitigation.

Environmental Assessment and Review Process (EARP) The process previously used by the Federal Government to consider the environ-mental implications of all proposals for which the Federal Government had decision-making authority. This process reviewed and approved development of the EKATI™ Diamond Mine.

Ephemeral Stream A stream that lasts for only a short time.

Esker Sinuous ridge of weakly stratified gravel and sand deposited by a stream flowing in (or beneath) the ice of a retreating glacier, and left behind when the ice melted.

Features Non-portable artifacts of human construction; examples include hearths, tent rings and caches.

Flakes Fragments of rock discarded during core reduction or the manufacture of stone tools.

Food chain The transfer of nutrients and energy from one group of organisms to another, linked together in a series resembling a "chain".

Geographic Information System (GIS) A mapping tool that is used to depict large amounts of information in a spatial context.

Glacial till Stiff clay containing boulders, sand, and other rocks deposited by melting glaciers and ice sheets.

Glaciofluvial deposits Unconsolidated rock material deposited by melt water streams flowing from glaciers.

Global Positioning System (GPS) A sophisticated system used to define a precise geographic location with the aid of a satellite system.

Gram g

Grams per cubic centimetre g/cm^3

Grams per litre g/L

Greater than >

Greenhouse effect The phenomenon describing warming of the Earth's surface by trapping the sun's warmth in the lower atmosphere by "greenhouse gases" (e.g., carbon monoxide, carbon dioxide).

Graver A stone tool characterized by a narrow working edge produced by intentional retouch and intended for incising softer materials.

Groundwater Water found in soil or in pores, crevices, etc., under the ground.

Habitat Any area that provides food, water and/or shelter for an organism.

Herbivore An animal that feeds on plants.

Hectare ha

Historic Refers to the period of time for which there are written records; also referred to as post-contact.

Hour h

Hydrology The study of the properties of water and its movement in relation to land.

Impact Benefit Agreements (IBA) Benefits agreements negotiated between BHP and the four Aboriginal groups that have traditionally used the claim block: Dogrib Treaty 11; Akaitcho Treaty 8; North Slave Metis Alliance; and Inuit of Kugluktuk.

Independent Environmental Monitoring Agency An agency established in 1997 to serve as a public watchdog for environmental management at the EKATI™ Diamond Mine.

Infrastructure The basic structural installations used for operations (e.g., roads, buildings, water supply and sewage treatment facilities, etc.)

Isolated find An archaeological site consisting of a single artifact, whether an unworked flake, stone tool or other specimen.

Kame A mound, knob or short irregular ridge composed of stratified sand and gravel. The deposit can be formed by a subglacial stream as a fan or delta at the margin of a melting glacier, by a superglacial stream through a hole on the surface of the glacier, or as a ponded deposit on the surface or at the margin of sedentary ice.

Kettle A depression in a glacial deposit formed by the melting of a detached block of ice buried in the deposit.

Kilogram kg

Kilometre km

Kilometres per hour km/h

Lacustrine Pertaining to, or produced by, a lake.

Lanceolate A long, narrow "lance-shaped" biface or spear point.

Less than <

Lichen Any plant organism composed of a fungus and an alga in symbiotic association, usually of green, grey or yellow tint and growing on and colouring rocks, trees, roofs, walls, etc.

Lithic Stone

Lithic scatter An archaeological site consisting of unworked flakes and/or stone tools (also referred to as an artifact scatter).

Litre L

Littoral Region of a lake from the highest water level to the depth at which photosynthesis ceases, usually within the upper 10 m.

Lookout An archaeological site presumed to have served as a strategic location for viewing the surrounding terrain.

Metre m

Metric tonne t

Milligrams per litre mg/L

Millimetre mm

Mitigation An activity aimed at avoiding, controlling or reducing the severity of adverse physical, biological and/or socio-economic impacts of a project activity.

Moraine deposit An accumulation of earth materials carried by and finally deposited by a glacier.

Nutrient Any substance that provides essential nourishment for the maintenance of life.

Nutrient enrichment The enhancement of nutrients in a water body over and above the concentration that would be considered typical.

Oligotrophic Nutrient-deficient waters with low primary productivity. The vast majority of Arctic lakes are oligotrophic

Operational Environmental Management Plan (OEMP) A general plan that outlines environmental practices and policies followed at the EKATI™ Diamond Mine. Covers all major environment-related issues such as environmental monitoring and the management of air quality, materials, wildlife and aquatic life.

Open mat tundra An ecosystem type characterized as having patchy, un-vegetated terrain (boulders and rocky outcrops) with an open map of dwarf birch and prostrate shrub vegetation.

Percent %

Permafrost A soil or rock layer that has been frozen for at least two years.

Plano tradition Refers to a Paleo-Indian culture characterized by distinctive lanceolate- shaped spear points.

Plus or minus ±

Prehistoric Refers to the period of time prior to written records; also referred to as pre-contact.

Quarry A location where outcroppings of a lithic material suitable for stone tool manufacture has been quarried or mined.

Reclamation Any activity aimed at rehabilitating a disturbed site.

Resource Wildlife and Economic Development (RWED) Territorial government department responsible for the management of wildlife resources.

Retouch A type of modification used in the manufacture of stone tools.

Revegetation Introduction of new vegetation on disturbed or barren ground.

Riparian area The wet soil areas that border a stream, lake or wetland.

Scraper For the purposes of this study, a stone tool worked intensively on one face or side assumed to have been used to scrape hides and other materials; often called a formed uniface when it has been intentionally shaped.

Sedge Any grasslike plant with triangular stems, usually growing in wet areas.

Shield Archaic A culture that follows and may be ancestral to the Plano tradition.

Square kilometre km^2

Sustainable Development Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Taltheilei tradition A culture that is associated with the Athapaskan occupation that followed the Arctic Small Tool tradition.

Tent ring A ring of rocks presumably used to hold down a tent or tipi-like structure.

Tonne T

Total suspended particulates (TSP) Airborne particles with a diameter of less than 30 microns, collected by a high-volume air sampler and recorded as micrograms per cubic metre of air ($\Phi g/m^3$).

Total suspended solids (TSS) The weight of solids suspended in a known volume of water (e.g., mg/L).

Toxicity The inherent potential or capacity of a material to cause adverse effects in a living organism.

Traditional Environmental Knowledge (TEK) As defined by the Den Cultural Institute: *"a body of knowledge and beliefs transmitted through oral tradition and first hand observation. It includes a system of classification, a set of empirical observation about the local environment and a system of self-management that governs resource use. Ecological aspects are closely tied to social and spiritual aspects of the knowledge system."*

Tundra Habitat typically found in the Arctic, north of the treeline, that is adapted to cold temperatures, a short growing season and low precipitation. Typical tundra vegetation includes moss, licen, Labrador tea and small shrubs.

U.S. dollar US$

Watershed An entire geographic area that contributes surface and ground-water to a particular lake, river or stream.

Wedge A stone tool characterized by bipolar battering and flaking to produce a double wedge shape, may be worked on all edges forming a disc; inferred use is for splitting antler and bone.

Wedge A stone tool characterized by bipolar battering and flaking to produce a double wedge shape, may be worked on all edges forming a disc; inferred use is for splitting antler and bone.

Wetland A swamp, march or other land that is usually water-saturated.

West Kitikmeot Slave Study Society (WKSS) A society located in Yellowknife that deals largely with research focused on a mineral-rich area that stretches north of Yellowknife to the Arctic Ocean.

Workshop Archaeological site containing a significant quantity of lithic material suggesting intensive use of locally available stone to manufacture tools or tool blanks/preforms.

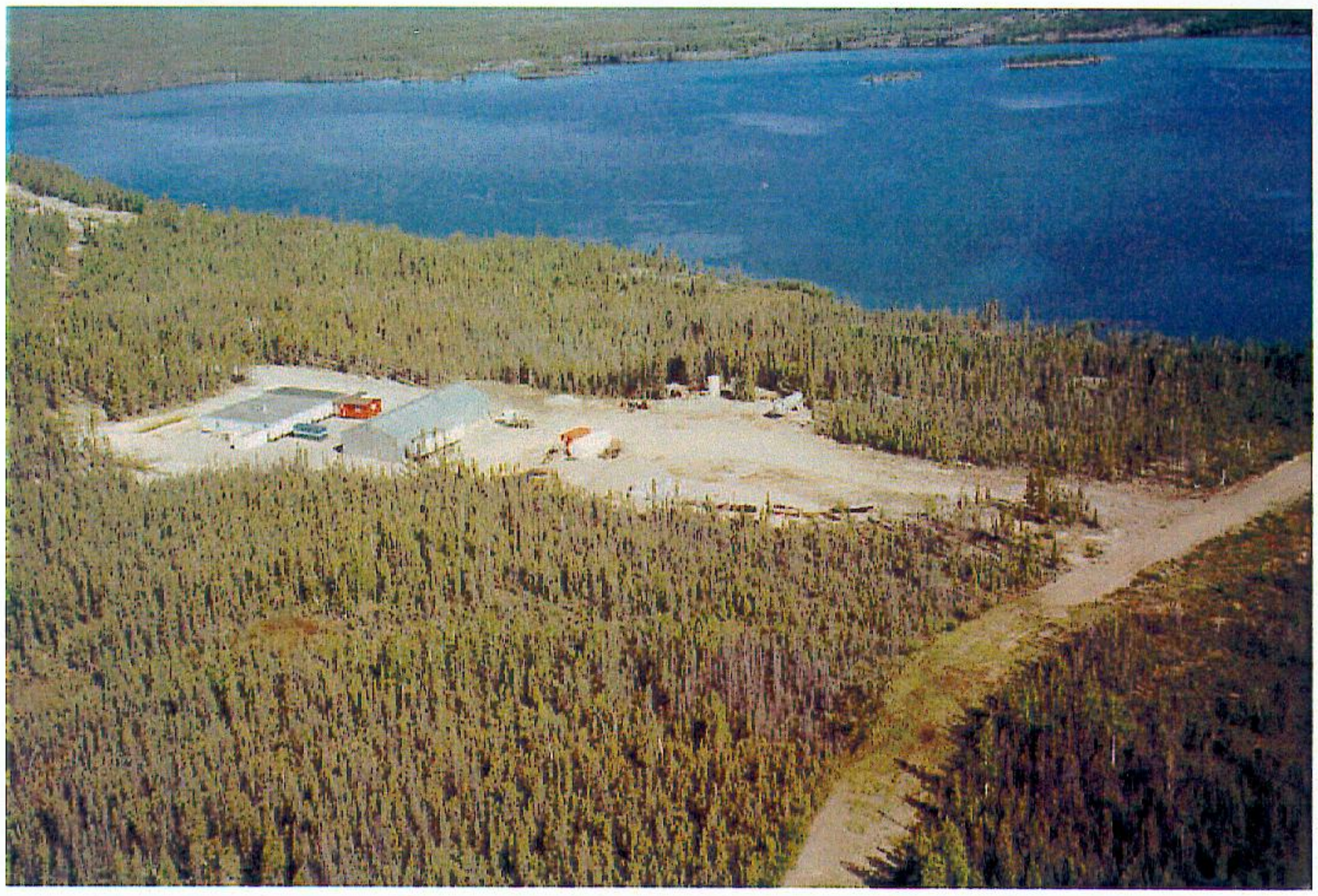

Figure 2.2-1 Dome Lake Camp

TIBBITT TO CONTWOYTO
WINTER ROAD JOINT VENTURE

eba

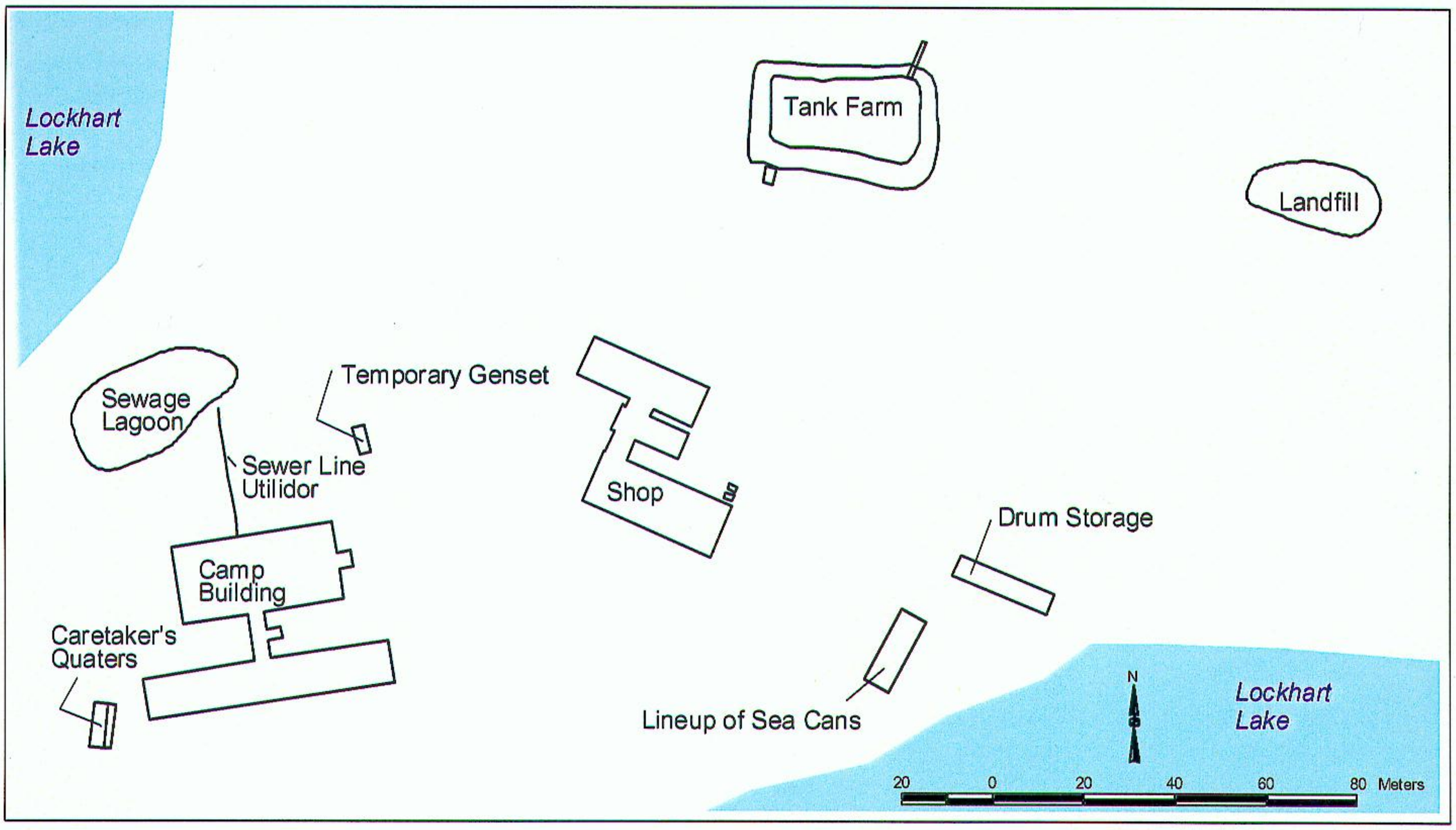

Figure 2.2-2 Lockhart Lake Camp

TIBBITT TO CONTWOYTO
WINTER ROAD JOINT VENTURE

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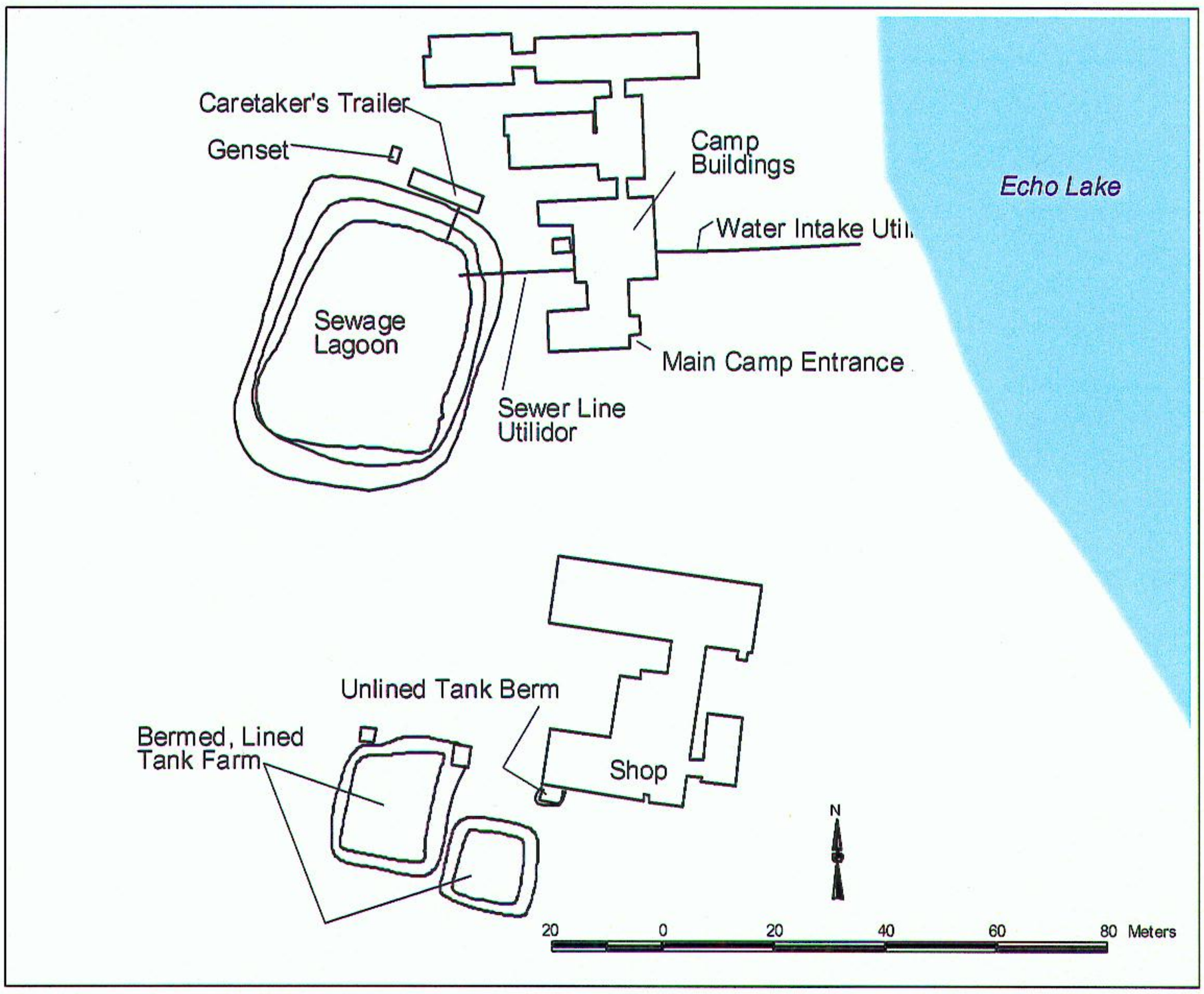

Figure 2.2-3 Lac de Gras Camp

TIBBITT TO CONTWOYTO
WINTER ROAD JOINT VENTURE

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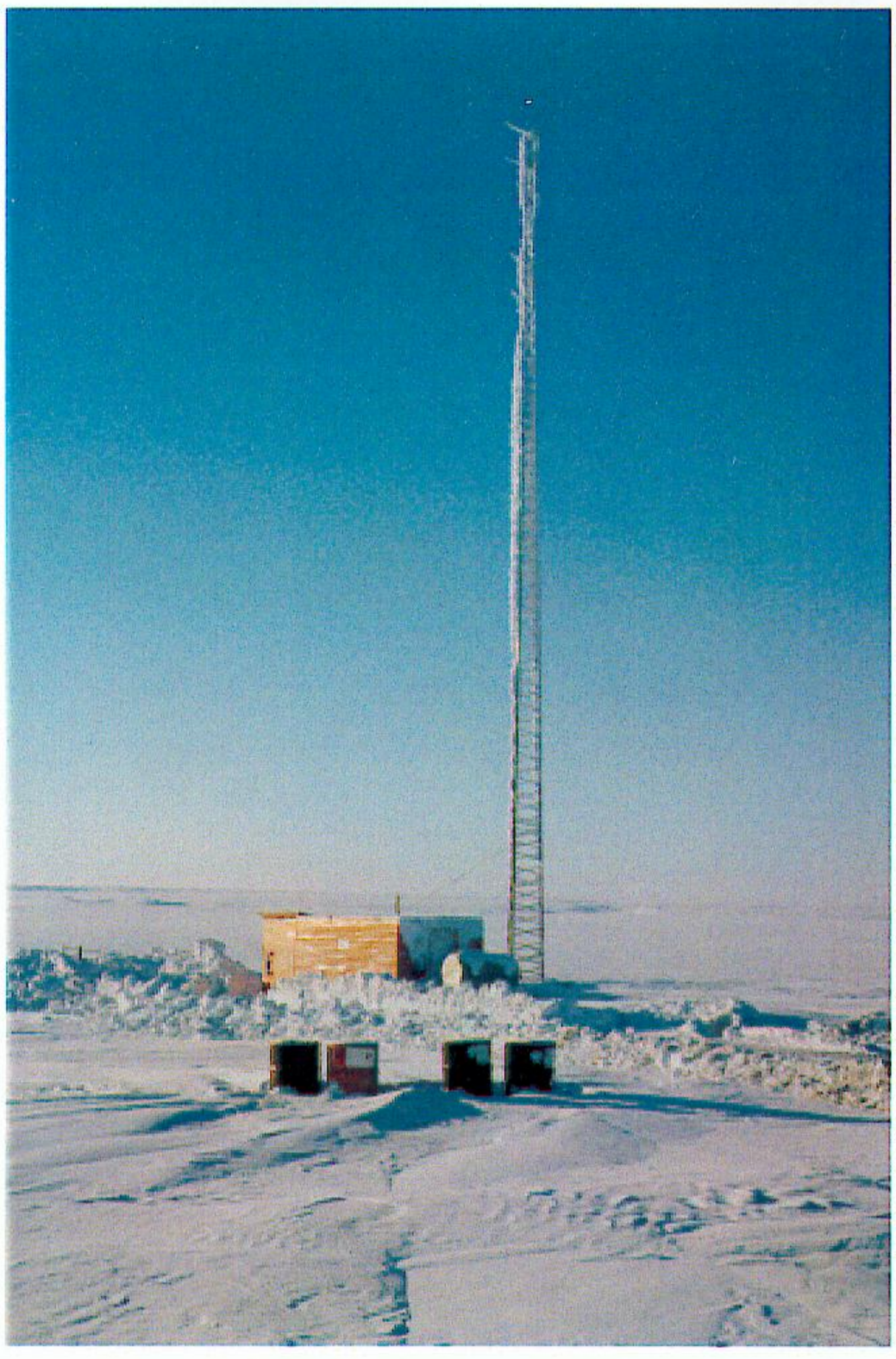

Plate 2.2-9 Winter Road Communications Repeater Station situated South of Contwoyto Lake

Plate 2.2-10 Gravel Borrow Pit along the Winter Road

Plate 2.2-11 Early Season Augering to Determine Ice Thickness Prior to Opening the Winter Road

Plate 2.2-12 Ground Penetrating Radar Used to Conduct Continuous Ice Thickness Surveys along the Winter Road

Plate 2.2-13 Light-weight ARDCO Plow Operating on Warburton Bay

Plate 2.2-14 Snow Plow Working on Warburton Bay

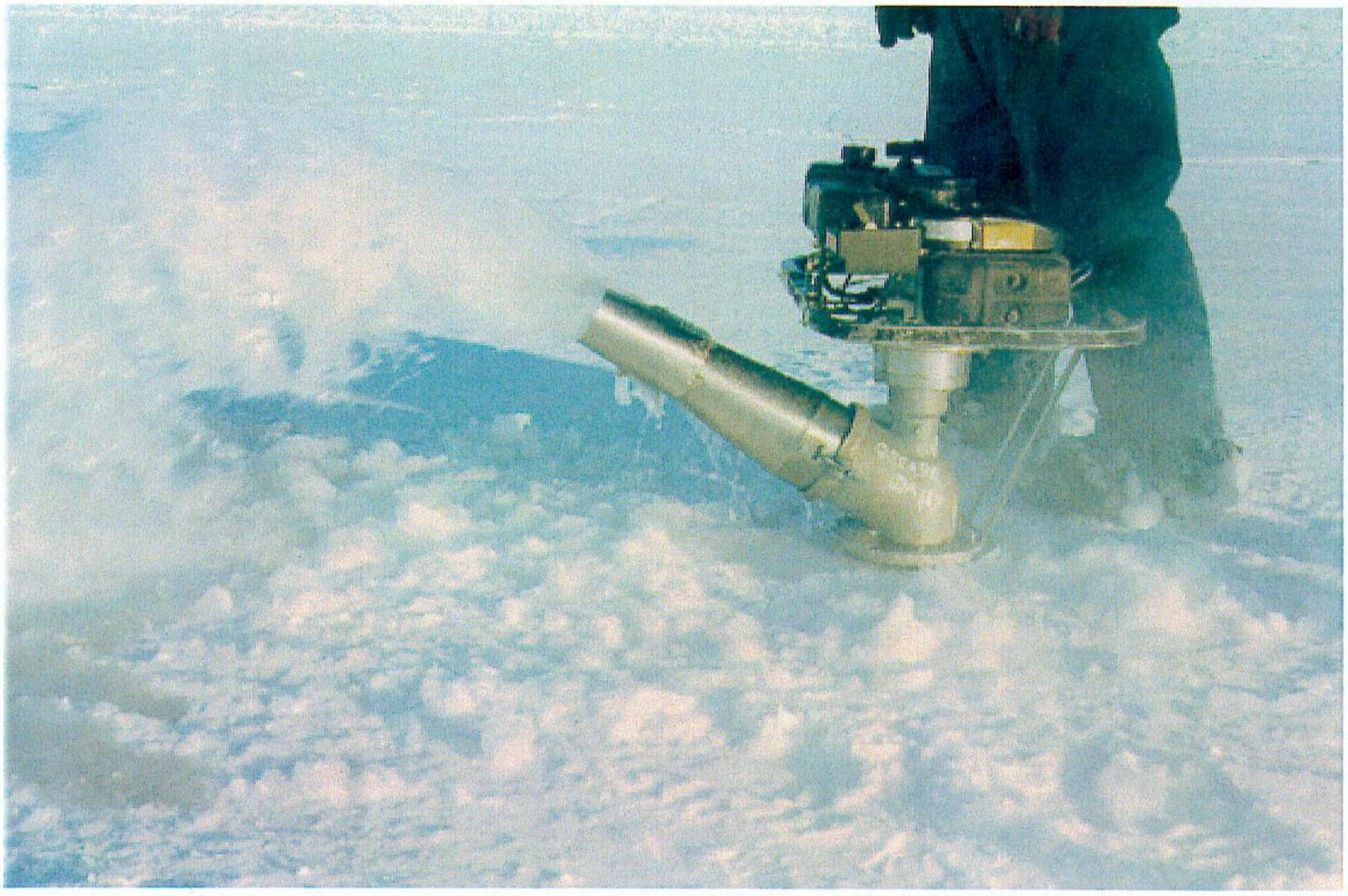

Plate 2.2-15 Close-up of Water Pump used to Flood Ice Crossings

Plate 2.2-16 Two Pumps in Operation near North End of Long Lake

Plate 2.2-17 Portage Section through Rugged Terrain Below Treeline

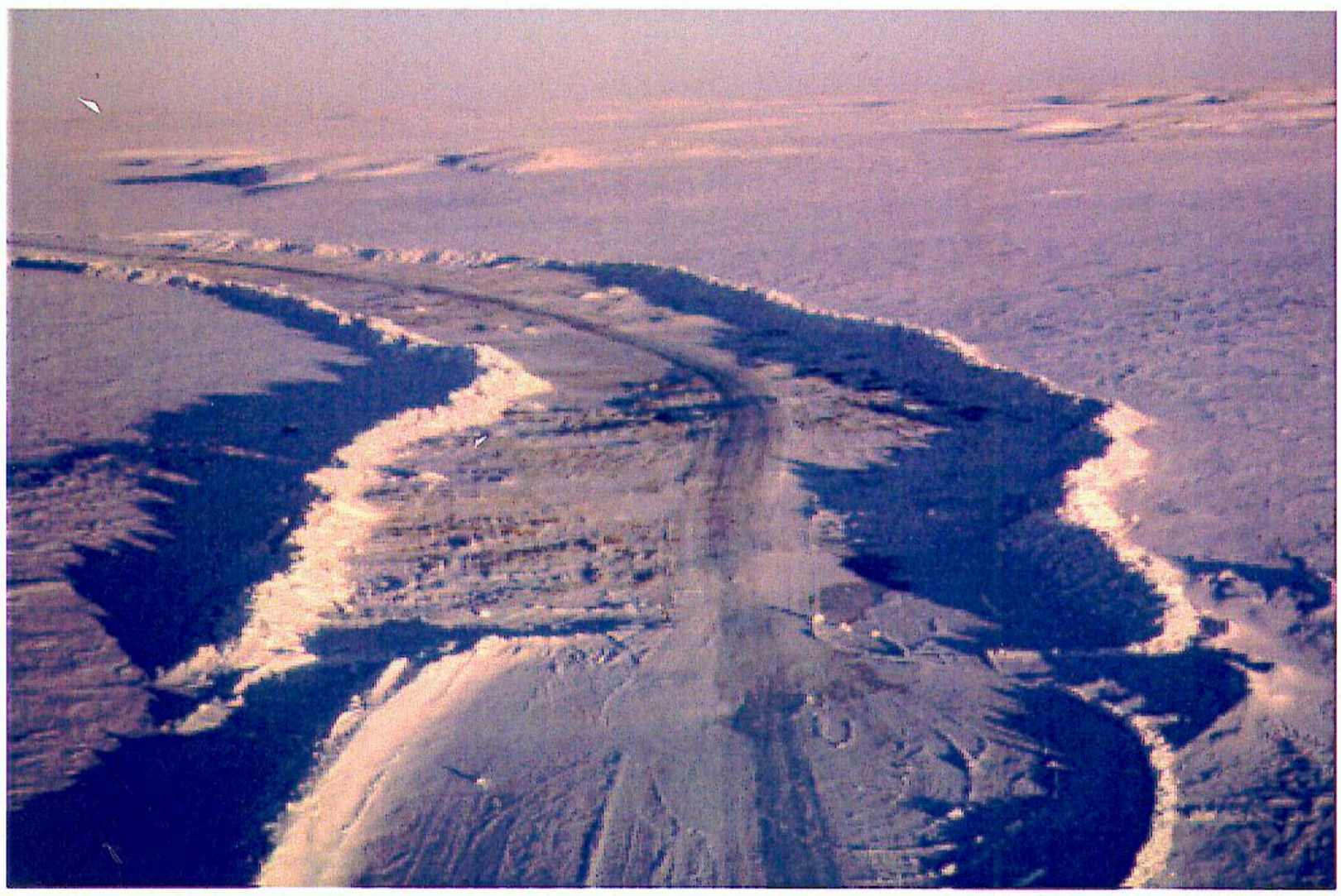

Plate 2.2-18 Snowbanks Pushed Back from Embankment Portage in the Barrenlands to Reduce the Effects of Drifting Snow

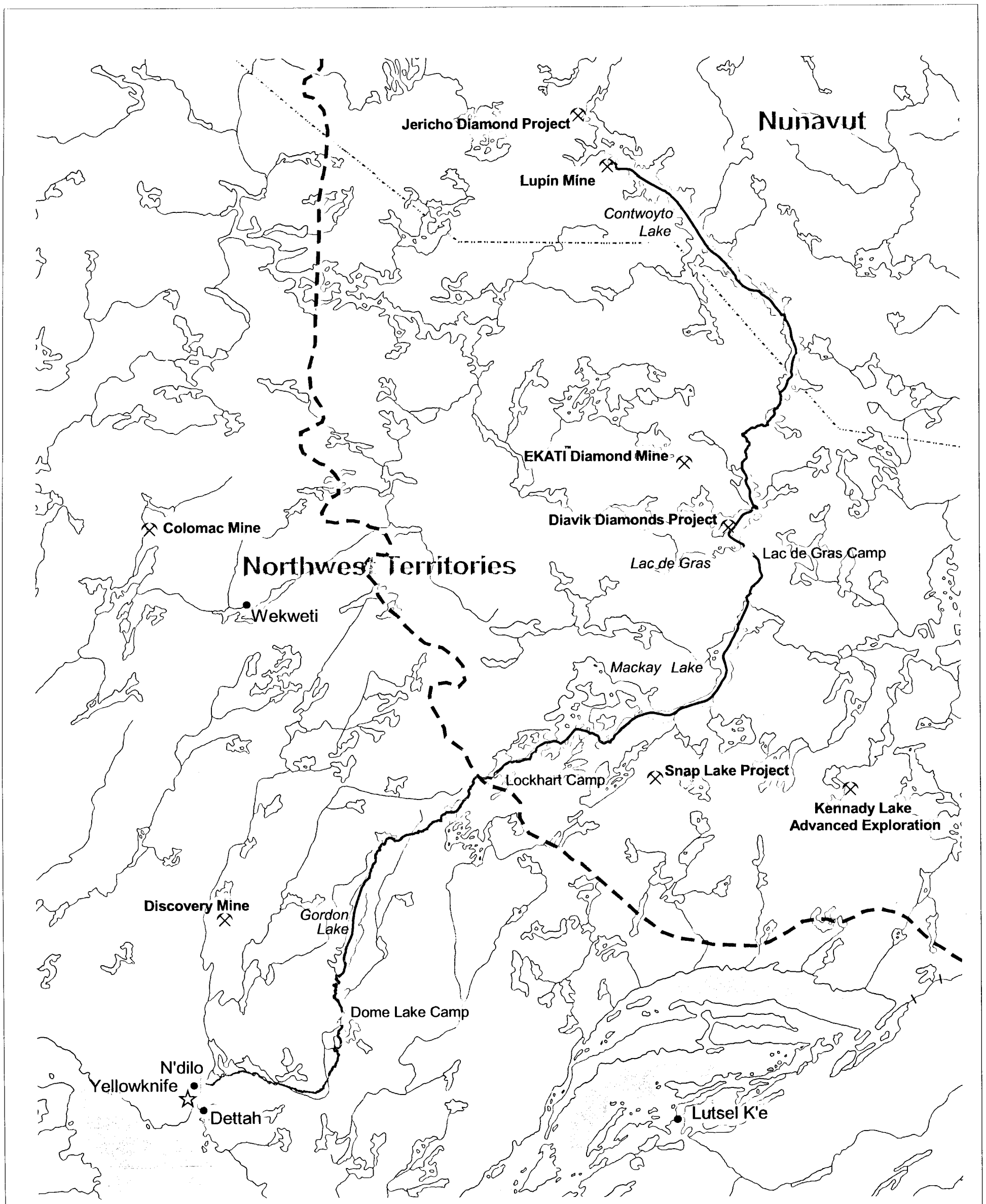

Figure 1.1-1 Tibbitt to Contwoyto Winter Road Location Map

Tibbitt to Contwoyto Winter Road

Landsat TM Bands 5,4,2 (RBG) - September, 2000 & September, 1999

Tibbitt to Contwoyto Winter Road Facts

- Private Road to service mines and exploration activities, open to general public
- First year of operation - 1982
- Total length 568 km - 495 km (87%) on frozen lakes, 73 km (13%) overland
- 65 overland portages, 20% of which have been upgraded with gravel/sand pads
- 3 maintenance camps - Dome Lake, Lockhart Lake and Lac de Gras
- Season of operation - January to April
- Average number of operational days/year - 67 days
- Normal speed of traffic on Winter Road - 30 km/hr loaded on ice, 40 km/hr empty, 5 km/hr on portages
- All trucks required to follow Winter Road Driver's Policy and Procedures Manual

LEGEND

- Tundra
- Burns (Past Forest Fires)
- Water
- Forest
- Active Camp
- Abandoned Camp
- Lodge
- Existing Mine Location
- Proposed Mine Location
- Kilometer Post
- Nunavut Boundary
- Winter Road (Portages)
- Approximate Boundary of Tree Line
- Appoximate Boundary of Continuous Permafrost
- Ingraham Trail

INDEX MAP

N

50 0 50 Kilometers

TIBBITT TO CONTWOYTO
WINTER ROAD JOINT VENTURE

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