APPENDIX 7

CANADIAN ZINC CORPORATION

VEGETATION AND WILDLIFE & WILDLIFE HABITAT – DEVELOPERS ASSESSMENT REPORT SECTIONS

Prairie Creek Mine – All Season Road and Airstrip, Northwest Territories

FEBRUARY 2015

TETRA TECH EBA

ISSUED FOR USE
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LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Canadian Zinc Corporation and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Canadian Zinc Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

1.1 General

Canadian Zinc Corporation (CZN), is proposing to operate the Prairie Creek Mine. The Mine is located at approximately 61º 33' north latitude and 124º 48' west longitude adjacent to Prairie Creek, a tributary of the South Nahanni River, NWT. Prairie Creek flows into the South Nahanni River approximately 43 km downstream of the Prairie Creek Mine.

Applications for operating permits were referred to the Mackenzie Valley Environmental Review Board (MVEIRB) for environmental assessment (EA0809-002) and on December 8, 2011 the MVEIRB issued their Report of Environmental Assessment (REA). The MVEIRB concluded that the proposed development, as described in the REA and including CZN's commitments, is not likely to have any significant adverse impacts on the environment or to be a cause for significant public concern.

The file was returned to the Mackenzie Valley Land and Water Board (MVLWB) for the permitting phase, and mine operations permits were subsequently issued, including Water Licence MV2008L2-0002 issued on September 24, 2013. As changes were made to the access road alignment during the EA, CZN applied for and received new access road Land Use Permits (LUPs) and Water Licences from both the MVLWB and Parks Canada.

In the previous environmental assessment (EA0809-002), CZN received approval for winter road access (and its associated facilities and temporary camps and work support infrastructure) to the Mine. CZN is now proposing to upgrade the winter road to an all season road and develop an airstrip outside the Mackenzie Mountains (the Project) (Figure 1). The length of the access road from the Mine to the existing Nahanni Access Road, located on the south side of the Liard River, is 174.5 km. Approximately 83 km of the proposed all season road crosses Nahanni National Park Reserve (NNPR) land. The proposed all season road generally follows the winter road alignment assessed and approved during the MVEIRB EA0809-02 review process. CZN has proposed to complete the access road upgrade in two phases. Descriptions of these two phases as they have been described to date are presented in Section 2.0 of this report.

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by CZN to conduct an assessment of the potential effects of upgrading part or all of the existing approved winter access road to an all season road and an airstrip on the vegetation and wildlife of the project area. This assessment of potential impacts is intended to be incorporated by CZN into its Developer's Assessment Report (DAR) for the proposed Project.

1.2 Use of This Report

This report was prepared by Tetra Tech EBA using existing available information and baseline surveys. The material in this report reflects Tetra Tech EBA's best professional judgment in light of information available to it at the time of preparation. It is understood that portions of this report will be incorporated into the body of the DAR, but that the report in its entirety will be included as an appendix to the DAR.

Any use which a third party makes of this report or any reliance on or decisions to be made based on it, are the responsibility of such third party. Tetra Tech EBA accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or action based on this report.

1.3 Report Organization

This report has been organized in separate sections reflecting the organization of the DAR. Specifically, the following sections of the DAR are addressed:

- Existing Environment and Baseline sections for species at risk, wildlife and vegetation (Sections 5.1.4, 5,1.6 and 5.1.7 of the TOR); which correspond to Sections 4.4, 4.6 and 4.7 of the DAR Table of Contents;
- Impacts to traditional harvesting and traditionally harvested species (Section 7.2.1 of the TOR; which corresponds to Section 8.0 of the DAR Table of Contents;
- Impact assessment for species at risk, wildlife and vegetation (Sections 7.3.6, 7.3.8 and 7.3.9 of the TOR); which correspond to Sections 11.6, 11.8 and 11.9 of the DAR Table of Contents); and
- Cumulative effects assessment as it relates to traditional harvesting, species at risk, wildlife and vegetation (Section 10 of the TOR); which corresponds to Section 14 of the DAR Table of Contents.

The various report sections, in aggregate, constitute the assessment of the potential effects of the Project on species at risk, wildlife and vegetation along the proposed all season access road and airstrip.

2.0 PROJECT DESCRIPTION

Canadian Zinc intends to complete construction of the all season road and airstrip and operate the Mine using the winter road for the first few years of operation. The majority of the road right-of-way is proposed to be cleared during winter road construction in the first years of operations. The all season access road effects assessment is consistent with the approach previously employed by CZN (2010) and Golder (2010) for the winter road approval and licenses, with differentiation between two all season road project development phases (Table 2-1).

CZN proposes to develop the all season road in two phases: 1) Phase 1 from the Mine to the Tetcela Transfer Facility (TTF); and 2) Phase 2 from the TTF to the Liard Transfer Facility (LTF). Once in operation, full scale concentrate hauling is restricted to approximately 250 calendar days per year due to seasonal constraints at the Liard River crossing (e.g., barge operation from mid-May to early November and winter ice bridge open to full 60 tonne capacity from mid-January to late March).

Table 2-1: Project Development Phases at a Glance

Project Scope	Geographic Scope	Temporal Scope	Included as Part of All Season Access Road Assessment
PHASE 1 ALL SEASON ROAD			
Clearing the 20 m wide winter road alignment from the Mine to Kilometre Post (KP) 86, currently approved under existing Land Use and Water Licences	KP 0-86	September to January, year 1 of mine construction	*No.* *Currently approved.*
Clearing a 4 km long, approx. 20 m wide (5 m running surface) road alignment different from the approved winter road	KP 24.5-28.5	Winter clearing year 2 or 3 of mine operation	Yes

Table 2-1: Project Development Phases at a Glance

Project Scope	Geographic Scope	Temporal Scope	Included as Part of All Season Access Road Assessment
Construction of a 86 km long all season road with a 5 m wide running surface from the Prairie Creek Mine to the Tetcela Transfer Facility following the approved winter road route (note, an all season road bed already exists from the Mine to approx. KP 33)	KP 0-86	Summer/fall/winter construction, year 2 or 3 of mine construction	Yes
Clearing and excavation of 31 borrow pits (total area approximately 13.31 ha) and their access roads (total area approximately 0.80 ha)	Locations as identified in this DAR	Clearing September to January. Combination of summer/fall and winter construction and excavation commencing in year 2 or 3 of mine operation and tentatively extending to year 5 of mine operation	Yes
Construction of the Tetcela Transfer Facility (TTF) beyond that approved with the winter road (2 ha additional)	KP 86	Summer/fall/winter construction, year 2 or 3 of mine construction	Yes
Operation and maintenance of the road and facilities	KP 0-86	~14 year mine life, plus 6 year closure	Yes
Construction and operation of temporary construction support infrastructure and workspaces including camps, laydown, staging areas, and bulk fuel storage. To be located within borrow pits and existing disturbances, as much as possible (total area approximately 3.69 ha)	Locations as identified in this DAR	Combination of summer/fall and winter construction commencing in year 2 or 3 of mine operation and tentatively extending to year 5 of mine operation for temporary camps and life of mine for permanent camps	*No.* *Currently approved.*
PHASE 2 ALL SEASON ROAD			
Clearing the 20 m wide winter road alignment from KP 86 to the Nahanni Access Road, currently approved under existing Land Use and Water Licences	KP 86-174.5	September to January, year 1 of mine construction	*No.* *Currently approved.*
Clearing a 4 km long, approx. 20 m wide (5 m wide running surface) road alignment different from the approved winter road	KP 90.5-94.5	Winter clearing, tentatively year 5 of mine operation	Yes
Clearing a 1 km long, approx. 20 m wide (5 m wide running surface) road alignment different from the approved winter road	KP 122.5-123.5	Winter clearing, tentatively year 5 of mine operation	Yes
Construction of a 90 km long, 5 m wide running surface all season road from the Tetcela Transfer Facility to the Nahanni Access Road	KP 86-174.5	Combination of summer/fall and winter construction, tentatively year 5 of mine operation	Yes

Table 2-1: Project Development Phases at a Glance

Project Scope	Geographic Scope	Temporal Scope	Included as Part of All Season Access Road Assessment
Clearing and excavation of 18 borrow pits (total area approximately 27.37 ha) and their access roads (total area approximately 3.86 ha)	Locations as identified in this DAR	Clearing September to January. Combination of summer/fall and winter construction and excavation commencing in year 2 or 3 of mine operation and tentatively extending to year 5 of mine operation	Yes
Construction and operation of temporary construction support infrastructure and workspaces including camps, laydown, staging areas, and bulk fuel storage. To be located within borrow pits and existing disturbances, as much as possible (total area approximately 3.69 ha)	Locations as identified in this DAR	Combination of summer/fall and winter construction commencing in year 2 or 3 of mine operation and tentatively extending to year 5 of mine operation for temporary camps and life of mine for permanent camps	*No.* *Currently approved.*
Construction of landing areas and operation of a barge crossing at the Liard River	KP 160	~14 year mine life, plus 6 year closure	Yes
Operation and maintenance of the road and facilities, annually	KP 86-184.5	~14 year mine life, plus 6 year closure	Yes
Construction and operation of the Liard River winter crossing, annually	KP 160	~14 year mine life, plus 6 year closure	*No.* *Currently approved.*
AIRSTRIP			
Clearing to accommodate approx.1 km long, 50 m wide airstrip to support road construction & maintenance, and secondarily as an alternate to the existing airstrip at the Prairie Creek Mine (total area approximately 7.62 ha)	KP 55	Winter clearing, ~14 year mine life, plus 6 year closure	Yes
Construction, operation, and maintenance of the airstrip	KP 55	~14 year mine life, plus 6 year closure	Yes
COMBINED DEVELOPMENTS			
Closure and reclamation	KP 0-174.5 and airstrip	~ 6 years after mine closure (2029-2036)	Yes

2.1 Road Alignment

The original winter access road to the Prairie Creek Mine was constructed in the early 1980's and operated for two winter seasons carrying over 800 loads into the Mine site. During EA0809-002, the route was optimized to reduce environmental and logistical risks. Four re-alignments were included in the revised route:

- Polje By-Pass, within the expanded Nahanni National Park Reserve (NNPR);

- Silent Hills re-alignment, within the expanded NNPR;
- Wolverine-Grainger Gap re-alignment; and,
- Nahanni Front Range re-alignment.

In accordance with the MVLWB and Parks Canada Land Use Permits and Water Licences, CZN is authorized to construct and operate a winter road that mostly follows the same route as the historical winter road constructed in 1981 and 1982. These authorizations permit the clearing of the winter access road, which will occur prior to the construction of this proposed all season road. As part of these authorizations, CZN concluded Impact Benefits Agreement negotiations with the NDDB and LKFN, and potential impacts on harvesting was one of the issues discussed. The all season road will generally follow the cleared winter access route, except in three locations that traverse wet areas that are conducive for winter road operations and an area of steep talus scree (Figure 1):

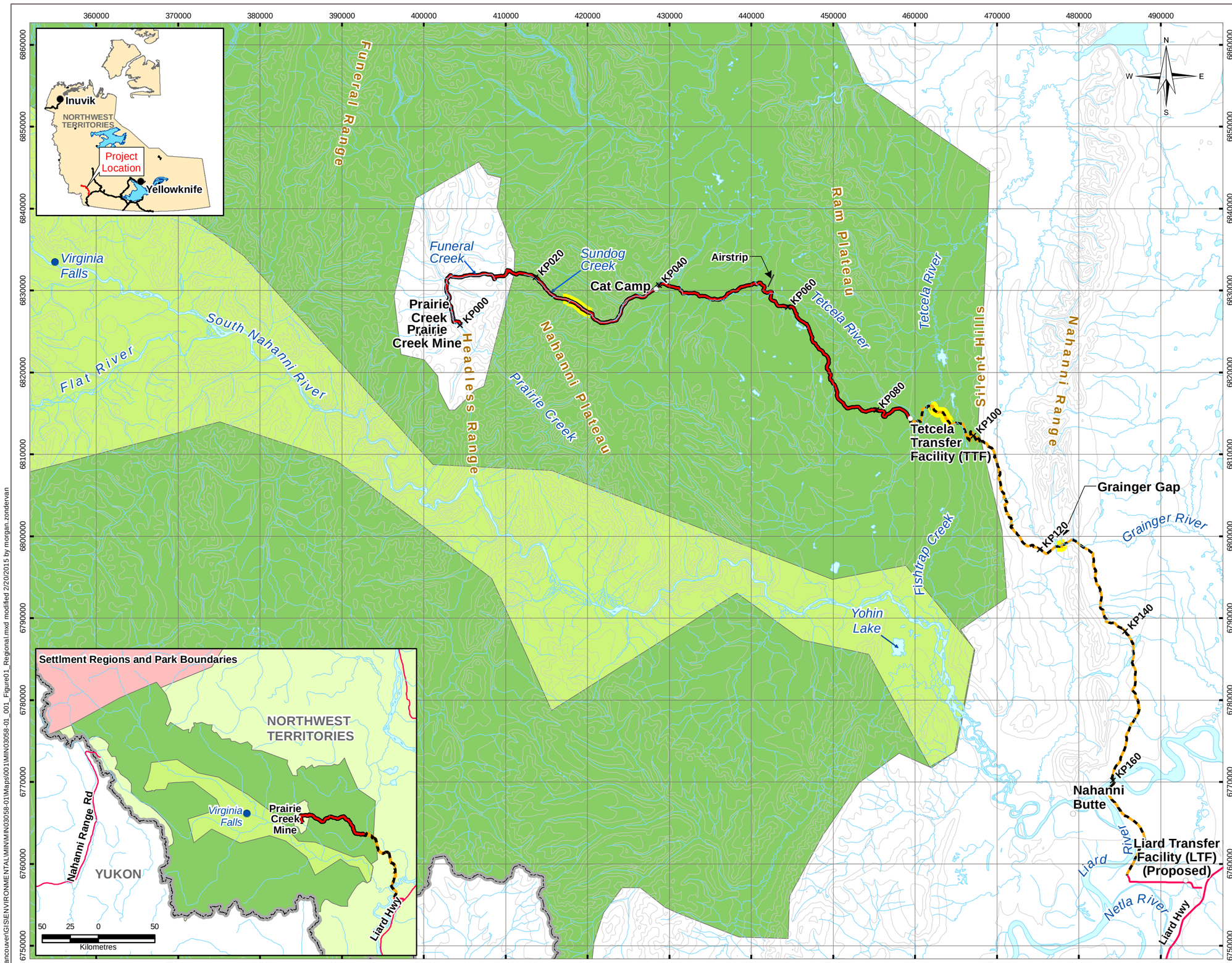
- 4 km section in Phase 1 (approximately from KP 24.5-28.5) (rerouted to avoid steep talus scree);
- 4 km section in Phase 2 (approximately from KP 90.5-94.5) (rerouted to avoid wet area); and
- 1 km section in Phase 2 (approximately from KP 122.5-123.5) (rerouted to avoid wet area).

A detailed field program is required to locate the precise road location, and therefore, the proposed road alignment provided herein has been defined to within a 100 m corridor, plus or minus 50 m on either side.

From an economic perspective, seasonal road access only would penalize the operation because significant working capital is required to finance annual operating activities before any revenue from the concentrates produced in that year is available. Seasonal road access only also presents logistical challenges for the effective and efficient operation of the Prairie Creek Mine.

All season access would remove the economic and logistical penalties, but is counter-balanced by the anticipated significant cost to upgrade the access road. However, all season access could promote other activities, such as increased tourism, and greater involvement of local aboriginal groups may occur. Also, with all season access, CZN could consider alternate, lower cost and more environmentally-friendly fuels to power the operation, such as propane or liquefied natural gas (LNG).

Therefore, in addition to applying for all season road use from the Mine to the TTF (Phase 1), CZN has also applied for all season road use from the TTF to the Nahanni Butte Access Road (Phase 2), which when combined represents the entire road to the Liard Highway. This will enable the year-round transport of concentrates and consumables.



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LEGEND

Proposed All Season Road

- Phase 1
- Phase 2
- Existing Road
- Proposed All Season Road Realignment
- All Season Road Kilometre Marker
- Proposed Airstrip
- Contour (200 m)
- Watercourse
- Waterbody
- Previous Nahanni National Park Reserve Boundary
- Current Nahanni National Park Reserve Boundary
- Deh Cho Settlement Region
- Sahtu Settlment Region
- Yukon / NWT Border

NOTES
Base data source:
NTS 1:250,000
Road alignment provided by AllNorth (Jan 22, 2015)

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL SEASON ROAD DEVELOPER'S ASSESSMENT REPORT

Project Location

PROJECTION UTM Zone 10		**DATUM** NAD83			**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:450,000 (5 2.5 0 5 Kilometres)					TETRA TECH EBA
FILE NO. MIN03058-01_001_Figure01_Regional.mxd					
PROJECT NO. ENVMIN03058-01	**DWN** MEZ	**CKD** SL	**APVD** KL	**REV** 0	**Figure 1**
OFFICE Tt EBA-VANC	**DATE** February 20, 2015				

The road bed from the Mine (KP 0) to KP 39 (Cat Camp) is already of all season quality. In addition, Cadillac's road LUP provided for all season use of that section. The majority of the remainder of the road to the TTF location (Phase 1 KP 86) is on solid ground with very little muskeg terrain. Although initial road use for early mine operations would be winter only using existing permits, CZN wishes to obtain new permits to allow phased all season use of the road.

Phase 1 would see the western portion of the road upgraded for all season use to allow the mineral concentrates to be transported to the TTF. Subject to future economic justification and funding, Phase 2 would see the eastern portion of the road from the TTF to the Liard River crossing upgraded. This phase would also provide an opportunity for multi-party collaboration and use.

2.2 Road Bed Design and Construction

The average cleared right-of-way is understood to be 20 m wide, with sections of up to 35 m wide in locations with significant side slopes. The proposed width of the all season road surface will be a 5 m running surface (or 10 m including shoulders) for a single lane. There will be approximately 3 turnouts per kilometre for passing, making for an 8 m wide running surface in these locations. Turnouts will be approximately 30 m long.

The additional limited clearing required for the all season road will be undertaken outside the migratory bird nesting period, as birds and nests are protected under the *Migratory Birds Convention Act* (Government of Canada 1994) under Section 12(1h). All season road construction will preferentially be completed in the summer, but will also occur through the fall and winter.

The road bed will preferably be built with free-draining gravel fill and with a slight camber. Side slopes will be a minimum two horizontal to one vertical units. For crossing soft ground, the bed thickness will be increased, and/or a geotextile will be laid first.

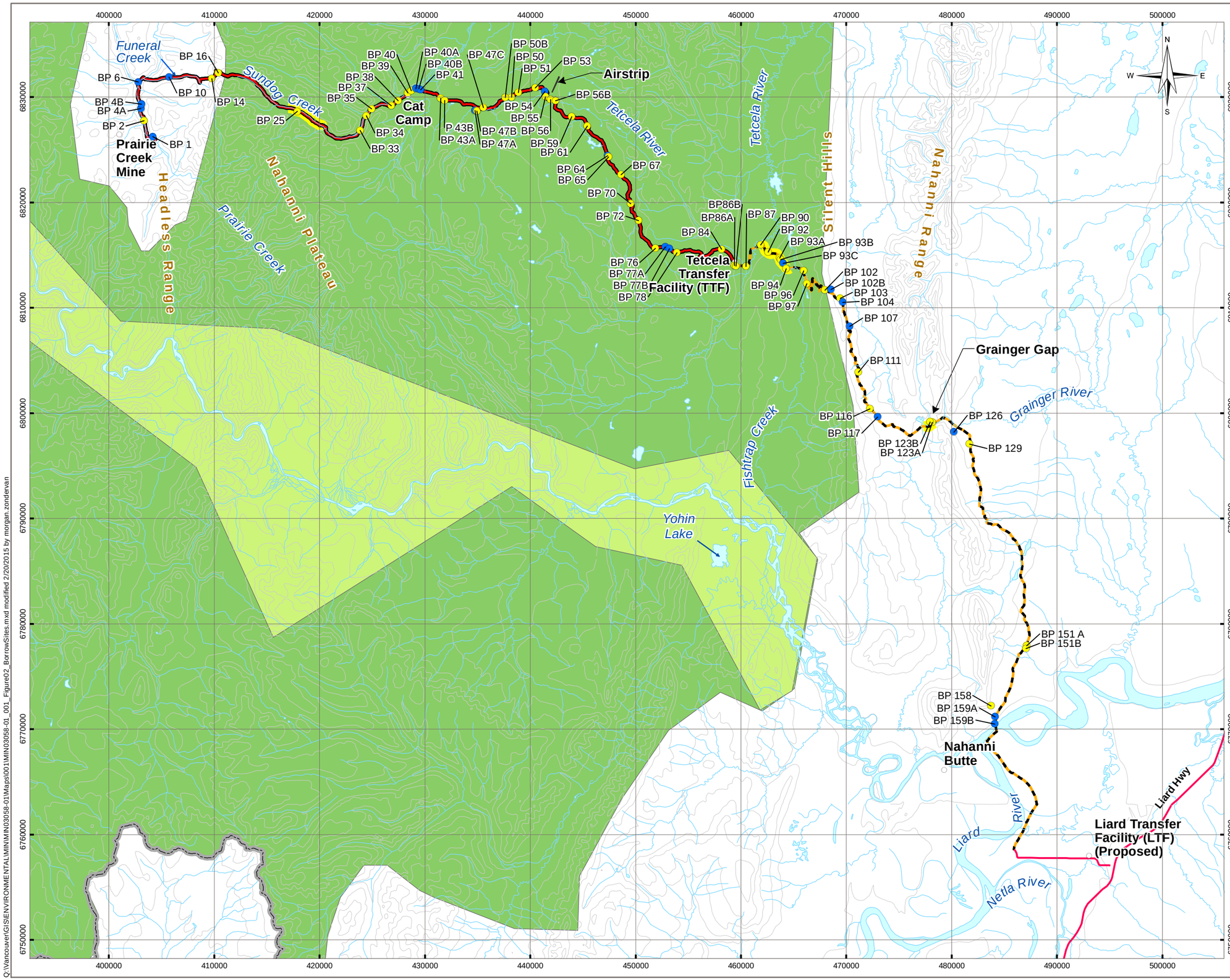
To facilitate road construction and minimize travel, a temporary camp will be established near the location of construction. As construction progresses, the camp would be moved closer. The camp would likely consist of a number of accommodation trailers, a kitchen/diner, a diesel-fed generator with a storage tank up to a capacity of 4,500 litres, a double-chamber garbage incinerator plus an ash bin, and a sewage lagoon or pit. Some of the possible locations for such camps include Cat Camp, the TTF, the eastern lower slope of the Silent Hills, and the eastern side of the Front Range near Grainger Gap.

Larger watercourses will be crossed by span-crossing structures. Some of these have already been approved for the winter road. Smaller watercourses, and areas where runoff would pond upslope of the road, would be addressed by closed or open-bottom culverts on a case-by-case basis, as required.

There are two possible construction approaches: 1) a large crew or crews working day and night shifts to complete construction in a relatively short period of time; or 2) a smaller crew working a single shift on a multi-year basis. Either possible construction approach is being considered; however, the smaller crew working over multiple years may prove most suitable to the overall development plan and is most likely to be adopted.

2.3 Borrow Sources

Aggregate materials for road construction will be obtained from multiple local sources located within or in close proximity to the all season road right-of way. Forty nine (49) preferred borrow sources (Figure 2) have been identified for use during the construction phase, and 25 additional borrow sources have be identified as possible backup sources. The borrow sites have been categorized by the type of material and its' construction application. The borrow sites will be utilized for three construction applications; Subgrade Borrow Supply, Surfacing Aggregate Supply, and Rock Quarry Supply. Possible sources for winter sand are also noted.



LEGEND

Proposed All Season Road

- Phase 1
- Phase 2
- Existing Road
- Proposed All Season Road Realignment

Borrow Site

- Preferred
- Potential Alternative Source
- Proposed Airstrip
- Contour (200 m)
- Watercourse
- Waterbody
- Previous Nahanni National Park Reserve Boundary
- Current Nahanni National Park Reserve Boundary
- Yukon / NWT Border

NOTES
Base data source:
NTS 1:250,000
Road alignment provided by AllNorth (Jan 22, 2015)

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL SEASON ROAD DEVELOPER'S ASSESSMENT REPORT

Proposed All Season Road and Airstrip Locations

PROJECTION UTM Zone 10	**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:350,000 (5 2.5 0 5 Kilometres)			TETRA TECH EBA
FILE NO. MIN03058-01_001_Figure02_BorrowSites.mxd			
PROJECT NO. ENVMIN03058-01	**DWN** MEZ / **CKD** SL / **APVD** RH / **REV** 0		**Figure 2**
OFFICE Tt EBA-VANC	**DATE** February 20, 2015		

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All borrow source development needed for construction of the all season road and airstrip will conform with INAC's Northern Land Use Guidelines – Pits and Quarries (2010). The majority of the all season road right-of-way is underlain with rock that originated from shallow Paleozoic ocean margins, and as such consists primarily of carbonate materials which are non-acid generating. In some areas of the route there are additional interspersed and separate sedimentary layers consisting of siltstones, mudstones, and shale, as noted in outcrops inspected by Allnorth (2015). Many of these outcrops were sampled and the parent material is considered to be calcareous as well and they constitute acid absorbing materials, not acid generating materials.

2.4 Phase 1 Development (KP 0 to KP 86, TTF)

2.4.1 All Season Road

The road from the Mine (KP 0) to the TTF (KP 86) would be upgraded for all season use (Figure 1). The section from KP 0 to Cat Camp (KP 39) was previously permitted for all season use in 1980. However, there are potentially fish-bearing creek crossings from KP 26.5 to KP 39 that would require crossing structures in order to be crossed outside of the winter period.

Upgrading the road will require little to no work from KP 0 to KP 23 over and above the work that will already have been completed for winter use. From KP 23 to KP 28.5, an all season road bed exists, although a re-alignment is proposed between KP 24.5 and 28.5 to avoid talus slopes and reduce the number of creek crossings. If bridges have not already been installed at these locations for winter use, they will need to be.

From KP 28.5 to Cat Camp (KP39), the road traverses the Sundog Creek alluvial floodplain. The old winter road alignment currently crosses the creek channel approximately six times. However, the future road alignment can be shifted slightly south in some places to avoid these crossings. In two locations (approximately KP 35 and 38), the creek channel needs to be moved to the north. Because of the braided nature of the channel, and the fact that the channel changes location significantly from year to year, no net loss in habitat value is expected to occur from the realignment.

A significant tributary to Sundog Creek at KP 39 will require a crossing structure. A gravel road bed will need to be placed between KP 40 and at least KP 55 because the underlying soils are too soft to support vehicles.

There are significant gravel sources in the Cat Camp area in the form of talus slopes immediately adjacent to the road alignment. Additional borrow sources are also present from KP 49 to 54. A bridge crossing of Polje Creek at KP 54 is already planned. From KP 55 to the TTF (KP 86), the road traverses mostly upland karst terrain with thin soil cover.

Gravel fill requirements are expected to be much less, except in a few locations, such as at KP 62 and KP 64 where the road crosses drainage in proximity to Mosquito Lake, and from KP 83 to the TTF, where there is muskeg.

2.4.2 Tetcela Transfer Facility

The approved TTF at KP 86 would be enlarged to accommodate storage of all of the concentrates between the annual closure of the winter road to the Highway and the opening of the next winter road. Additional storage sheds would be added to the existing infrastructure, or the existing sheds would be enlarged. The TTF would become the main concentrate storage location, as opposed to the Mine. Therefore, the concentrate storage shed at the Mine could be moved to the TTF.

A dry storage shed may also be provided to store incoming materials. These would be brought in during the winter and mostly hauled directly into the Mine, however there might be a need to have some storage at the TTF

to allow hauling to the Mine over the course of the following spring and summer. During the winter period, fuel will be back-hauled into the Mine directly and there will be no need for temporary storage at the TTF. However, a truck fueling station with a 10,000 litre storage tank in a bermed and lined enclosure may be provided so that the mine fleet can fuel up at the TTF instead of at the Mine, thus avoiding the haul of that fuel into the Mine. Because the facility would be in operation all season, fire-fighting equipment and protocols would be put in place.

2.4.3 Concentrate/Supplies Haul

The Mine will produce ~120,000 tonnes of concentrate per year when the Mine is producing at maximum capacity. Therefore, approximately 330 tonnes will be produced daily and will need to be transported to the TTF. For a truck capacity of 30 tonnes, this means 11 trips. Travel time to the TTF and back averaging 30 kms per hour (km/hr) would be approximately 7 hours, with 1 hour added for unloading, rest, and turnaround. As a result, it is likely that there would be a mine fleet of approximately 6 trucks which would make 2 trips per day in convoys, with a day shift and a night shift. The trucks would return empty, unless they carry some supplies that were left in storage at the TTF.

When the winter road is open to the Highway, all of the annual Mine fuel requirement and most of the annual supplies required will be brought in to the Mine directly on the back-haul of taking concentrates out. This will be accomplished by using 10,000 litre fuel tanks incorporated into the trailers used for the concentrate haul, the same approach that will be used when the entire road is used in winter only. Traffic over the winter period on the western portion of the road will be much less than before, but the same as before on the eastern portion of the road. Special deliveries will be required as before, for consumables such as explosives and mine reagents.

2.5 Phase 2 Development (KP 86 to KP 183, LTF)

2.5.1 All Season Road

Subject to future economic justification and funding, Phase 2, the eastern portion of the road from the TTF (KP 86) to the Liard River crossing would be constructed. The road from the TTF to approximately KP 96 at the toe of the Silent Hills crosses some of the softest ground on the whole route. There are two crossings of the Tetcela River, each of which would require a bridge, followed by a muskeg area and then the short Fishtrap Creek wetland section. The current alignment will be moved slightly to the south onto firmer ground between KP 90.5 and 94.5. There may be borrow sources in intervening areas, and at the lower slopes of the Silent Hills.

The road then ascends the Silent Hills to Wolverine Pass via switch-backs, and after the Pass heads south along the eastern slope of the range before turning east towards Grainger Gap at KP 121. This section of the road should not require significant fill because the upland terrain is well drained. From KP 121 to KP 126, the road crosses the headwaters of the Grainger River. A re-alignment between KP 122.5 and 123.5 will avoid some very boggy ground. The Grainger Gap area is next to KP 125 and the road is on the northern bank of the Grainger River on an old floodplain terrace where the ground is firmer. There are significant gravel sources in the Gap area.

The road section from KP 125 to the Liard River (KP 160) has varied ground conditions. The first 15 km is well drained, but the remainder has increasing muskeg as the road crosses the historical Liard floodplain. There is significant borrow material available along the toe of the Front Range. East of the Liard River, the road continues across the Liard floodplain to the Nahanni Butte Access Road at KP 174.5.

A private barge would operate on the Liard River crossing during the ice-free period, with an ice bridge in the winter. As the preferred barge landing locations may not coincide exactly with the ice bridge, there may be two

road approaches on each side of the river. Small staging areas will be required adjacent to the barge landing sites on both sides of the river. Equipment will likely be stationed at these sites to maintain the barge landing areas.

2.5.2 Concentrate/Supplies Haul

Concentrates would be hauled out of the Mine daily to travel the 184 km to the Liard Transfer Facility (LTF) near the Liard Highway. Travel will not occur during periods when crossings of the Liard River are not possible. At the Liard River crossing near Fort Simpson, the 10 year average (1998-2008) dates for ferry operation are May 13 to November 4, and for ice bridge operation November 28 to April 21. However, 60 tonne ice bridge crossings are only possible from January 15, and likely have to end sooner than April 21. Therefore, it is assumed that approximately 250 days would be available for hauling in an average year. Thus, to move 120,000 tonnes of concentrate using trucks with 30 tonne loads, 16 trips per day would be required.

Travel time to the LTF averaging 30 km/hr with a brief stop would be approximately 8 hours in winter. In summer, the trip would be approximately 9 hours to allow for the barge crossing of the Liard River, which could be a bottle-neck. In winter, sixteen trucks might transport concentrates to the LTF during the day shift, with the trucks returned with supplies during the night shift. There are two possible summer transportation scenarios, as follows:

- Sixteen trucks will leave the Mine, equally spaced throughout the 24 hour day to the west bank of the Liard River. Trailers loaded with supplies for the Mine will be delivered to the west bank for shipment to the Mine. When the trucks arrive, the rigs will unhitch from the concentrate trailers and hitch the supplies trailers. A second truck crew will then take the supplies trailers into the Mine. This avoids a bottle-neck at the ferry crossing as there would be nearly a full day to transfer the concentrate trailers to the LTF, unload and load, and return them to the north bank. However, this option will require a trailer transfer area on the west bank of the river; and,

- Sixteen trucks leave the Mine in one hour intervals and travel all the way to the LTF. After unloading and loading, a second crew driver immediately returns the truck to the Mine. Ferry crossings are synchronized so that few crossings are made without a loaded truck aboard.

The most efficient transportation plan will need to be determined. As for the Phase 1 road, there will be special delivery trips in addition to the concentrate trips.

2.6 Airstrip

CZN proposes to build an airstrip in the Sundog-Ram Plateau area to support road construction, maintenance and restoration/closure, and secondarily to facilitate air access to the Mine when the existing Mine airstrip is inaccessible due to poor weather. This new airstrip, with proposed dimensions approximately 1,000 x 50 m, would also be available to Parks Canada to support NNPR activities, and to all aircraft for emergency landings.

A number of potential locations were studied previously by BGC Engineering in 2001 and more recently by Allnorth (2015). The current preferred new airstrip location is in the Poljie Creek area (Figure 2). This site offers a good alignment with the apparent prevailing winds, ample runway length, clear approaches on both ends, and suitable runway constructability (Allnorth 2015).

The soil overburden of this area has been typically characterized by Allnorth (2015) as consisting of a thin veneer ranging from approximately 0.3 to 0.6 m deep, with the surface soils ranging between sandy and silty materials over distance. It was also noted that the entire investigation area had been burned by forest fires within the last few decades and has regenerated to pine.

As the new airstrip will also serve as a backup to the existing Prairie Creek Mine airstrip, during times when that airstrip is inaccessible, the air traffic (3-4 aircraft/week) will be diverted to the new airstrip to bring in both supplies and people. Aircraft that have used the existing airstrip include the DHC-5 Buffalo, the DHC-6 Twin Otter, Dash 7-100, and Hawker Siddeley 748. Many smaller aircraft have also accessed the strip, including Caravan, Beaver, Islander and Beechcraft.

3.0 ASSESSMENT METHODOLOGY

The assessment methodology employed to assess potential impacts on the valued components — species at risk, wildlife and vegetation conforms with the impact assessment steps summarized in Section 4.1 of the MVEIRB TOR for the Prairie Creek Mine All Season Road. Consistent with the MVEIRB TOR, the assessment methodology employed includes:

- identify any valued components used and how they were determined;
- identify the natural range of background conditions (where historic data are available), and current baseline conditions, and analyze for discernible trends over time in each valued component, where appropriate, in light of the natural or existing variability for each;
- identify any potential direct and indirect impacts on the valued components that may occur as a result of the proposed development, identifying all analytical assumptions;
- identify and evaluate any proposed mitigation measures as to their technical and economic feasibility to reduce the predicted impacts and discuss constraints, uncertainties and implementation challenges to the effective use of the proposed measures and clearly identify all mitigation commitments;
- predict the likelihood of each impact occurring after the committed to mitigation measures are implemented, providing a rationale for the confidence held in the prediction. The developer will also present the predictions in a manner that facilitates the formulation of testable questions for future follow-up programs, as well as textually and schematically indicate the pathways of predicted impacts;
- compare the predicted impacts to pre-development conditions or to conditions without the Project as appropriate. Include a description of any plans, strategies or commitments to avoid, reduce or otherwise manage and mitigate the identified potential adverse impacts, with consideration of best management practices in relation to the valued component or development component in question;
- describe techniques such as models utilized in impact prediction including techniques used where any uncertainty in impact prediction was identified;
- identify, and provide an opinion on the significance of any residual adverse impacts predicted to remain after any mitigation measures and indicate the methodologies for reaching such conclusions; and
- identify any monitoring, evaluation, and adaptive management plans required to:

  i. detect potential unexpected changes;

  ii. ensure that predictions are accurate; and

  iii. proactively manage against developing adverse impacts when they (or unexpected changes) are encountered.

The developer will describe how the predicted impacts are expected to arise from the proposed development, as well as its views on impact significance. This will include describing the mechanisms for cause and effect and providing supporting references (including where Traditional Knowledge was used). Where professional judgment has been used in determining impacts, this must be made clear. The developer will also provide a discussion on the uncertainty involved with each prediction. For each predicted impact, the developer will describe:

- the nature or type of the impact;
- the geographical range of the impact;
- the timing of the impact (including duration, frequency and extent);
- the magnitude of the impact (what degree of change is expected);
- the reversibility of the impact; and
- the likelihood and certainty of the impact.

The criteria described above will be used by the developer as a basis for its opinions on the significance of impacts on the biophysical and human environment.

This assessment of potential effects related to the upgrading of the current approved winter access road to an all season road addresses the wildlife and vegetation valued components discussed in this supporting report to the DAR for the Prairie Creek Mine All Season Road. The assessment of effects considers direction/magnitude, geographic extent, duration, frequency of occurrence, reversibility and certainty of predicted effects, and is consistent with the approach previously employed by Golder (2010).

The following criteria have been used for the significance determination with respect to wildlife and vegetation, as summarized in Table 3-1:

- Direction and Magnitude – The degree, extensiveness, or scale to which an activity may affect a valued component. Effects can be negative (adverse) or positive (beneficial) while magnitude may be defined as low, moderate or high, depending on how the particular valued component or group of valued components are affected;
- Geographic Extent – The geographic location or area where the effect is predicted to occur. The geographic extent may be identified as local (confined to the area of the access road), regional (with respect to the Dehcho), or territorial in scale;
- Duration – The length of time that an effect is expected to occur as a result of an activity. Short-term duration is defined as the construction phase (in this case one year for each phase), medium-term duration (up to the end of mine life, 14 years), or long-term duration (extending beyond end of mine life);
- Frequency – The predicted rate of occurrence over which an effect may take place. Frequency is defined as low if it occurs once, medium if it occurs intermittently or periodically, or high if it occurs often or continuously;
- Reversibility – Whether the predicted effect(s) can be reversed, or the capacity of the valued component to be restored to pre-development conditions with mine and road closure and reclamation; and
- Certainty – the likelihood and certainty of an effect.

Table 3-1: Assessment of Effects Criteria Associated with the Project

Criterion (of effect)	Low	Moderate	High
Direction and magnitude (severity of adverse environmental effects)	Change is above baseline conditions but within thresholds and within likely range of natural variability	Change is substantially above baseline conditions but within thresholds and within likely range of natural variability	Change exceeds baseline conditions and causes changes beyond the range of natural variability
Geographic extent	Area of effect does not extend past the footprint of the project	Area of effect extends beyond the project footprint but not of regional or territorial consequence	Area of effect is likely to extend into the region or be of territorial consequence
Duration	Effect is only evident during the construction or startup phase	Effect is evident during operation phase	Effect extends beyond the operational life of the road
Frequency	Factors causing the effect occur infrequently	Factors causing the effect occur at regular intervals but infrequently	Factors causing the effects occur regularly and frequently
Reversibility	Effect is readily reversible over a short period of time (i.e., one season)	Effect is reversible over the life of the road	Effect is not reversible even after road closure and reclamation
Certainty	Unlikely to occur	Could reasonably be expected to occur	Will occur, or is likely to occur

An explanation of the significance of environmental effects based on the criteria outlined in Table 3-1 is provided in Table 3-2.

Table 3-2: Significance Criteria for Environmental Effects Assessment

Overall Significance	**Low**	The effect is expected to be of low significance and further assessment and/or specific management are likely not required.
	Moderate	The effect is expected to be of moderate significance and specific management measures or plans are necessary.
	High	The effect is expected to be of high significance and further study or monitoring is necessary to supplement the baseline data, and to be used for refining a management strategy and planning.

4.0 EXISTING ENVIRONMENT AND BASELINE CONDITIONS

4.1 Environmental Setting

The Prairie Creek Mine site is located within the Alpine Forest-Tundra section of the Boreal Forest, characterized by stunted fir with limited undergrowth and open areas dominated by lichen.

The Mine is connected to the Liard Highway via an access road (Figure 1), most of which already exists from the old alignment used in 1981-82. The road leaves the Mine site heading north along the Prairie Creek valley for about 7 km before turning east to cross the Mackenzie Mountains. As the Access Road climbs out of the Prairie Creek valley it enters Sub-Alpine Shrub and Alpine Tundra from an elevation of approximately 1000 m AMSL at KP 10.

The road continues to climb through the Alpine to the summit of 1530 m at KP 17, then dropping down and leaving the Sub-Alpine again at the 1000 m elevation around KP 25. As the road drops from the 1000 m elevation to the 900 m elevation, it passes through a spruce-lichen Alpine forest zone similar to that found at the Mine site and then into Riparian Alluvial habitat in the Sundog tributary valley bottom.

As the road crosses the Ram Plateau, it passes through an open forest Black Spruce/Pine Parkland setting between the 830 to 930 m elevations, before dropping down into the Tetcela River valley. The valley consists of a mixed coniferous/deciduous closed forest. The road then passes through a short distance of muskeg open shrub/sedge wetland at the headwaters of Fishtrap Creek, and climbs up and over the Silent Hills, again a closed mixed coniferous/deciduous forest. The road then crosses an area of black spruce muskeg and wetlands of the Grainger River headwaters before passing through mixed coniferous deciduous pine parkland at Grainger Gap (Second Gap).

Once through the Grainger Gap, the road heads south along the foothills of the Front Range through mixed deciduous coniferous forest towards Nahanni Butte, thus avoiding the Grainger Till plain. The road crosses the Liard River near the community and continues through forest to the Liard Highway.

Vegetation and/or wildlife field studies specific to the Prairie Creek Mine and its access road have included:

Table 4-1: Summary of the Prairie Creek Mine and Access Road Field Surveys

Survey Month	Beak (1980; 1981)	RES (1994)	CZN (2006)	Chillborne (2007)	EBA (2009; 2010)	Golder (2010; 2014a; 2014b)
January	X					X
February						X
March	X					
April	X			X		
May						
June	X		X			
July	X				X	
August						
September		X				X
October						
November						
December						X

4.2 Wildlife Species at Risk

The focus of this assessment is the biological status of species at a territorial level, and includes consideration of those species potentially present along the all season access road that are:

- Listed on the *Species at Risk (NWT) Act*;
- Listed on Schedule 1 of the *Species at Risk Act* (SARA) public registry; or
- Ranked by the General Status Ranks of Wild Species in the NWT as May Be At Risk and At Risk.

The all season access road also lies at the distributional limit of other species that have special conservation status, but the occurrence of these species in the region of the road route and NNPR have not been reported or reported only once. The known range of the Canada Warbler (*Wilsonia canadensis*; listed as Threatened under the SARA and At Risk in the NWT) extends as far north as the very southern border of the expanded NNPR, approximately 20 km south of the all season access road junction with the Liard Highway. Since the Prairie Creek all season access road route predominantly follows the permitted winter route (thereby reducing any potential habitat loss) and is slightly outside the northern extent of this species distribution, the Canada Warbler was not evaluated for this effects assessment. Nonetheless, mitigation to alleviate potential adverse effects to the Canada Warbler will be similar to species included in the effects assessment.

Where available, detailed species descriptions presented in the baseline Vegetation and Wildlife Assessment Report for the Prairie Creek Mine (Golder 2010) and the Occupancy Pattern of Caribou in the Prairie Creek Mine Road and Surrounding Area (Golder 2014a) were directly applied.

The Mackenzie Valley Review Board (MVEIRB) Terms of Reference (TOR) (dated September 12, 2014) identified the following key objectives to describe species at risk (including birds) baseline conditions relating to the Prairie Creek All Season Road (EA1415-01):

- Wildlife species presence, distribution, and abundance;
- Seasonal movements, habitat requirements (e.g., breeding, calving, feeding) and sensitive time periods;
- Population status and trends, limits and size, sensitivity, including species use and timing;
- Habitat types including local and regional distribution and abundance;
- Migratory patterns, routes and timing in relation to all season road route alternatives, construction activities, and operation;
- Harvest pressures (subsistence, resident and non-resident harvesting) by species, season, and geographic area;
- Current and historical levels of natural and human-caused fragmentation and connectivity;
- Baseline contaminant concentrations in harvested species that may change as a result of the all season road using existing data;
- Any known issues with respect to the health (e.g., parasites, diseases, condition) using existing data;
- Location of raptor nesting sites within 1 km of the proposed project footprint; and
- Use of the project area by resident and migratory birds.

4.2.1 Collared Pika (*Ochotona collaris*)

Table 4-2: Collared Pika at a Glance

Collared Pika	
NWT Population Summary	
Conservation Status	Assessed as Special Concern by COSEWIC (2011) and ranked as May Be At Risk in the NWT
Trend	Population trend unknown
Size	Population size unknown in the NWT, Dehcho, or the Prairie Creek Mine area
Sensitivities and Threats	Climate-driven changes to habitat
Health, Parasites, and Contaminants	Known infections from a number of internal parasites and fleas, but their impact to overall health unknown
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 within the Mackenzie Mountains (approximately KP 0-36), but not all suitable habitat is occupied
Seasons of Use	All seasons, but most sensitive to road disturbances in the spring, summer, and fall
Key Habitats	Above the treeline (between 700 to 1,800 m elevation) in talus slopes (i.e., boulder fields with medium to large sized rocks), alpine meadows within 10 m from talus, and predominantly on south-facing slopes (COSEWIC 2011)
Existing Harvest Pressure	None
Traditional Knowledge	
No known reports	

Collared Pikas are poorly surveyed across the NWT, and known observations are recorded mainly as incidental observations. Although the presence of Collared Pikas is generally based on their sighting, distinct vocal calls, and observed haypiles, their presence is under-reported due to the general remoteness of their distribution. Nonetheless, collared pikas were assessed by COSEWIC as Special Concern (2011) and ranked as May Be At Risk in the NWT. Their population size and trend is currently unknown in the NWT, but they are considered particularly sensitive to climate-related changes in habitat and habitat availability such as tree and shrub encroachment.

Collared Pikas are a small member of the rabbit and hare group of species. They live in boulder fields (or talus slopes) in alpine areas, above the treeline, and commonly 700 to 1,800 m above sea level (COSEWIC 2011). These boulder fields occur in small isolated patches across the region. Within the talus slope, they defend small territories year round ranging in size from a 15-25 m radius area (COSEWIC 2011). Within talus, medium to large sized boulders are preferred and the availability of nearby alpine meadows are essential for suitable habitat (COSEWIC 2011). While foraging in the meadows, Collared Pikas commonly remain within 10 m of the protective cover of the talus (COSEWIC 2011).

In the meadows, Collared Pikas forage on a variety of grasses and herbs, some of which they immediately eat while others are harvested and laid out to dry in haypiles located within the talus. These haypiles are an important component of the pikas winter survival. Since pikas do not hibernate, they rely on their stored haypiles deep within the talus matrix to overwinter; however, they may continue to forage in meadows and within the talus matrix under the snow (COSEWIC 2011). Collared Pikas are most sensitive to potential road-related disturbances in the spring, summer, and fall when they are actively foraging and haying, and in July when juveniles are dispersing.

They also use the talus for protective cover from weather (including warm temperatures) and predators (e.g., weasels, foxes, and raptors). In June, the young are born in a nest within the talus. Once weaned, juvenile pikas disperse in July in search of their own territory, a time in which they may be particularly exposed to predation.

Juveniles rarely disperse far from their natal boulder field; however, evidence of dispersal greater than 2 km has been documented (COSEWIC 2011).

Pika abundance within suitable talus patches vary considerably both temporally and spatially (COSEWIC 2011). South facing talus slopes are generally the most productive habitat, and therefore, densities of Collared Pikas are generally higher (COSEWIC 2011). Population fluctuations are known to occur, likely as a result of harsh winters and early springs (COSEWIC 2011). Within a talus slope, collared pikas may be locally abundant. However, talus naturally occurs in isolated pockets across the alpine, and not all suitable habitat may be occupied. COSEWIC (2011) reports that in 2009, no pikas were observed in suitable habitat in the Ram Plateau despite an abundance of suitable talus slope habitat. Likewise, in 2010 only 56% of suitable talus patches were occupied by Collared Pikas in Tombstone Territorial Park, Yukon (COSEWIC 2011).

Collared Pikas may be present along the first 36 kilometres of the all season access road from the mine site where suitable talus slopes may occur. An additional two kilometres of the all season access road within the Nahanni Range, is proposed in the forested valley bottom (less than 600 m elevation) and likely outside suitable Collared Pika habitat. Collared Pikas were unreported during the Prairie Creek Mine and access road studies and camp observation logs. However in July 2012, 12 Collared Pikas were recorded incidentally immediately near the all season access road and reported in Environment and Natural Resources' (ENR's) Wildlife Management Information System (WMIS) (ENR 2014a). Pikas were observed and/or heard in talus between Phase 1 KP 15 to 22.

4.2.2 Boreal Woodland Caribou (*Rangifer tarandus caribou*)

Table 4-3: Boreal Woodland Caribou at a Glance

Boreal Woodland Caribou	
NWT Population Summary	
Conservation Status	Listed as Threatened under the NWT (2014) and federal (2003) SARAs
Trend	Declining in the Dehcho
Size	Estimated 2,318 caribou in the Dehcho North and Southwest portions (Species at Risk Committee 2012)
Sensitivities and Threats	Habitat loss and changes resulting from forest fires and human developments that may increase access and hunting success of predators and hunters, and sensory disturbances
Health, Parasites, and Contaminants	A number of parasites known to occur (Johnson et al. 2010). Contaminant levels typical for large mammals and representative of natural background conditions (Deh Cho First Nations ND)
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 2 (approximately from KP 125 to the Liard Highway; total of 25 km before joining with the Nahanni Access Road) (Species at Risk Committee 2012)
Seasons of Use	All seasons
Key Habitats	Strongly associated with upland and lowlands with black spruce and lichens (Species at Risk Committee 2012)
Existing Harvest Pressure	Low. Hunted opportunistically for subsistence use, particularly in the winter (Species at Risk Committee 2012)
Traditional Knowledge	
▪ The population west of the Liard River to the mountains considered low abundance but stable (i.e., generally west of the Nahanni Range) (Species at Risk Committee 2012). Whereas the population east of the Liard River to Trout Lake is considered high abundance and stable (i.e., generally east of the Nahanni Range) (Species at Risk Committee 2012). ▪ Animals generally healthy, and disease and parasites not considered a major threat to the population (Species at Risk Committee 2012). ▪ Very sensitive to human noises and disturbances, but are thought to adapt a certain extent to only some disturbance types (Species at Risk Committee 2012).	

Habitat fragmentation and degradation of the boreal forests across Canada have led to declining Boreal Woodland Caribou populations. In the NWT, their overall range has remained relatively intact; however, their populations are protected as a Threatened species under both the territorial and federal SARAs because of their small population size and the expected threat to their habitat (e.g., forest fires and human development).

The Boreal Woodland Caribou population estimated in the Dehcho was reportedly in decline from 2005 to 2010, with the adult female annual survival rate ranging from 62 to 93% (Larter and Allaire 2010). Current population estimates are unknown; however, the Species at Risk Committee (2012) estimated caribou densities in the Dehcho north and southwest were approximately 2 caribou per 100 km^2, and therefore, deriving a population of 2,318 caribou across the 115,888 km^2 area.

The Status of Boreal Caribou in the NWT (Species at Risk Committee 2012) suggests that the all season access road extends through Boreal Caribou range from approximately KP 125 to 173 (east of the Nahanni Range), along the existing Nahanni Butte road, and Liard Highway (Species at Risk Committee 2012). Golder (2010) also reported that Boreal Woodland Caribou may also occupy the Tetcela River and Fishtrap Creek areas (west of the Nahanni Range), which they access via the Grainger Gap. However, uncertainty exists whether the caribou reported occupying the Tetcela River and Fishtrap Creek areas may instead be Northern Mountain Woodland Caribou ecotype (Section 4.2.3). Traditional knowledge may help to clarify this uncertainty, and indicates that Boreal Woodland and Northern Mountain caribou are known to interact particularly west of the Liard River near Nahanni National Park Reserve (Species at Risk Committee 2012). For the purposes of this report, it is assumed that Boreal Woodland Caribou primarily occur east of the Nahanni Range, but may infrequently occur to the west in the Tetcela River and Fishtrap Creek areas.

Group size and daily movements change seasonally. Boreal Caribou live in small groups during much of the year, though group size increases leading up to the rut (rut occurring mid-September to mid-October) and is the highest in March and April (Larter and Allaire 2010). Pregnant females become solitary and disperse from the group to calve; possibly only rejoining another female during post-calving (Larter and Allaire 2010) to minimize predation risk to their calf. Boreal Woodland Caribou are non-migratory, but they do make seasonal movements to exploit best available habitats in response to plant phenology and weather. Movement is most reduced the week or two after calving and in mid-winter (February) (Larter and Allaire 2010), but increases in late summer and fall. Routes of travel include areas with hard ground and adequate cover. These may include high ridges, large river drainages, seismic lines, and snowmobile tracks (Species at Risk Committee 2012).

Individual caribou occupy their home range year round, with the location and size of home ranges being dependent on the distribution and relative availability of high quality habitat, primarily upland and lowland black spruce and lichen dominated habitats (Gunn et al. 2004).

In the Dehcho, collared female Boreal Woodland Caribou occupy home ranges averaging 2,824 km^2 (Larter and Allaire 2010). At individual and population levels, Boreal Woodland Caribou require large expanses of suitable habitat with specific habitat features to support key life requirements (e.g., calving, predator avoidance).

To determine the integrity of existing Boreal Woodland Caribou habitat, the Deh Cho Land Use Planning Committee (ND) completed a minimum patch size analysis, and indicated habitat along the proposed all season road meets the species minimum habitat patch size requirements (>515 ha) and represents core Boreal Woodland Caribou habitat. The density of linear corridors (including the existing Prairie Creek winter road) surrounding the proposed all season road is low, ranging from <0.6 km/km^2 along the Phase 1 section and majority of the Phase 2 section, and a high of 0.6-1.0 km/km^2 in isolated locations along Phase 2, primarily as a result of seismic activity (Deh Cho Land Use Planning Committee ND).

This linear corridor density is below the Dehcho Land Use Planning Committee's (ND) Cautionary Threshold (1.0 km/km^2), which represents the lowest threshold at which development, upon reaching the Cautionary Threshold, should be required to monitor impacts. The majority of lands within the Dehcho also fall below this Cautionary Threshold with a few exceptions including the Cameron Hills and Fort Liard areas (Deh Cho Land Use Planning Committee ND).

Across the larger Dehcho region, the Species at Risk Committee (2012) analyzed the degree of habitat fragmentation using known forest fires (1965-2010) and development activity (e.g., seismic lines, existing roads including the Prairie Creek winter road). Results indicate that 13.8% of Boreal Woodland Caribou range across the Dehcho-South study area remains as unburned habitat patches greater than 500 km^2 in size and beyond 500 m from human disturbances (i.e., the most valuable Boreal Caribou habitat) (Species at Risk Committee 2012). This large undisturbed area (500 km^2), is considered the minimum size required for Boreal Caribou to effectively reduce risk of predation (Species at Risk Committee 2012).

Caribou are particularly sensitive to disturbance during calving, post-calving, and winter periods. On average, female caribou in the Dehcho calve on or around May 15 (but may range from April 30 to June 6) (Larter and Allaire 2010; Species at Risk Committee 2012). During the calving season, females seek secluded habitats that are difficult for predators to access, and include large wetlands and marshes, islands in lakes, high ridges, and burn areas (Species at Risk Committee 2012). In all seasons, Boreal Woodland Caribou are often associated with lichen-rich mature or old growth black and white spruce forests (greater than 100 years old) present within bogs and along lakes and rivers (Gunn et al. 2004; Species at Risk Committee 2012).

In winter, Boreal Woodland Caribou tend to favour uplands of forested rolling hills, bogs, and south facing slopes where the snow is not too deep. Their winter diet consists of up to 80% ground and tree lichens. In summer, they may also occupy forest edges, marshes, burn areas, and meadows on higher ground that provide the fresh green growth of flowering plants and grasses (Species at Risk Committee 2012). In the fall, caribou tend to also occupy higher elevations.

Field observations of caribou (ecotype not classified) occurring throughout the Mackenzie Mountains and east along the proposed all season road have been summarized and reported in Golder 2010 and 2014 (Appendix B). During these studies, few caribou were documented east of the Nahanni Range in the winter and summer (assumed to represent Boreal Woodland Caribou's primary range, as reported by the Species at Risk Committee [2012]); however, caribou tracks and some visual sightings of caribou were also recorded in the Tetcela River and Sundog Creek valleys in the winter (Golder 2010; 2014).

Golder (2014) estimated the area of caribou occupancy during the 2010-2011 and 2014 winters along the all season access road. During the 2010-2011 winter studies, caribou occupancy was estimated to be lowest (less than 20%) from the TTF to the Liard Highway (approximately 100 km to the Liard Highway or 54% of the entire road length) and the highest (80-100%) occupancy from the mine site to KP 18 as well as near the Ram Plateau and Sundog Creek (total 52 km). The remaining sections of the all season access road (Phase 1 sections within the Mackenzie Mountains) were estimated to have moderately-low to moderately-high caribou winter occupancy (21-79%) (Golder 2014b). In contrast, during the 2014 winter, the area of caribou occupancy was estimated to be low (less than 20%) from approximately KP 8 to the Liard Highway, representing 96% of the entire all season access road (Golder 2014b). These results may indicate annual variation in overwintering caribou along the access road.

During the field surveys, caribou were most commonly observed in the Mackenzie Mountains (e.g., Prairie and Vera creek valleys), and likely represent Northern Mountain Woodland Caribou (Section 4.2.3). Caribou observed in the Tetcela River and Sundog Creek valleys may have been boreal woodland and/or northern mountain woodland caribou.

To date, little is known about the occurrence and frequency of disease and parasites within Boreal Caribou. Johnson et al. (2010) have begun testing boreal caribou occurring in the Dehcho and reported all 104 adult female caribou

appeared healthy when examined in the field. Based on the analysis of blood and fecal samples, evidence of ten disease agents were detected, including *Trypanosoma* species, Trichostrongyle-type ova, and *Bovine herpesvirus* 1 at a prevalence of approximately 72, 62, and 38% respectively, of the samples tested. Evidence of these disease agents have also been previously reported in woodland caribou and/or other wild ungulates in Canada and Alaska.

Heavy metals, organochlorines (OC's), and polycyclic aromatic hydrocarbons (PAH's) were measured in key traditional foods across the North. The Deh Cho First Nations (ND) report that caribou kidney and livers collected from the Yukon have the highest levels of naturally occurring cadmium; however, these levels remain safe for human consumption.

Across the Dehcho, some harvests are believed to be unreported, but with this in mind, boreal woodland caribou harvest levels are estimated to range from 100–150 a year (Species at Risk Committee 2012). In the study area, incidental resident harvest for subsistence predominates, with the majority of all harvests occurring in the winter (Species at Risk Committee 2012). A total of 1070 Boreal Caribou harvest sites within living memory (spanning approximately 60 years) from residents of Nahanni Butte and other Dehcho communities were identified and mapped (Gunn et al. 2004).

Based on fixed kernel analysis of these lifetime harvest sites, the larger proportion of Boreal Caribou harvesting occurs around Trout Lake, Kakisa and Tathlina lakes, and Fort Simpson, with a small harvesting area north of Liard River near Nahanni Butte and the southern portion of the proposed all season access road (Gunn et al. 2004).

Currently NWT residents and non-residents are permitted to harvest one caribou annually from the Dehcho and the Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitter zones.

4.2.3 Northern Mountain Woodland Caribou (*Rangifer tarandus caribou*)

Table 4-4: Northern Mountain Woodland Caribou at a Glance

Northern Mountain Woodland Caribou	
NWT Population Summary	
Conservation Status	Listed as Special Concern under SARA (2005), but assessed as Secure under the NWT General Status Rank
Trend	The Nahanni Complex and Redstone herds believed to be stable throughout their range (ENR 2014b)
Size	Nahanni complex estimated at 3,000 animals, and Redstone herd estimated at 10,000 (ENR 2014b)
Sensitivities and Threats	Hunting and industrial disturbances. Increased access resulting in increased hunting pressure and predation risk.
Health, Parasites, and Contaminants	Contaminant levels below human and animal health concern (Larter et al. ND). Most of the metals analyzed were found in concentrations similar or lower than Barren-ground Caribou, Reindeer, and/or other mountain ungulates (Larter et al. ND).
Relationship with the Prairie Creek All Season Road	
Expected Presence	Entire Prairie Creek Mine and the all season access road outside the defined species range; however, Northern Mountain woodland caribou may occasionally occur between the Mackenzie Mountains and the Nahanni Range
Seasons of Use	Possibly year round, but infrequent
Key Habitats	Alpine and subalpine plateaus, and open conifer forests found in valley bottoms, lower slopes, and boreal forest zone
Existing Harvest Pressure	Moderate
Traditional Knowledge	
▪ First Nations have reported declining caribou numbers in the mountains (Parks Canada et al. 2009)	

The Northern Mountain Woodland Caribou range has remained relatively intact due to its innate remoteness. Although, threats of habitat modifications and loss from human developments are increasing. As a result, the Northern Mountain Caribou is listed as Special Concern under SARA and assessed as Secure in the NWT.

The Prairie Creek Mine and the all season access road are located outside of the defined range of Northern Mountain Caribou (ENR 2014c); however, a few caribou have been observed near the Mine and access road route in the spring, summer, and winter (CZN 2010; Golder 2010). ENR (2014) explained that “trace occurrences” of Northern Mountain Caribou are known in the area east of the Mine site to the Nahanni Range. However, it is not clear which mountain herd(s) occupy this zone.

The Nahanni Complex (consisting of the Lower Nahanni, La Biche, and Coal River herd) and Redstone herds are closest to the Prairie Creek mine and all season access road route (CZN 2010). Based on the Management Plan for Northern Mountain Caribou (Environment Canada 2012b), the Coal River and possibly the La Biche herds overwinter primarily within NNPR, with the Prairie Creek Mine located at the most north easterly edge of their annual ranges; however, the Redstone herd may be the most likely caribou herd occurring near the Prairie Creek Mine.

The Nahanni Complex group are estimated to total 3,000 animals (ENR 2014c). Of the three herds, the Coal River herd occupies the largest annual range, covering approximately 30,000 km^2 (with just over half of their range extending into the Yukon) (Weaver 2008; Gullickson and Manseau 2000). In general, the annual range of collared females from the Nahanni Complex extend primarily south of the Prairie Creek Mine and south and west into the Yukon; however, a few individuals may winter near the Prairie Creek Mine site (Weaver 2008). They are known to spend their calving, summer, and fall periods in the south-east corner of Yukon, and after rut, migrate north and east into the Northwest Territories to spend the winter primarily within the original boundaries of the NNPR and further south into the expanded park zone (Weaver 2008).

The Redstone herd is one of the largest Northern Mountain Caribou herds in the NWT, estimated at 10,000 animals, and covers an annual range of nearly 90,000 km^2 (includes the Dehcho, Sahtu, and Gwich’in regions) (Weaver 2006; ENR 2014c). Recent evidence seems to suggest the Redstone herd is divided into two sub-herds, the Moose Horn River sub-herd ranging the furthest south and likely occurring near the all season access road (Creighton 2006). The Redstone herd occupies range further north and west of the Prairie Creek Mine and all season access road in the Dehcho and Sahtu regions. Their calving and summer periods are spent in the Mackenzie Mountains near the NWT and Yukon border at the headwaters of the South Nahanni watershed, and move down into the boreal forest of the Sahtu regions in the winter. With exceptions, in the fall and winter, some move further south into the Dehcho region and overwinter in the South Nahanni River watershed (north of Virginia Falls) (Weaver 2006).

These caribou herds have an annual range that straddles the Northwest Territories and Yukon, and are migratory; moving in elevation and between summer and winter ranges seasonally. They summer primarily in alpine and subalpine areas, exploiting alpine plateaus for forage and insect avoidance (1,200-1,600 m elevations) (Weaver 2006; Creighton 2006). Calving primarily occurs in the Yukon or near the Yukon/NWT border, where between the last week of May and the first week of June (May 26-June 5), gravid cows disperse to known plateaus and upland sites to calve (Weaver 2008). In particular, the Moose Horn River sub-herd primarily calves near Moose Ponds, in the headwaters of the South Nahanni, Caribou Cry, and Keel rivers (Creighton 2006).

In the winter, the Nahanni Complex herd move to lower elevations in the subalpine (400-900 m elevations) and the Redstone herd (Moose Horn River sub-herd) moves further into river valleys in the boreal forest zone (600-1,700 m elevations) where snow depths are lower and snow is softer (Weaver 2008; Creighton 2006). However, in years with low snowfall, caribou may remain in upper subalpine and alpine areas (1,250 – 1,400 m elevation) (Weaver 2008). On the spring migration to calving ranges, the Moose Horn River sub-herd follow major river

valleys, such as the Ravens Throat, Silverberry, and Keel rivers (Creighton 2006), but this varies depending on winter distribution and in some years, may include the Tetcela River valley.

Weaver (2008) identified preferred seasonal habitat based on collared caribou locations. These include:

- Winter (early and late): subalpine and montane open conifer forests found in valley bottoms and lower slopes;
- calving: open and closed conifer habitats near the timberline adjacent to and also within rock outcrops and alpine meadows;
- summer: rock outcrops and snowfields, low shrub, and herb dominated alpine tundra habitats;
- rut: montane plateaus near low shrub and open conifer habitats (often on or near their summer range); and
- migration: major river valleys either following the river courses or along the higher elevation valleys.

Between these elevation and seasonal range migrations, Weaver (2008) found a strong pattern of fidelity to spring migration routes, calving sites, and summer ranges; moderate fidelity to rutting areas; and weaker fidelity to winter ranges and fall migration routes. Calving and the late winter seasons are the most sensitive periods of time when caribou may be occasionally interact with the all season road.

Winter Mine site and access road surveys in January and March 1981 found only one group of 5 caribou to the west of the Mine site (CZN 2010). This is a relatively small number, suggesting the area is not part of the “core” winter range (CZN 2010; Beak 1981). By June 9 and 10, 1981, 19 groups of 74 caribou (including calves) were observed in high elevation habitats (ranging from 1,112 to 1,585 m), and by mid-July, two caribou were observed at 1,370 and 1,555 m; all June and July observations were within 16 km of the Prairie Creek Mine and/or its access road (Beak 1981). Similarly, a few caribou (total of 14 observations of 28 adult females, bulls, and calves, plus a single observation of large group consisting of 25-35 animals) have been reported infrequently in the camp wildlife logs (2001-2008) in June, July, and August (Golder 2010). June 1 was the earliest report of a calf observed within the camp log (Golder 2010). The June observations of females with calves confirm that calving may infrequently occur in the area; however, based on the timing of known calving season (May 26-June 5), the calves observed may have already been a week or two old.

Forty-three caribou were also observed within the first 26 km of the all season access road and documented in ENR’s WMIS (ENR 2014a). These observations consisted of eleven separate groups detected in June and July. The group size ranged from 1 to 12 (ENR 2014a).

Caribou occupancy modeling was completed in 2014 to determine the distribution of caribou along the access road route during the non-winter period (Golder 2014b). Using a ground-based caribou sign survey and occupancy model, caribou were predicted to most likely occur in elevated terrain within the Mackenzie Mountains near the Mine site, the lower Sundog Creek drainage, west of the Ram Plateau, and the Silent Hills (Golder 2014b). The remaining sections of the access road displayed a low probability (0.00 – 0.20) of caribou occurrence (Golder 2014b).

A few Northern Mountain Caribou may be expected to occasionally occur near the all season access road year round; however, are uncommon in the winter. Caribou at and near the Prairie Creek Mine site (including near the access road from KP 0-36) may be part of the Nahanni Complex (particularly the Coal River herd), and/or the Redstone herd (i.e., Moose Horn River sub-herd), and/or a local population (Golder 2010). Caribou observed east of the Mackenzie Mountains to the Nahanni Range, along the access road from KP 36-125, are likely from the Redstone herd or are Boreal Woodland caribou.

NWT residents and non-residents are permitted to harvest one caribou annually from the Dehcho and the Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitter zones. ENR (2014) report that an average of 159 Northern Mountain Caribou are harvested by non-resident hunters per year throughout the entire Mackenzie Mountains (total of eight outfitter zones). Since 1965, the average annual harvest of mountain caribou by non-resident harvesters has risen from 44 (from 1965 to1968) to 171 (from 1991 to 1997) (Veitch et al. 2000). After Dall's Sheep, Mountain Woodland Caribou are the second-most sought after species in the Mackenzie Mountains by non-resident harvesters (Veitch et al. 2000). The number of Northern Mountain Caribou harvested each year by residents of Nahanni Butte or the Dehcho region are unknown.

Northern Mountain Caribou harvested from the Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitter zones were found to have metal and radionuclide contaminant levels below human and animal health concern (Larter et al. ND). Although metal and radionuclide concentrations were found in caribou kidney and/or muscle tissue, the levels were similar or lower than Barren-ground Caribou, Reindeer, and/or other mountain ungulates (e.g., sheep, goats) except for cadmium and mercury (Larter et al. ND). Cadmium levels found in caribou kidney tissue was significantly lower than compared to moose inhabiting the southern Mackenzie Mountains.

4.2.4 Mountain Goat (*Oreamnos americanus*)

Table 4-5: Mountain Goat at a Glance

Mountain Goat	
NWT Population Summary	
Conservation Status	Not Assessed by COSEWIC, but ranked as May Be At Risk in the NWT
Trend	Stable
Size	Estimated 351-424 within the Nahanni Butte (D/OT/02) outfitter zone and 70-80 inside NNPR (Veitch et al. 2002)
Sensitivities and Threats	Availability of winter forage, human disturbance
Health, Parasites, and Contaminants	Generally healthy, some metal concentrations in muscles and kidneys, and *Trichinella* species not found in tests (Larter and McDonald 2014)
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 12 to 42 and Phase 2 KP 123 to 160
Seasons of Use	All seasons
Key Habitats	High alpine precipice cliffs
Existing Harvest Pressure	Low
Traditional Knowledge	
▪ No known reports	

In the NWT, Mountain Goats are ranked as May Be At Risk since they exist as a disjunct population, which amplifies their sensitivity to natural and human disturbances. In the Nahanni Butte (D/OT/02) outfitter zone, which includes the all season access road route, the Mountain Goat population is estimated at 351-424 (ENR 2014b). Similarly, in the Flat River area within the NNPR, the Mountain Goat population was estimated at 429 in 2004 (Larter 2004). In 1981, an estimated 70-80 goats occurred within the original boundaries of NNPR (Veitch et al. 2002).

The Ragged Range near the Yukon border is considered core Mountain Goat range; however, smaller discontinuous, occupied areas exist along the South Nahanni River (Wilson and Haas 2012). Near the Prairie Creek Mine and its access road, Mountain Goat range exists primarily along the Nahanni Range, as well as further north onto the Ram Plateau and south onto the Headless Range. Along the all season access road,

Mountain Goats may be expected to occur from approximately Phase 1 KP 12 to 42 and Phase 2 KP 123 to the Liard River crossing. Mountain Goats were not observed during any Prairie Creek Mine and access road surveys, including on the Nahanni Range (Beak 1981; RES 1994; CNZ 2006; Chillborne 2007; EBA 2009; EBA 2010; Golder 2010; Golder 2014).

Mountain goats prefer areas above timberline in subalpine and alpine zones with exposed rock faces comprising of cliffs, ledges, pinnacles, and talus slopes. Mountain goats do not migrate; they maintain the same ranges throughout the year but undertake seasonal movements in elevation (Banfield 1974). In the winter, they move to lower elevations to less steep terrain that provides both available forage and rock faces, which they use as escape terrain to avoid predation (Rideout and Hoffman 1975). Highest wind exposed ridges may also be favoured seasonally, as wind action exposes their winter forage items. In the spring and summer, they gradually move to higher elevations to areas with steep cliff faces and available forage that includes grasses, sedges, rushes, conifers, and forbs (Yukon Government 2014).

Proximity to escape terrain remains important during all seasons, especially in May and June when kids are born. Landscape features such as caves and large rock overhangs are particularly important during the kidding season (Yukon Government 2014) to provide shelter and additional protection from predators. Although little is known about dispersal, it is thought to occur infrequently in late summer by juvenile males (and even fewer females), which have been reported to travel up to 93 km to occupy new range; sometimes even traveling through coniferous forest away from escape terrain (Mountain Goat Management Team 2010).

Adult males disperse across their range, often observed alone or in pairs in the spring and summer. Females occur in small groups of two to four individuals (Rideout and Hoffman 1975). Goats begin to congregate for the rut (November and December), and may be seen in larger groups throughout the winter (Government of Yukon 2014; Rideout and Hoffman 1975). Although the size of annual home ranges are unknown in the NWT, in Montana the average home range was 21.5 km^2, 24.0 km^2, and 48.3 km^2 for adult males, females, and yearlings, respectively (Rideout and Hoffman 1975).

Goats may be seen in larger groups at salt licks, an important habitat for which they may travel several kilometres in the spring and summer to reach (Rideout and Hoffman 1975). Several known mineral licks occur within approximately 10 km of Mountain Goat range near the Prairie Creek Mine and its access road. These licks occur near the Liard River at the southern tip of the Nahanni Range, surrounding Nahanni Butte, the community's access road, and along the Liard Highway (nearest to approximately Phase 2 KP 151 south) (Wilson and Haas 2012; ENR 2014a).

There are no known records of subsistence harvesting of Mountain Goats in the Dehcho, Sahtu, or Gwich'in regions (including within the NNPR) (Veitch et al. 2002); hunting is being conducted solely by a few resident and non-resident harvesters (Veitch et al. 2002; Larter 2012).

Of the five outfitting zones known to include Mountain Goats, only two, the Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitter zones account for 74% of the total harvest (Veitch et al. 2002). Over a period of 20 years (1981-2001), residents harvested 25 goats (Veitch et al. 2002). Most current harvest data from 2002-2010 indicates an average annual harvest increased to 13 adults (range of 5 to 21 goats a year) (Larter 2012). In 2004, Larter (2004) indicated the existing levels of harvesting (1-4 adults a year) likely do not affect the current population.

Kidney and muscle tissues from 17 Mountain Goat harvested from the Nahanni Butte and South Nahanni outfitting zones have been analyzed for metals. Concentrations of select metals, including cadmium were elevated, but cadmium concentrations were substantially lower than found in Moose, which has resulted in a

health advisory (Larter and McDonald 2014). No evidence of *Trichinella* spp. was found (Larter and McDonald 2014).

4.2.5 Wood Bison (*Bison bison athabascae*)

Table 4-6: Wood Bison at a Glance

Wood Bison	
NWT Population Summary	
Conservation Status	Listed as Threatened under the SARA (2003) and ranked At Risk in the NWT
Trend	Slowly increasing (ENR 2010)
Size	In 2004, the Nahanni herd estimated at 400 animals (ENR 2010)
Sensitivities and Threats	Disease, collisions with motor vehicles, and drowning
Health, Parasites, and Contaminants	Believed to be free of bovine tuberculosis and bovine brucellosis, and no anthrax outbreak has been recorded (ENR 2010)
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 2 from approximately KP 140 to along the Liard Highway
Seasons of Use	All seasons
Key Habitats	Liard River and its tributaries, meadows, and oxbows with sedges and horsetails
Existing Harvest Pressure	Negligible to low
Traditional Knowledge	
▪ Some communities no longer recognize bison as part of their heritage, due to the long ago absence of wood bison in the NWT (ENR 2010). Re-introduced herds allow for cultural and spiritual reconnection (ENR 2010).	

Historically, Wood Bison ranged throughout most of the boreal regions of western Canada, including the Dehcho and specifically the Nahanni Butte areas. Due to overharvesting and a period of severe winters, Wood Bison were thought to be extinct until a residual population of approximately 200 Wood Bison (believed to have not hybridized with Plains Bison) were discovered remaining in Wood Buffalo National Park, NWT in 1957 (Parks Canada 1984). Today, Wood Bison are listed as Threatened under SARA (2003) and ranked as At Risk in the NWT.

Wood Bison present along the all season access road route are part of the Nahanni herd, which were re-introduced near Nahanni Butte over a span of 18 years (1980, 1989, and 1998) as part of a re-introduction program into their former range. During this time, approximately 100 Wood Bison were re-introduced. By 2004, the Nahanni herd was last estimated at 400 animals, and their population is considered to be slowing increasing (ENR 2010; Larter and Allaire 2007).

Wood Bison undertake seasonal movements to best utilize differing habitats and food resources. However, their annual distribution largely remains within the Liard River valley, and are seldom observed in the Nahanni National Park Reserve (Parks Canada et al. 2009). Their range extends on both sides of the Liard River, from the Blackstone River (approximately 25 km east of Nahanni Butte) south into northern British Columbia (Golder 2010). Project-related activities may encounter Wood Bison year round in the Phase 2 development from approximately KP 140 to the Nahanni Butte access road (total of approximately 35 km) and beyond along the Liard Highway to Fort Liard.

Golder (2010; 2014) summarized bison observations reported during the Prairie Creek Mine and access road surveys. Bison were yet to be introduced to the area by the time of Beak's early 1980 surveys; however, since then, four bison were observed at the airstrip in Nahanni Butte in June 2006, 13 bison were seen in December

2010, and three bison were seen in February 2011. Bison visual observations and tracks have been reported within 2 km of the Liard and South Nahanni rivers and their oxbows (Golder 2010; 2014).

Wood Bison observations from the Dehcho Nahanni Bison Classification Surveys (1999 to present) and incidental observations have also been reported in ENR's WMIS (ENR 2014a). A total of 440 bison (including calves) documented in the WMIS were concentrated along the Liard River, at the community of Nahanni Butte, and the oxbows and tributaries towards the Liard Highway (ENR 2014a) (Phase 1 KP 156 to 184.5).

Wood Bison are grazers, and rely heavily on sedges and horsetail that grow in meadow openings, particularly in the winter. In summer, bison can be found in small willow pastures, wetlands, and uplands where they feed on sedges, grasses, forbs, and willow leaves and twigs. In the fall, they can be found in forests and in winter, bison move to graminoid fens and lakeshores where they feed on sedges.

Larter and Allaire (2007) indicate that the Nahanni herd is known to commonly swim across the Liard River to access important habitat on either side of the river. Although animals may cross the Liard River anywhere within the herds range, crossings are known at Swan Point (approximately 6 km downstream from the proposed access road barge crossing) and Muskeg and Kotaneelee rivers (at least 130 km upstream from the access road barge crossing). While crossing, a few bison are known to drown annually during spring break up and peak discharge from the mountains (Larter and Allaire 2007).

The Government of the Northwest Territories maintains an extensive program to prevent bison from diseased herds interacting with those considered disease-free. The Nahanni herd is thought to be healthy, and free of bovine tuberculosis (*Mycobacterium bovis*), brucellosis (*Brucella abortis*), and Johne's disease (*Mycobacterium avium paratuberculosis*) (Larter and Allaire 2007). Similarly, no anthrax (*Bacillus anthracis*) outbreak has been reported within this herd (EBR 2010).

Wood Bison are known to be attracted to and become habituated to roadways, traffic, and human activities. The all season access road may provide bison with palatable forage along the roadway side slopes, easier travel with long sightlines to see approaching predators, and suitable habitat to avoid biting insects. Bison are known to occupy habitats on and near the Liard Highway, which places them at risk of vehicle-collisions. Bison-vehicle collisions have been reported on the Liard Highway, particularly where known bison trails converge onto the Highway between Flett Crossing and Muskeg River (highway section between Nahanni Butte and Fort Liard) (Wildlife Collision Prevention Program 2014). Since 2000, a total of 12 bison from the Nahanni herd have been reportedly involved in vehicle collisions, with most collisions occurring from August to October (associated with the rut season) (Larter and Allaire 2007; Wildlife Collision Prevention Program 2014). Of these 12 reported collisions, local residents were most commonly involved than compared to commercial and tourist traffic (Wildlife Collision Prevention Program 2014).

Residents of Nahanni Butte and Fort Liard have each been allowed a single Wood Bison harvest per year since 1998. Since this time, Larter and Allaire (2007) have reported only two bison being harvested. This seems to indicate bison harvest has not been an important component of today's subsistence harvest from these two communities. However, the current NWT Hunting Guide now permits NWT residents to harvest Wood Bison from this herd via a tag quota for one male bison to be hunted from July 1 to June 30.

4.2.6 Grizzly Bear (*Ursus arctos*)

Table 4-7: Grizzly Bear at a Glance

Grizzly Bear	
NWT Population Summary	
Conservation Status	Assessed as Special Concern by COSEWIC (2012) and ranked as Sensitive in the NWT
Trend	Stable within the NNPR (Parks Canada et al. 2009)
Size	Estimated 665 Grizzly Bears in NNPR (Parks Canada et al. 2009), and 10 individual Grizzly Bears in the Prairie Creek drainage and adjacent Mackenzie Mountains (Weaver 2006)
Sensitivities and Threats	Human developments and activities, hunting
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Predominantly in Phase 1 from KP 0-70, with low expected presence the remainder of the road
Seasons of Use	Year round, as denning habitat may exist in the Prairie Creek drainage (Golder 2010)
Key Habitats	High elevation valleys associated with subalpine and alpine habitat types
Existing Harvest Pressure	Low to negligible
Traditional Knowledge	
▪ There used to be more Grizzly Bears at the eastern portion of the South Nahanni Watershed and near Nahanni Butte (Parks Canada et al. 2009).	

The current distributions of Grizzly Bears have significantly contracted from their historical range in southern and western Canada; however, they are reportedly expanding in the NWT, Nunavut, Saskatchewan, and Manitoba (COSEWIC 2012a). They are considered highly sensitive to human disturbances, and risk higher rates of mortality near roads and human developments. Consequently, Grizzly Bears were assessed by COSEWIC as Special Concern (2012) and ranked as Sensitive in the NWT.

The majority of the Grizzly Bears occupying the NWT occur in the Mackenzie Mountains (ENR 2014b). Within Nahanni National Park, their population is considered stable and, in 2009, estimated at 665 individuals (Parks Canada et al. 2009). Weaver (2006) suggested 500 Grizzly Bears in this population is needed to maintain a viable population. Within the Greater Nahanni Ecosystem, Grizzly Bear occurrence was reportedly higher in mountainous habitats, such as Prairie Creek, than compared to the boreal forested zone (Weaver 2006). Those individual bears detected within the boreal forest zone were usually associated with mountainous terrain (Weaver 2006), possibly indicating that the boreal forest zone may represent the periphery of individual home ranges that are less frequently occupied. Home range sizes are negatively correlated to habitat quality. Weaver (2006) estimated the average male Grizzly Bear range may encompass as much as 2,147 km^2, a home range much larger than estimated Grizzly Bear range sizes in the Yukon (COSEWIC 2012a).

In the Mackenzie Mountains, Grizzly Bears are active from approximately mid-April to late October. Grizzly Bear habitat use outside of the denning season is complex and a function of many factors including plant phenology (as plants make up about 90% of their diet), prey availability and distribution, and human presence (ENR 2014d). Miller et al. (1982) reported Grizzly Bears in the Mackenzie Mountains select for alpine habitats in June and July (likely in response to availability of food sources), subalpine habitats in August, both alpine and subalpine habitats equally in September, and higher elevation habitat types as winter approached. Similarly, Weaver (2006) documented Grizzly Bears in the Greater Nahanni Watershed most commonly occur in high elevation valleys associated with subalpine and alpine habitat types in June. Less commonly, Grizzly Bears occupy spruce-lichen woodland or pine-aspen habitat types at the lower elevation boreal forests (Weaver 2006).

Dens are located predominantly on southeast facing slopes in alpine habitat between 1,400 to 1,800 m in elevation; however, a few dens are reported in subalpine habitat, and even fewer in white spruce forest habitat (Miller et al. 1982). Golder (2010) indicated potential denning areas may occur on the eastern slope of the Mackenzie Mountains. Pregnant females give birth to cubs in February while hibernating.

Grizzly Bear densities were predicted by Weaver (2006) across the Greater Nahanni Ecosystem, including the entirety of Phase 1 of the all season access road. These modeling results indicate that Grizzly Bear densities are predicted to be high to very high (22 to 28 bears per 1,000 km^2) at the Mine to approximately KP 39, moderate to low (17 to 10 bears per 1,000 km^2) from approximately KP 39 to 70, and consistently low for the remainder of their study area through the boreal forest zone (Weaver 2006). The areas of high to moderate densities reported by Weaver (2006) also correlate with the Important Wildlife Area designated for Grizzly Bears in the Greater Nahanni Ecosystem (Wilson and Haas 2012). Of particular importance, the area north and northwest of the original NNPR boundaries (and north of the Prairie Creek Mine and proposed all season road) has the largest expanse of high to very high predicted Grizzly Bear densities, and Weaver (2006) concluded this area is particularly important for a viable grizzly population. Based on Weaver's (2006) predicted bear density map, the all season access road from KP 0 to 39 bisects a potential bear movement corridor from the South Nahanni River to this more northern area.

Grizzly Bears can be expected to occur throughout the length of the all season access road; however, are most common in Phase 1 from KP 0 to 70. Considering known den site elevation preferences, denning may occur near KP 0 to 40. Grizzly Bears are considered infrequent visitors to the remainder of the road, including the entire Phase 2 development. However, a single Grizzly Bear has been documented in the Nahanni Range, near the Grainger Gap (Phase 2 KP 125) (ENR 2014a).

As reported by Golder (2010), Grizzly Bears have been infrequently observed during the wildlife surveys, with observations restricted to five visual observations (including a sow with two cubs) and sign including bear diggings, feeding logs, tracks, and scat. Anecdotal information from the camp observation logs suggest that a number of lone Grizzly Bears move through the Prairie Creek valley each spring and summer (May to August), along with occasional family groups (sow and cubs) (CZN 2010). Observations were mostly in the immediate Mine site area, the airstrip, and the road in between (CZN 2010). Information from Canadian Zinc is that Grizzly Bears numbering up to 5-6 per annum are commonly seen moving up the Prairie Creek valley in the spring, and down the valley in the summer. Groups are usually a single male or a sow with one or two cubs. The same groups have been seen infrequently in the Sundog Creek drainage as far east as Cat Camp.

In the Mackenzie Mountains, non-resident hunting of Grizzly Bears has been prohibited since 1982; however, NWT residents may harvest one adult Grizzly Bear (not accompanied by a cub or in a den) from August 15 to October 31. First Nations subsistence hunts are permitted year round. The reported Grizzly Bear harvests from the Mackenzie Mountains occur primarily in the Gwich'in and Inuvialuit Settlement areas (COSEWIC 2012a). From 2001 to 2010, an average of 42.4 Grizzly Bears are killed in the NWT annually, of which, 69% are hunted (49.6% subsistence hunts), 30% are killed for defense of life or property, and less than 1% are killed because of an accident, vehicle-collision, or research-related (COSEWIC 2012a).

4.2.7 Wolverine (*Gulo gulo*)

Table 4-8: Wolverine at a Glance

Wolverine	
NWT Population Summary	
Conservation Status	Assessed as Special Concern by COSEWIC (2003) and ranked as Sensitive in the NWT
Trend	Stable in the NWT
Size	Approximately 3,500-7,300 across the NWT; no data for the Dehcho
Sensitivities and Threats	Overharvesting, habitat loss and fragmentation, and a decline in prey populations
Health, Parasites, and Contaminants	No baseline conditions known for the Dehcho; however, parasitic trematodes, cestodes, and nematodes documented in the NWT
Relationship with the Prairie Creek All Season Road	
Expected Presence	All of Phases 1 and 2
Seasons of Use	All seasons
Key Habitats	Wherever existing prey species exist
Existing Harvest Pressure	Low
Traditional Knowledge	
▪ Wolverine populations vary in space and time (COSEWIC 2014)	

Wolverines are assessed as Special Concern by COSEWIC (2003) and ranked as Sensitive in the NWT, due to their low resiliency to human-caused effects, their innate low reproductive rates, and requirement for expansive home ranges. The Wolverine population size in the NWT is estimated approximately 3,500-7,300 (COSEWIC 2014). Although the population size is relatively unknown, their population is considered stable (COSEWIC 2014).

Wolverines remain solitary and require an expansive home range; living at low population densities even under optimal conditions (Banci 1994). Across North America, northern mountain populations, such as Kluane Wildlife Sanctuary in the Yukon, have the highest densities (maximum of 10 Wolverines per 1,000 km2) (COSEWIC 2014). It has been suggested an area as large as 20,000 km2 may be required to maintain a stable Wolverine population (to appreciate the size, the expanded boundary of the NNPR now covers 30,000 km2) (COSEWIC 2014).

Wolverines occupy a variety of habitats within the boreal forest and Mackenzie Mountains year-round. Home ranges and habitat selection varies between sexes. In northern British Columbia, home ranges were up to 405 km^2 for females, 1,366 km^2 for males, and 4,600 km^2 for sub-adults (Hatler et al. 2008 in Golder 2010). With male home ranges generally overlapping with several females. Based on these large home ranges, the all season access road may directly interact with approximately 16 females, 8 males, and 5 sub-adults from the Mine site to the Nahanni Access road (KP 0-174.5).

Habitat selection is directly associated with food abundance, predation risk (especially for females with kits), and level of human disturbances (COSEWIC 2014). In mountainous regions, females appear to select higher elevations and steeper terrain, whereas, males and sub-adults more commonly occupy lower elevation forests, particularly in the winter (COSEWIC 2014). Wolverine habitat is present throughout the geographic scope of the all season road (entirety of Phases 1 and 2) wherever abundant food resources exist.

Wolverines are generalists; they scavenge on carrion and prey on birds and small and large mammals and forage on plant materials. The presence of large prey, such as ungulates, at least at some time during the year, appears to be important for the persistence of Wolverine populations. On the tundra, Wolverine densities reportedly decline in direct association with caribou populations (COSEWIC 214).

During the Prairie Creek Mine and access road surveys, Wolverine observations were uncommon (Golder 2010). A single Wolverine was reported in July 1980 in alpine tundra habitat and tracks were seen in December 2010 and February 2011 near the Tetcela River (approximately 25 km north of the all season access road) (Golder 2010; 2014). Mine site personnel reported seeing Wolverines infrequently from 1968 to 1980 (Golder 2010).

Although active year round, Wolverines construct snow dens to escape predators, cache food, and raise their young. Natal dens are generally associated with large boulders in talus slopes, downed logs in avalanche chutes, and/or persistent snow banks that remain into late spring (e.g., ravines and leeward slopes, COSEWIC 2014). Kits (young) are born in February or March within this natal den. Within the boreal zone, natal dens have also been documented in abandoned beaver lodges and bear dens, in upturned roots and fallen logs, or rock crevices (Banci 1994). Fidelity to den sites or denning areas is observed in some females (COSEWIC 2014). An accumulation of persistent snow may also be important for food caching to protect against other scavengers, insects, and decomposition (COSEWIC 2014). Food caching is considered important for continued persistence during low prey densities. Natal denning and food caches are more likely within the mountainous regions of the Phase 1 all season access road from KP 0-40.

Although considered healthy, Wolverines in the NWT are known to host several parasites including trematodes, cestodes, and nematodes (COSEWIC 2014).

Besides being a species with special conservation status, Wolverines are also an important furbearer for local communities throughout the NWT. The majority of Wolverines, approximately 70%, in the territories are hunted from snowmobiles during winter (Mulders 1999). Harvests are typically centred near the communities and where road access is available.

4.2.8 Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Western Long-eared Myotis (*Myotis evotis*)

Table 4-9: Little Brown Myotis, Northern Myotis, and Western Long-eared Myotis at a Glance

Little Brown Myotis, Northern Myotis, and Western Long-eared Myotis	
NWT Population Summary	
Conservation Status	Little Brown Myotis and Northern Myotis listed as Endangered by SARA (2014) and ranked as May Be At Risk in the NWT. Western Long-eared Myotis is Not Assessed by COSEWIC, but ranked as May Be At Risk in the NWT
Trend	Population trend unknown in the NWT
Size	Population size unknown in the NWT
Sensitivities and Threats	Habitat loss, white-nose syndrome fungus, over-wintering habitat
Health, Parasites, and Contaminants	White-nose syndrome fungus unreported in the NWT
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 40-86 and the entire Phase 2 (KP 86 to the Liard Highway)
Seasons of Use	All seasons
Key Habitats	Karst terrain for overwintering
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

After unprecedented rates of population decline due to white-nose syndrome (*Pseudogymnoascus destructans*, a fungal disease which arrived in the United States in 2006 and Canada in 2010) across eastern Canada and the United States, Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*Myotis septentrionalis*) are listed as Endangered by SARA (2014) and ranked as May Be At Risk in the NWT. To date, COSEWIC has yet to assess the Western Long-eared Myotis (*Myotis evotis*), but it is ranked as May Be At Risk in the NWT. Although white-nose syndrome has yet to be reported west of Ontario in Canada it is estimated to be spreading 200 to 400 km a year, and has the potential to reach the NWT in 12 to 18 years (ENR 2014b; COSEWIC 2013a)

COSEWIC (2013) identified limiting bat habitat includes foraging areas, maternity roosts, and overwintering hibernacula. Foraging areas are common within the Dehcho and along the all season access road. Northern Myotis and Western Long-eared Myotis are reliant on forested habitats and forest clearings, including trails, and the Little Brown Myotis favours open habitats, particularly aquatic environments. Both species will forage across a variety of habitat types, wherever an abundance of insects exist.

During the day, bats roost in trees, tree cavities, rock crevices, buildings, and bridges; at night they feed on insects. Between night feeding bouts, bats return to temporary night roosts. Wildlife trees, specifically those with rot damage, cavities, or loose bark, are important roosting habitat. Bats are known to use these wildlife trees for maternity colonies, as well as day and night roosts. These wildlife trees are most commonly present in mature forest stands likely occurring in the dense mixedwood habitats. Summer foraging habitat is common throughout their NWT range.

In the spring, females occupy maternity roosts, sometimes in large colonies, under bridges, in buildings, rock crevices, tree cavities in large-diameter trees, or even in large clumps of tree lichens (COSEWIC 2013a). These maternity roosts are reused each year.

The Little Brown Myotis and the Northern Myotis are likely year round residents and overwinter in colonies where suitable habitat exists. There is no current evidence to suggest the Western Long-eared Myotis overwinters in the NWT. Bats across Canada may begin their state of hibernation (more specifically torpor) in late September to October, and arouse in late April to early June (COSEWIC 2013a). Although specific periods of hibernation are unknown in the NWT, it is anticipated that it extends from late September to early June, in direct association with insect availability.

Suitable hibernacula in the NWT may be limited, restricting their northern distribution; however, may be common in the NNPR. Hibernacula are critical habitats, and are reused annually (COSEWIC 2013a). In the area of the all season access road, caves and rock crevices have the most potential as hibernacula, possibly occurring in the karst terrain between KP 60-64. The all season access road (following the permitted winter road (EA0809-002)) has been re-routed from the original 1980s winter road route to avoid potential disturbances to these sinkholes and poljes and fragmentation of habitats in between. However, not all potential hibernacula habitat (e.g., caves, rock crevices) are suitable for over-wintering bats (COSEWIC 2013a). Overwintering occupancy is influenced by site-specific conditions including the temperature and temperature stability, humidity, running water, cave and opening sizes, and length and angle of tunnels (COSEWIC 2013a).

To date, only a single hibernaculum is known in the South Slave Region of the NWT (COSEWIC 2013a; ENR 2014b). The location is confidential and not publically available.

Lausen (2006) completed mist-net and ultrasound detector system surveys from July 16-31 and August 3-5, 2006 in the South Nahanni River watershed, which included surveys in the karst terrain near the all season access road (near Phase 1 KP 56 to 59). During these surveys, both the Little Brown Myotis and Northern Myotis were detected; however, there were fewer bat captures in the karst area near the access road than compared to lower elevations in the NNPR. Lausen (2006) concluded that the karst terrain near the access road did not appear to

provide highly favourable summer roosting habitat (at least for females) due to its higher elevation and cooler night temperatures, but more suitable habitat was present along the South Nahanni River. Little Brown Myotis and Northern Myotis were most common, and a single Western Long-eared Myotis was detected within the NNPR during these surveys (Lausen 2006).

Although this survey provided confirmation of these three bat species occurring in the karst area (near KP 56 to 59) and/or in the NNPR during the summer, it remains unknown whether these bat species overwinter (Lausen 2006). There are no observation records of bats during the Prairie Creek Mine and access road studies and from the camp observation logs.

While overwintering, bats are not sensitive to disturbances except if occurring directly at or within the hibernacula (COSEWIC 2013a).

4.2.9 Harlequin Duck (*Histrionicus histrionicus*)

Table 4-10: Harlequin Duck at a Glance

Harlequin Duck	
NWT Population Summary	
Conservation Status	Ranked as May Be At Risk in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Human disturbance and habitat loss
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 37-41
Seasons of Use	Late spring to early fall
Key Habitats	Fast-flowing turbulent rivers and streams in the forested zone
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Harlequin Duck populations show signs of recovery across their range; however, their populations May Be At Risk in the NWT with an estimated population size in the low 100s. Human-related disturbances and habitat loss are potential threats to their population. Harlequin Ducks are sensitive to human-related effects. Alteration of habitat, nest site disturbances, and contamination altering aquatic invertebrate abundance potentially threaten breeding populations (Kneteman et al. 2010; COSEWIC 2013b).

In the forested zone, swift-flowing streams, particularly those with braided channels provide nesting habitat. Harlequin Ducks nest on or near the ground, preferring stream channel islands or stream banks (generally within 5 m) with suitable protective cover (e.g., shrubs, fallen logs). Nest site fidelity is expected (Robertson and Goudie 1999). They may also occupy lakes downstream from the nest site, and moult in large groups away from the nesting site (Robertson and Goudie 1999).

In Alberta, Harlequin Ducks arrive in late April or early May and depart by mid-September (Kneteman et al. 2010). Inside NNPR, Harlequin Ducks have been recorded along the South Nahanni River, its southern tributaries, and nearby lakes. Based on these records, Harlequin Ducks are present from at least early May to the end of August

(Sullivan et al. 2009). Harlequin Ducks observed at Rabbitkettle Lake is the nearest known observation to the Prairie Creek Mine, approximately 135 km (Sullivan et al. 2009).

The fast-flowing Sundog Creek tributary along the proposed all season access road from Phase 1 KP 37 to 41 may provide suitable Harlequin Duck habitat, although Canadian Zinc report no sightings of ducks of any kind in Sundog Creek, and note that KP 37 to 41 is often dry in the summer and fall, apart from a few ribbons and deep pools.

4.2.10 Horned Grebe (*Podiceps auritus*)

Table 4-11: Horned Grebe at a Glance

Horned Grebe	
NWT Population Summary	
Conservation Status	Assessed as Special Concern by COSEWIC (2009) and ranked as Sensitive in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Habitat loss and alteration
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 40-86 and Phase 2 KP 86 to the Liard Highway
Seasons of Use	Late spring, summer, and early fall
Key Habitats	Small sized waterbodies with high cover of emergent and submergent vegetation
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Horned Grebes have been assessed by COSEWIC as Special Concern (2009), and ranked as Sensitive in the NWT. The Horned Grebe population is stable in the Yellowknife area, and is presumed to be stable throughout its range in the NWT (Fournier and Hines 1999; ENR 2014b). In the Yellowknife area, Horned Grebes were found in higher densities along Highway 3 as a direct result of the large number of small man-made (borrow pits) and natural ponds in the area (Fournier and Hines 1999).

Horned Grebes arrive in the NWT in May and depart by mid-August to early September (Environment Canada 2014). Within their breeding range, Horned Grebes occupy small ponds, wetlands, shallow lakeshores, and other natural or human-made permanent or semi-permanent waterbodies, wherever their main foods (aquatic insects, fish, frogs, and crustaceans) are abundant. Favourable breeding ponds include areas of open water for feeding and sufficient cover of emergent (e.g., cattails and sedge) and submergent vegetation to provide nesting substrate (Fournier and Hines 1999). Horned Grebes are most sensitive during nesting.

In late July and August, adults leave their pre-fledged young at the breeding ponds and reside at larger waterbodies (waterbodies greater than 15 ha in size and depths greater than 1 m) to molt immediately prior to fall migration. During molt, Horned Grebes experience a flightless period and may form large post-breeding aggregations during this sensitive time (Fournier and Hines 1999; Stout and Cook 2003).

Grebes have the potential to occur wherever suitable habitat exists along the all season access road in Phase 1 from KP 40-86 and in Phase 2 from KP 86 to the Liard Highway. Horned Grebe's were not observed during any of the wildlife and wetland surveys completed for Prairie Creek mine and its winter road; however, an unidentified

grebe was recorded at an identified wetland along the access road route in 1980 (KPA 1980 in Golder 2010). Parks Canada (1984) reported Horned Grebes were uncommon breeders in the NNPR; however, observation records exist along the South Nahanni and Liard rivers; none known along or within many kilometres from the all season access road (Sullivan et al. 2009).

4.2.11 Peregrine Falcon (*Falco peregrinus anatum*)

Table 4-12: Peregrine Falcon at a Glance

Peregrine Falcon	
NWT Population Summary	
Conservation Status	Listed as Special Concern under the SARA (2012) and ranked Sensitive in the NWT
Trend	Stable
Size	Greater than 1000 known breeders in the NWT; population in the Dehcho or near the Prairie Creek mine unknown
Sensitivities and Threats	Limited threats within the NWT
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Potential nesting habitat within 1.5 km from Phase 1 KP 56-59 and Phase 2 KP 125-127, 129-130, 136-137, and 157-159; but entire all season access road for hunting
Seasons of Use	Late spring, summer, early fall
Key Habitats	Nesting cliffs near water and preferably 50 to 200 m in height
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

The Peregrine Falcon population has nearly recovered following the ban of organochlorine pesticide use and re-introduction programs across Canada. However, they remain listed as Special Concern under the SARA, and are ranked as Sensitive in the NWT.

In the NWT, the *anatum* subspecies range extends along the South Nahanni River (and area) within the NNPR boundaries and along the Mackenzie River valley (Environment Canada et al. 2014), and may be expected to occur along the all season access road. Peregrine Falcons may occur along the all season access road from mid-May to late August.

Peregrine Falcons require suitable nesting habitat and a larger hunting home range from which they return to in successive years. Peregrine Falcons nest on ledges of cliffs, preferably 50 to 200 m in height and commonly near water. Not only is a nest site reused by a territorial pair in successive years, but the same nest site may be reused through successive generations (COSEWIC 2007a). The all season access road route does not meet the necessary habitat requirements for nesting Peregrine Falcons throughout most of its length; however, potential cliff habitat may be provided by the karst features located near KP 56-59 and along Phase 2 of the Nahanni Range.

Their home range from which they hunt can extend up to 27 km from their nest (ENR 2014e). Hunting occurs in open habitats, such as alpine and subalpine tundra, meadows, riparian areas, lakes, and may also include roadways and other man-made disturbance areas. Suitable hunting habitat exists along the length of the access road.

Surveys in 1980, 1981, 1994, 2006, 2007 and 2009 did not result in any observations of Peregrine Falcons (CZN 2010). Parks Canada (1984) reported Peregrine Falcons were rare breeders in the NNPR, and a single nest site was is known along the South Nahanni River (ENR 2014a). A territorial pair, which may be nesting along the lower South Nahanni River, may hunt along the all season access road where suitable habitat exists, as the majority of the road route is within the probable home range.

The sensitivity of Peregrine Falcons to human disturbances and equipment/vehicles is relatively unknown. Overtime, they may show a degree of tolerance to human activities.

4.2.12 Yellow Rail (*Coturnicops noveboracensis*)

Table 4-13: Yellow Rail at a Glance

Yellow Rail	
NWT Population Summary	
Conservation Status	Listed as Special Concern under SARA (2003) and ranked as May Be At Risk in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Habitat loss and alteration
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 2 KP 126 to the Nahanni Access Road (total approximately 49 km) and further to the Liard Highway
Seasons of Use	Late spring, summer, and early fall
Key Habitats	Sedge dominated wetlands and marshes
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Across Canada, much of the Yellow Rail habitat has been altered and lost. Although population estimates are unknown across the majority of their Canadian range, this significant loss of habitat is believed to have affected their population size. Therefore, the Yellow Rail is listed as Special Concern under SARA (2003) and ranked as May Be At Risk in the NWT. The all season access road is located at the extreme northern limit of their range. Based on their known distribution in the NWT (Environment Canada et al. 2014) and their preferred habitat requirements, the potential to occur along the all season access road is restricted primarily east of Nahanni Range and along the Liard Highway, wherever site specific habitat conditions exists. The Phase 1 portion of the all season access road is located outside its known range. However, Environment Canada et al. (2014) report that the presence of Yellow Rails has not been confirmed at other suitable habitats outside existing range boundaries.

Yellow Rails arrive in the NWT in early May to breed and, during this time, are sensitive to disturbances particularly from human activities and changes in water levels. Nests are constructed on the ground, concealed with sedge and grasses. Yellow Rails may return to the same breeding site for several years; however, fluctuating water levels are thought to influence annual nest site selection (Bazin and Baldwin 2007). Yellow Rails begin their southern migration in late September to early October.

Preferred feeding and nesting habitats are sedge and rush dominated wetlands with low tree/shrub cover and shallow water depths (ranging from moist substrate to 12 cm water). In shallow water and along muddy

shorelines, they feed on freshwater snails, aquatic and terrestrial insects, and seeds. Suitable habitat is restricted to small isolated shrub and herb wetland land cover types present along the all season access road from approximately KP 126 to the Liard Highway. Although outside the known Yellow Rail range, sedge meadows also form inside the poljes nearest to Phase 1 KP 56 to 59 during low water years, and have the potential to irregularly provide Yellow Rail habitat.

There are no known records of Yellow Rail observations at the Prairie Creek Mine or its access road. Parks Canada (1984) reported Yellow Rails as not occurring inside the NNPR (Parks Canada 1984). Similarly, there are no reported Yellow Rails on eBird Canada within the NNPR or the entire Dehcho region (Sullivan et al. 2009).

4.2.13 Short-eared Owl (*Asio flammeus*)

Table 4-14: Short-eared Owl at a Glance

Short-eared Owl	
NWT Population Summary	
Conservation Status	Listed as Special Concern under SARA (2012) and ranked as Sensitive in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Limited threats in the NWT. Sensitive to disturbance during nesting
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 (approximately KP 0-70) and Phase 2 (approximately KP 125-130)
Seasons of Use	Spring, summer, and fall
Key Habitats	Large open areas of alpine tundra, low shrub and herb bogs, marshes, and other non-forested areas
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Short-eared Owls are listed as Special Concern under SARA and ranked as Sensitive in the NWT, due to habitat loss and degradation on its wintering grounds (primarily in the United States) and a progressive decline in habitat on its breeding range (within Canada).

Little is known about Short-eared Owls in the NWT. Much like elsewhere in the species range, their populations in the NWT fluctuate annually in size and distribution in direct association with small mammal populations (e.g., lemmings, mice, shrews). Short-eared Owls are nomadic, and arrive in the NWT to breed in April or May and depart by late October (CWS et al. 2014). While here, Short-eared Owls are associated with large open habitats wherever an abundance of small mammals are present, particularly in alpine tundra, bogs, marshes, and other non-forested areas (CWS et al. 2014). Preferred nesting habitat includes expansive areas of open grasslands or low-structured open shrublands that are dominated by grasses or sedges typically less than 50 cm in height.

Based on the existing land cover types, expansive open areas dominated by grasses or sedges occur along the all season access road potentially in low shrub, wetland herb, wetland shrub, and herb land cover classes in isolated patches along Phase 1 from KP 0-40 (approximately) and along Phase 2 from KP 125-130. Short-eared Owls also hunt in open areas such as along roadside ditches, beaver ponds, lakeshores, riparian areas, and

graminoid fens primarily at dawn and dusk. Suitable hunting areas are available throughout the length of the all season access road.

Nests are located on the ground in dry open habitats dominated by grasses or sedges typically less than 50 cm in height, or of sufficient height to conceal an incubating female (Wiggins et al. 2006). Nests may be re-used in consecutive years (Wiggins et al. 2006). Egg laying is initiated by mid-June, and owlets fledge by mid-August. Short-eared Owls are sensitive to disturbance during nesting, and may abandon nests as a result. However, they are known to successfully nest in close proximity to active agricultural activities (COSEWIC 2008).

Short-eared Owls have been observed near Rabbitkettle Lake, inside the original boundaries of NNPR, in early to mid-May and are expected breeding residents (Sullivan et al. 2009; Parks Canada 1984). This owl has not been observed in the Prairie Creek Mine site or along the access road during the field studies (CZN 2010); however, a single observation along the Liard River near Nahanni Butte was listed by Sullivan et al. (2009).

4.2.14 Common Nighthawk (*Chordeiles minor*)

Table 4-15: Common Nighthawk at a Glance

Common Nighthawk	
NWT Population Summary	
Conservation Status	Listed as Threatened under SARA (2010) and ranked as At Risk in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Vehicle collisions, reductions in insect abundance, human activities that increase predator abundance
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 0-8 and 37-86 and entire Phase 2
Seasons of Use	Summer and early fall
Key Habitats	Open forests, forest clearings, recent burns, rock outcrops, and peat bogs
Existing Harvest Pressure	None
Traditional Knowledge	
▪ Trout Lake residents (approximately 125 km southeast of Nahanni Butte) have reported Common Nighthawk numbers have been decreasing in recent years (Parks Canada et al. 2009).	

Across Canada Common Nighthawk populations are declining due to habitat loss and reductions in insect abundance. In the NWT, Common Nighthawks occur at the northern extent of their range. As a result, they have been listed as Threatened under SARA and ranked At Risk in the NWT.

Population estimates within the NWT or in the Dehcho are unknown; however, they are expected summer residents along the all season access road wherever suitable habitat exists. They arrive in the NWT in mid-May to early June, and depart by mid-August to mid-September (CWS et al. 2014). Common Nighthawks nest directly on the ground in a variety of substrates, including sand, gravel, or bare rock, and are sensitive to disturbances while nesting (CWS et al. 2014; COSEWIC 2007b). However, the level of sensitivity to human disturbances is unknown.

They maintain territories, which vary in size depending on habitat suitability and nest site availability (COSEWIC 2007b). Preferred nesting habitat includes: open forests, forest clearings, recent burn areas, rock outcrops, lakeshores,

gravel areas (including gravel quarries, airstrips, and roads), and exposed land (CWS et al. 2014; COSEWIC 2007a). Although Common Nighthawks are known to nest on human developed sites, they tend to prefer natural sites (COSEWIC 2007b). Appropriate nesting habitat is likely common throughout the all season access road route.

Common Nighthawks are aerial insectivores, feeding on flying ants and beetles, and other flying insects primarily at dawn and dusk. Their preferred feeding habitat includes areas with an abundance of insects, including habitats preferred for nesting, as well as wetlands and marshes and open water (including lakes, rivers, and streams). Common Nighthawks will also forage near artificial lights that have attracted insects (CWS et al. 2014).

Suitable nesting and foraging habitat exists primarily within the boreal forest zone and possibly within large montane valleys such as Prairie Creek. Within Phase 1 of the all season access road development, Common Nighthawks may occur from KP 0-8 and KP 37-86. Within Phase 2, they may be expected to occur along its entire length from KP 86 to the Liard Highway.

There is no record of Common Nighthawks being observed in the Prairie Creek Mine area, but there were several observations near ponds along the access road in wetland surveys during the July 1980 studies (CZN 2010). The sightings near ponds along the access road route suggest that Common Nighthawk is a breeding resident (CZN 2010). Suitable habitat occurs in the Prairie Creek valley (open gravel areas, airstrip) and in the open terrain lying between the east slope of the Mackenzie Mountains and the Nahanni Range. As such, habitat for Common Nighthawk is in proximity to the Mine site and portions of the access road. Within the NNPR, Lausen (2006) captured a Common Nighthawk while mist-netting bats, and Parks Canada (1984) reports Common Nighthawks are a common summer breeder in the area.

4.2.15 Olive-sided Flycatcher (*Contopus cooperi*)

Table 4-16: Olive-sided Flycatcher at a Glance

Olive-sided Flycatcher	
NWT Population Summary	
Conservation Status	Listed as Threatened under SARA (2010) and ranked as At Risk in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Limited threats in the NWT
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 0-8 and 37-86 and entire Phase 2
Seasons of Use	Summer
Key Habitats	Open and semi-open habitats and habitat edges
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Olive-sided Flycatcher populations are declining across Canada; however, there is no clear cause for this decline. For this reason, the Olive-sided Flycatcher is legally listed as Threatened under SARA, and ranked At Risk in the NWT. Population estimates within the NWT or in the Dehcho are unknown; however, they are an expected summer resident along the all season access road wherever suitable habitat exists.

Similar to other insectivores, the Olive-sided Flycatcher arrives in the NWT late (late May and early June) and departs early (late July and early August) in response to insect availability (CWS et al. 2014).

Feeding Olive-sided Flycatchers are closely associated with waterbodies that have a high density of insects (e.g., beaver ponds, lake edges, streams), but they also feed in open and semi-open habitats such as natural and man-made habitat edges, open forests, regenerating forests, and wetland edges. Preferred feeding areas include tall prominent trees or snags for perching and from which they pursue flying insects.

Typical Olive-sided Flycatcher nesting habitat includes forest edges with large trees and standing snags (COSEWIC 2007). Nests are typically built in coniferous trees (COSEWIC 2007c). Along the all season access road, Olive-sided Flycatchers may occupy open and sparse coniferous and mixedwood forests, wetlands, shrublands, and habitat edges such as along the road, transfer facility stations, airstrips, and the mine. Olive-sided Flycatchers may be expected to occur in the Phase 1 development from KP 0-8 and 37-86 and the entire Phase 2 portion.

Parks Canada (1984) reported Olive-sided Flycatchers were possible breeders in NNPR, and they have been reported multiple times within the NNPR and along the Liard Highway (Sullivan et al. 2009). No Olive-sided Flycatchers have been reported at the Prairie Creek Mine or along its access road (CZN 2010). Nonetheless, they are expected to occur throughout much of the all season access road route, primarily within the boreal forest zone.

4.2.16 Bank Swallow (*Riparia riparia*) and Barn Swallow (*Hirundo rustica*)

Table 4-17: Bank and Barn Swallow at a Glance

Bank Swallow and Barn Swallow	
NWT Population Summary	
Conservation Status	Bank and Barn swallows assessed as Threatened by COSEWIC (2013 and 2011, respectively) and ranked as Secure and Sensitive in the NWT, respectively
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	None known in the NWT (ENR 2014b)
Health, Parasites, and Contaminants	Nest and body parasites
Relationship with the Prairie Creek All Season Road	
Expected Presence	Entire Phase 1 and 2
Seasons of Use	Spring to Fall
Key Habitats	Open habitats, sheltered vertical substrates and steep banks near water
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

There has been an evident decline in both the Barn and Bank swallow populations across Canada; in the NWT, the Barn Swallow population may be declining even though there are no known threats (ENR 2014b). Consequently, Barn and Bank swallows were assessed by COSEWIC as Threatened and ranked as Sensitive and Secure in the NWT, respectively.

Barn and Bank swallows may migrate together in mixed-flocks. Both are insectivores, and are expected to arrive by mid-May with the abundance of flying insects and depart late summer to early fall (Garrison 1999; Bromley and Trauger ND).

Throughout its Canadian range, Barn Swallows are most associated with human settlements. Barn Swallow preferred habitat includes fields and open meadows, wetlands, and lakes for feeding, buildings and man-made structures (including bridges and buildings) for nesting, and a waterbody near the nest site to supply the required mud for nest building (Brown and Bomberger Brown 1999). Natural nest sites, such as cliffs and caves may also be used, and old nests may be reused the following year. Nest re-use leads to common infections with body parasites such as fleas and blowflies (COSEWIC 2011b). Favoured nesting habitat for the Barn Swallow exists at the Prairie Creek Mine site and outbuildings, possibly within Nahanni Butte and from the park buildings inside the NNPR.

Unlike the Barn Swallow, the Bank Swallow excavates its nest by burrowing in exposed soil banks along eroded watercourses and lakeshores; however, they may also nest in sand and gravel pits/quarries, and road embankments that are situated near feeding habitat (COSEWIC 2013c). They nest primarily in colonies, which can reach as many as thousands of individuals (Garrison 1999). Nests are re-occupied each year, and several flea and blowfly species are known to occur inside the burrows (COSEWIC 2013c). Wetlands, open water, meadows, riparian, and shrublands are preferred feeding habitats (Garrison 1999), and exist throughout the all season access road. Suitable nesting habitat may exist wherever exposed soil banks occur along the creeks and Tetecla River drainages and the east slopes of the Nahanni Range.

Although the all season access road is located within the species' known ranges and suitable nesting habitat exists, only a few Barn Swallows and multiple Bank Swallow observations have been reported along the South Nahanni and Liard rivers (Sullivan et al. 2009). In NNPR, Bank Swallows were considered common breeders (Parks Canada 1984). There have been no recorded observations of swallows during the Prairie Creek Mine and access road studies and from the camp observation logs.

4.2.17 Rusty Blackbird (*Euphagus carolinus*)

Table 4-18: Rusty Blackbird at a Glance

Rusty Blackbird	
NWT Population Summary	
Conservation Status	Listed as Special Concern under SARA (2009) and ranked as Sensitive in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Removal and destruction of nests from buildings, bridges, and quarries, exposure to uncharacteristically cold weather
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Expected Presence	Phase 1 KP 40-86 and all of Phase 2
Seasons of Use	Spring, summer, and fall
Key Habitats	Treed wetlands with open water
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Significant declines in Rusty Blackbird populations have been reported across North America; however, their population size in the NWT is generally unknown. Rusty Blackbirds are listed as Special Concern under SARA (2009) and ranked as Sensitive in the NWT. In the NWT, there is little threat to Rusty Blackbird populations to date, as there is little development and an abundance of suitable habitat.

Rusty Blackbirds can be expected to occur in the Dehcho and along the all season access road from early May to late September. Their occurrence along the all season access road is in direct association with boreal forest wetlands, which are located in low elevations east from the Mackenzie Mountains to the Liard River. Occurrence in habitats at high elevations, such as Phase 1 KP 0-39, is considered uncommon (Environment Canada 2014).

Rusty Blackbirds are most commonly associated with forest edges along natural waterbodies (COSEWIC 2006). They forage on the ground along the edges of these waterbodies (e.g., fens, bogs, beaver ponds, streams, and swampy lake shores) in search for aquatic and terrestrial insects and plant materials (e.g., seeds and fruits). Nests are constructed primarily in conifer and deciduous trees in suitable feeding habitat. Research indicates Rusty Blackbird populations are associated with beaver lodge densities in an area (Avery 1995). The Traditional Knowledge Assessment Report indicated beaver was once commonly harvested along Fishtrap Creek and Tetcela River, therefore, it is assumed these areas also support Rusty Blackbird. Areas with a low beaver lodge density are thought to have a low Rusty Blackbird abundance.

In the NNPR, Parks Canada (1984) reports Rusty Blackbirds are uncommon summer breeders; however, multiple reports of sightings within the Park and a single report in Nahanni Butte have since been reported (Sullivan et al. 2009). Previous field surveys for the Prairie Creek Mine site did not identify Rusty Blackbird as occurring there (CZN 2010). Appropriate Rusty Blackbird habitat along the all season access road occurs primarily in the low elevation boreal forest zone from Phase 1 KP 56-86 and all of Phase 2, wherever suitable habitat exists. Rusty Blackbird habitat is likely common throughout the Dehcho.

4.2.18 Western Toad (*Anaxyrus boreas*)

Table 4-19: Western Toad at a Glance

Western Toad	
NWT Population Summary	
Conservation Status	Assessed as Special Concern by COSEWIC (2012) and ranked as May Be At Risk in the NWT
Trend	Unknown
Size	Unknown. Unconfirmed sighting in NNPR (Parks Canada et al. 2009)
Sensitivities and Threats	Climate variability, disease, and vehicle-collisions
Health, Parasites, and Contaminants	No baseline conditions known to date
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	Phase 2 approximately KP 156 to Nahanni Access Road (total 19 km) and along the Liard Highway
Seasons of Use near the Access Road	All seasons
Key Habitats	Shallow ponds, springs, lake shores, oxbows, road ditches, and wetlands
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

The Western Toad, non-calling population, has declined or is projected to decline across much of its known range (COSEWIC 2012b). In Canada, the Western Toad has been assessed as Special Concern by COSEWIC (2012) and is ranked as May Be At Risk in the NWT. The Western Toad is at its northern most range in the Dehcho region, and its population is considered to be small; however, precise population sizes are unknown as few

surveys have been undertaken in the NWT. Western Toads are inconspicuous most of the year, since they are most active at night (i.e., nocturnal) and, in the NWT, do not call.

Western Toads undertake a spring migration to congregate at communal breeding ponds to reproduce within a 1 to 2 week period. Breeding ponds are used in successive years (COSEWIC 2012b). Only a few suitable breeding habitat sites available may be occupied, due to site fidelity and a communal breeding strategy (COSEWIC 2012b). In August, the newly emerged toadlets migrate away from the breeding pond *en masse.* During this time, they are especially vulnerable to predation and human disturbances such as vehicle traffic (COSEWIC 2012b).

Western Toads use a variety of aquatic and terrestrial habitat types throughout their life history stages including wetlands, shallow sandy margins of ponds, slow moving rivers and backwaters, beaver ponds, borrow pits and road ditches, and springs during breeding. The predominant characteristic of the breeding sites include silty and/or sandy bottom substrates and high water temperatures (COSEWIC 2012b). Western Toads are sensitive to disturbance at breeding, spring migration, and in the egg and tadpole stages. Both the egg masses and tadpoles are particularly vulnerable to predation and habitat changes such as altered water levels and water chemistry.

Wetlands, riparian areas, and upland sites are occupied in summer, sometimes several kilometres from the breeding pond. Throughout the summer, Western Toads may range up to approximately 1.2 km from a waterbody; however, their abundance is greatest in forests less than 100 m from water (COSEWIC 2012b). In the summer, they seek open warm foraging grounds with an abundance of prey such as closed deciduous forests, clearcuts and recent burns, subalpine and alpine meadows, and areas with sufficient overhead cover (e.g., coarse woody debris, boulders, shrubs).

Western Toads hibernate underground below the frost line in small mammal dens, abandoned beaver lodges, muskrat tunnels, red squirrel middens, or burrows dug themselves in or near springs and other waterbodies, and in areas that accumulate snow (COSEWIC 2012b). The use of communal hibernacula are common, particularly those within 2 km of the breeding sites.

Based on the presumed range of Western Toads, suitable year-round habitat may exists at and near the Liard River (Phase 2 KP 156 to the Nahanni Access Road, approximately) and along the Liard Highway. Western Toads have been unreported along the all season access road. However, a single unconfirmed report (considered questionable by Parks Canada (1984)) of toads near the Liard River, approximately 4 km upstream from the proposed barge crossing is acknowledged (ENR 2014a).

4.3 Other Wildlife and Wildlife Habitat Traditionally Harvested

Additional species with Secure and Sensitive populations in the NWT have known distributions along or near the all season access road. The focus of this assessment is the biological status of species or species groups traditionally harvested and those that are of ecological significance.

White-tailed Deer (*Odocoileus virginianus*), Mule Deer (*O. hemionus*), and Elk (*Cervus elaphus*) have been expanding their range north, but are rarely observed in or around NNPR and Nahanni Butte. These species are not discussed further in this document.

The MVEIRB Terms of Reference (TOR) (dated September 12, 2014) identified key objectives to describe wildlife and wildlife habitat baseline conditions relating to the Prairie Creek All season road (EA1415-01):

- Wildlife species presence, distribution, and abundance;
- Seasonal movements, habitat requirements (e.g., breeding, calving, feeding) and sensitive time periods;

- Habitat types including local and regional distribution and abundance;
- Species of importance to subsistence harvesters;
- Habitat or sites of special value or sensitivity, include species use and timing;
- Migratory patterns, routes, and timing in relation to the all season road route alternatives, construction activities;
- Harvest pressures (subsistence, resident, and non-resident harvesting) by species, season, and geographical area;
- Listing and location(s) of existing invasive species;
- Current and historic levels of natural and human-caused fragmentation and connectivity;
- Existing baseline contaminant concentrations in harvested species that may change as a result of the all season road;
- Any known issues with respect to the health of harvested species (e.g., parasites, diseases, condition);
- Use of the project area by resident and migratory birds; and
- Location of known raptor nesting sites or potential raptor nesting habitat within 1 km of the proposed project footprint.

4.3.1 Dall's Sheep (*Ovis dalli dalli*)

Table 4-20: Dall's Sheep at a Glance

Dall's Sheep	
NWT Population Summary	
Conservation Status	Not assessed by COSEWIC, and ranked as Secure in the NWT
Trend	Not Rated within NNPR, but status considered good (Parks Canada et al. 2009). In the NWT, populations likely stable
Size	Estimated at 800-1,200 within the Greater Nahanni Ecosystem (Weaver 2006) and 14,000-26,000 in the Mackenzie Mountains (Veitch 2014)
Sensitivities and Threats	Overharvesting, human disturbances, disease
Health, Parasites, and Contaminants	Generally healthy, but known to host sheep lungworm (*Protostrongylus stilesi*) and the ecthyma virus
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	Phase 1 within the Nahanni Plateau from KP 0-39 and Phase 2 along the Nahanni Range from KP 124-160
Seasons of Use near the Access Road	All seasons
Key Habitats	Alpine and subalpine plateaus, ridges, and mineral licks
Existing Harvest Pressure	Moderate
Traditional Knowledge	
▪ No known reports	

Dall's Sheep populations are ranked as Secure in the NWT. Their populations have been estimated at 14,500 to 26,500 of which 14,000 to 26,000 occur in the Mackenzie Mountains (Veitch 2014). Depending on the quality of habitat, Dall's Sheep densities may range from 20 to 55 sheep per 100 km^2, but are uncommonly over 55 per 100 km^2 (Barichello et al. 1987). Weaver (2006) reported that Dall's Sheep densities within the Greater Nahanni Ecosystem averaged 37 sheep per 100 km^2.

Important Dall's Sheep concentration areas within the Mackenzie Mountains are known to occur along and near the all season access road include the Nahanni Plateau (along Phase 1 KP 0-39), Ram Plateau (Phase 1 KP 61 is the closest point (approximately 4 km) to the Ram Plateau), and the Nahanni Range (Phase 2 KP 124-160). Dall's Sheep commonly spend their entire lives within a single well-defined mountain block or range (Simmons 1982), remaining primarily within the subalpine and alpine zones. Therefore, little dispersal is expected to occur between those potentially occupying the Nahanni Plateau, Ram Plateau, and Nahanni Range. Although infrequent, dispersal to new ranges has been reported, particularly involving young rams, although adult ewes have also been documented dispersing (Simmons 1982).

Outside the rutting period, adult males are often observed alone or in small groups of other males, whereas, ewe groups (including young rams, yearlings, and lambs) commonly occur in larger groups (ENR 2014f). Movements between annual ranges, as well as to mineral licks, are commonly confined to this specific mountain block. Annual movements between these ranges commonly follow the same route. In general, good winter habitat is also good summer habitat, with the winter range simply a contraction of the summer range (Simmons 1982; Beak 1981).

In the summer, Dall's Sheep commonly occupy high alpine meadows, and slowly begin moving to their winter ranges at lower elevations as snow accumulates. Sheep are particularly sensitive on their winter ranges, when suitable food resources are restricted and winter weather influences snow deposition and hardness. Optimum winter habitat includes low plateaus and ridges with shallow or wind swept snow, near timberline where snow crusting is limited, and in areas where forage is most accessible (Simmons 1982). A winter range is commonly utilized each year; however, shifts in winter range are known to occur (Simmons 1982).

Mineral licks are also an important habitat feature, particularly for ewe groups in the spring and early summer, but are regularly visited throughout the snow-free period (Parks Canada 1984). Parks Canada (1984) report Dall's Sheep visits to mineral licks "begin in early June, peaks in July, and ends by October". A high fidelity to mineral licks has been reported, with ewe groups travelling 5 to 20 km from their summer feeding areas to a mineral lick (Simmons 1982; Parks Canada 1984). Particularly, the location of mineral licks are believed to strongly influence the summer distribution of ewes, lambs, and juvenile groups (Parks Canada 1984).

At the Prairie Creek Mine, Beak (1981) reported the presence of a mineral lick below Adit #3 and explained the attraction to possibly rock salt used for melting ice. Near the all season access road, known mineral licks occur primarily along the South Nahanni and Liard rivers, including near the confluence with Prairie Creek (at least 25 km from the all season access road) (Wilson and Haas 2012; Parks Canada 1984). Known mineral licks near the confluence of Prairie Creek and the South Nahanni River are known to be visited by both Dall's sheep and Moose, and are subsequently considered important points of interest for Park visitors (Parks Canada 1984). Dall's Sheep travelling to this Prairie Creek/South Nahanni River mineral lick may move along Prairie Creek.

Another mineral lick is known approximately 11 km north of the all season access road nearest to Phase 1 KP 10, and multiple licks are known near the Liard River crossing and the community of Nahanni Butte (Wilson and Haas 2012; ENR 2014a). Dall's Sheep occurring on the Nahanni Range may occupy mineral licks on the north side of the Liard River, including a moderate and high density mineral lick area approximately 10 km west (nearest point) of the Phase 2 access road, and smaller mineral lick areas near KPs 156-157 (Wilson and Haas, ENR 2014a).

Sheep are grazers and require food supplies that are adjacent to suitable terrain to escape predators. Grasses and sedges compose the majority of their diet, with leaves and stems of some shrubs, forbs, mosses, and lichens selected seasonally. Typically, rugged terrain is occupied to escape from predators, and females will seek isolated high cliffs and ridges to lamb. Lambing occurs in late May to early June, with lambing completed by June 9-10 (Beak 1982 in Golder 2010). Beak (1981) indicated Dall's Sheep observations suggest three possible lambing areas: 1) Folded Mountain within a kilometre from Phase 1 KP 7 of the all season access road; and 2 and 3) peaks immediately east and west of the Mine site airstrip (both within a kilometre of Phase 1 KP 2 and 3). Similarly, the Nahanni Range would provide suitable lambing areas.

As indicated by CZN (2010), Dall's Sheep inhabit the Prairie Creek Mine site area and are regularly observed during the spring and summer around the mine, moving to fall range (including rutting) and winter range to the east of Prairie Creek on the Nahanni Plateau. Sheep, primarily ewes, yearlings and lambs, are common on the east side of the valley above the Mine and Mill site in the spring. Rams appear to be more widely dispersed, including the west side of the Prairie Creek valley. This draw to the Mine site by ewe, lamb, and juvenile groups in the summer may be attributable to possible soda ash near Adit #3, as described by Beak (1981), and to human presence which deters predators.

Surveys indicate sheep occur along the access road from the Mine site throughout the Nahanni Plateau, along Funeral Creek and the pass to Sundog Creek, primarily in the winter, spring, and early summer. On the Nahanni Range, March surveys indicated sheep occurred primarily north of the all season access road at elevations greater than 1,000 m, compared to the road elevation at 500 m (Beak 1981). In June 2006, the largest group of Dall's Sheep were immediately adjacent to the Mine site (Golder 2010).

Based on the camp log records, Dall's Sheep (primarily ewes with lambs, yearlings) are commonly at and near the Mine and Mine site airstrip in June and July, with sheep observations declining into August, September, and October (Golder 2010). Golder (2010) suggests the ewes, yearlings, and lambs may undertake a late-summer dispersal away from areas immediately around the Mine site. Overall, rams appear more widely dispersed away from the Mine site; the nearest known observation location being on the west side of the Prairie Creek valley (Golder 2010).

Threats to Dall's Sheep in the NWT include disease, human disturbance, inability to quickly colonize new areas, and potential over harvest (Barichello et al. 1987; ENR 2014b). Dall's Sheep are moderately resilient to human disturbances if within a continuous population (i.e., the Mackenzie Mountain population); however, they show a low resilience to disturbances if the population is fragmented or isolated from others. Dall's sheep are known to habituate to harmless human activity in routine space and time (Weaver 2006).

Although Dall's Sheep are considered healthy in the NWT, they are known to host sheep lungworm (*Protostrongylus stilesi*), which has been linked to fatal pneumonia outbreaks (ENR 2014f). Similarly, the ecthyma virus, a contagious virus to people and other ungulates including Moose and caribou, have also been reported in the NWT (ENR 2014f).

In the Mackenzie Mountains, non-resident harvesters preferentially seek trophy Dall's Sheep during their hunts from July 15 to October 31. During the 2012 hunting season, a total of 207 rams were harvested by non-resident harvesters; up from the average annual harvest of 197 calculated over the past 22 years (Larter and Allaire 2013). The meat is later distributed to the local communities, including Nahanni Butte. Resident and general hunting licence holders (e.g., First Nations groups) also harvest for subsistence in the Mackenzie Mountains. In the Mackenzie Mountains, resident hunters reportedly harvested 7 rams (Larter and Allaire 2013), and general hunting licence holders are known to harvest approximately 20-30 Dall's Sheep a year.

4.3.2 Moose (*Alces alces*)

Table 4-21: Moose at a Glance

Moose	
NWT Population Summary	
Conservation Status	Secure in the NWT
Trend	Assumed to be Stable (Parks Canada et al. 2009; RWED 2005)
Size	Density estimates range from 0.02-0.07 moose/km^2 around Nahanni Butte and southeast portion of the NNPR (Parks Canada et al. 2009). Also, 0.049 moose/km^2 in the Liard River valley (RWED 2005).
Sensitivities and Threats	Over harvesting, predation, vehicle collisions
Health, Parasites, and Contaminants	Cadmium levels relatively high in Moose kidney and liver tissues taken from the southern Mackenzie Mountains and Liard/Mackenzie river valleys (Larter and Kandola 2010). Ticks are rare. Moose warts (papillomas) and hydatid tapeworm cysts common (RWED 2005).
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	The entire Phase 1 and 2 portions
Seasons of Use near the Access Road	All seasons
Key Habitats	Valleys and riparian areas, mineral licks, semi-open forests, early successional habitats, lakeshores
Existing Harvest Pressure	Moderate
Traditional Knowledge	
▪ Moose are an important game animal in the NNPR (Parks Canada et al. 2009) ▪ Local accounts from the Dehcho region indicate the Moose population has been decreasing in some areas and stable in others (ENR 2014b)	

Moose commonly occur throughout the boreal forest, and their populations are listed as Secure in the Northwest Territories. Based on traditional harvesting areas identified during local consultations, an aerial Moose survey was conducted along the Liard River and uplands in 2004 (RWED 2005) (including Nahanni Butte and the Phase 2 portion of the all season access road east of Nahanni Range). Based on these results, the Moose density was estimated at 0.049 Moose/km² and the population was believed to be stable (RWED 2005). Similarly, the density of Moose around Nahanni Butte and the southeast portion of the NNPR ranged from 0.02-0.07 Moose/km^2 (Parks Canada 2009).

Moose habitat is not considered limiting within the geographic scope of the Prairie Creek all season road. Low elevation habitats such as semi-open forests and habitats with an abundance of willow and other deciduous shrubs close to lakes, inside river valleys and riparian areas, and along lakeshores are favoured by Moose, and common east of Nahanni Plateau. Suitable habitat types include tall and low shrub, wetlands (treed, shrub, and herb), coniferous open, broadleaf open, and mixedwoods. NNPR wardens also observed Moose occupying high elevation subalpine shrublands (a narrow band of shrubs in the transition between subalpine forests to alpine tundra) in the late fall and early winter, and with increasing snow deposition, moved to lower elevations later in the winter (Parks Canada 1984).

Moose are primarily browsers, and browse on willow, young aspen and balsam poplar, Saskatoon, Canada buffalo-berry, rose, and red-osier dogwood. These preferred browse species commonly occur in abundance in semi-open early successional habitats such as floodplains, oxbows, wetlands, regenerating burns, and previously

disturbed areas. Habitats with a high cover of willow and other browse material support Moose throughout the year, especially in the winter, and occur throughout the All season access road route east of Nahanni Plateau (beginning at approximately Phase 1 KP 37) to the Liard Highway.

The use of browse material declines in the spring and summer when forbs, grasses, and aquatic plants are available. Wet and aquatic habitats are common feeding areas during all non-winter months, but tend to peak during late June to early August when plant nutrition and digestibility are highest. In addition, Moose may seek aquatic habitats in the summer to avoid heat stress.

Moose also seek distinct habitats to minimize detection from predators and avoid insect harassment. Dense coniferous forests and tall shrub stands are used to conceal from predators, and open wind exposed ridgelines and aquatic habitats are used to avoid insects. They may also use lake shorelines and islands to reduce encounters with predators, especially during calving.

Gill (1978) recognized mineral licks as critical Moose habitat that are utilized year round, but especially in the winter. Along the Prairie Creek all season access road, known mineral licks occur primarily near the South Nahanni and Liard rivers (Wilson and Haas 2012). Based on known mineral lick locations and/or density map (Wilson and Haas 2012; ENR 2014a), the Phase 1 and 2 road developments may pass as close as:

- 11 km (approximately) south of a single known mineral lick (nearest to Phase 1 KP 10);
- 10 km (approximately) west of moderate and high density mineral lick areas located north of the Liard River (nearest to Phase 2 KP 151);
- 2 km (approximately) of a high density mineral lick area located near the Nahanni Butte airport (nearest to Phase 2 KP 162-164) and a single mineral lick near Phase 2 KP 156); and
- Within a few 100 m from three mineral licks near Phase 2 KP 157, the junction with the Nahanni Access road, and along the Liard Highway (nearest to Phase 2 KP 178-184.5).

Another area of mineral licks occur near the confluence with Prairie Creek and the South Nahanni River, at least 25 km from the all season access road (Parks Canada 1984). These known mineral licks are known to be visited by Moose (Parks Canada 1984), which may access the mineral lick along the South Nahanni River and the Prairie Creek valleys.

Previous field surveys for the Prairie Creek Mine and its access road observed Moose and Moose sign at the Mine site and along most of the length of the access road, albeit more commonly east of the Nahanni Plateau (Golder 2010; 2014b). Presumed Moose high and moderate winter and summer ranges included the area north of Liard River to the Grainger River, the Tetcela River and Fishtrap Creek valleys, and Silent Hills (Beak 1981). However, Moose were occasionally observed in the Mackenzie Mountains, along Prairie Creek and at the Mine site in the spring and summer. Over a seven year period (2001-2007), a total of three adult Moose were reported in the camp observation logs near the Mine and Mine site airstrip (Golder 2010). Movement corridors likely occur along low valleys in the Mackenzie Mountains, along the existing access road, and along major rivers and their larger tributaries.

Moose are assumed to be the preferred subsistence species in the area. Metal concentration analyses were conducted from Moose occurring in the Liard and Mackenzie River valleys and the southern Mackenzie Mountains due to concern of metal contaminants in country foods. The level of cadmium, mercury, and zinc were higher in Moose from the southern Mackenzie Mountains than compared to the Liard/Mackenzie river valleys (Larter and Kandola 2010). However, only cadmium levels in Moose kidney and liver tissue were above levels reported elsewhere and were considered a public health concern (Larter and Kandola 2010). As a result, a public health

advisory is in effect for cadmium levels reported in Moose liver and kidney tissues taken from the southern Mackenzie Mountains and Liard/Mackenzie river valleys (including all portions of the all season road) (Larter and Kandola 2010). Moose have also been found to commonly host Moose warts (papillomas) and hydatid tapeworm cysts, but ticks are rare (RWED 2005).

Traditional harvesting of Moose within the original boundaries of NNPR concentrated along the eastern boundary and into Yohin Lake, and totalled approximately 2 to 12 Moose annually (Parks Canada 1984). No other harvest locations and harvest numbers are known; however, assumed to frequently occur along the Liard River valley and the Liard Highway. NWT residents and non-residents are permitted to harvest one Moose annually from the Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitter zones. Across the Mackenzie Mountains, non-residents harvested a record number (85 Bull Moose) in 2012, the largest known harvest since records began in 1991 (Larter and Allaire 2013). This increased harvest was attributed to outfitter zone (D/OT/01) ownership changes, which prior to 2005, the majority of this outfitter's clientele targeted Dall's sheep, consequently only harvesting 24 Moose a year (Larter and Allaire 2013).

4.3.3 Furbearers

Furbearers are an important economic and cultural resource for many hunters and trappers in the north. Based on available species range maps and previous wildlife field surveys conducted in the Prairie Creek project area, three furbearing species were chosen to represent all furbearers potentially occurring in the area of the all season access road. These include: Grey Wolf (*Canis lupus*), Beaver (*Castor canadensis*), and Marten (*Martes americana*). Wolverines, another important furbearer, also occur along the all season access road and was described in Section 4.2.7.

The habitat requirements and potential distributions of these selected species along the all season access road are considered representative of other furbearers also occurring in the area (e.g., Red Fox *Vulpes vulpes*, Snowshoe Hare *Lepus americanus*, Muskrat *Ondatra zibethicus*, River Otter *Lontra canadensis*, American Mink *Neovison vison*, Canada Lynx *Canadensis*, and weasel species). Although these additional species were not selected for a focused effects assessment, the potential for Project-related effects and applicable Project mitigation to reduce adverse effects are addressed by the selected representative species.

Furbearer distribution and population abundance have not been formally surveyed for the Prairie Creek Mine and its access road; however, they are expected to occur throughout the all season access road route wherever suitable habitat exists.

Table 4-22: Furbearers at a Glance

Furbearers	
NWT Population Summary	
Conservation Status	Grey Wolf, Beaver, and Marten – All Secure in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Over harvesting, habitat loss, human activities
Health, Parasites, and Contaminants	No baseline conditions known for most species. Cadmium levels elevated in Beaver, but at levels suitable for consumption. Beavers in the Dehcho are considered a healthy food (Deh Cho First Nations ND)

Table 4-22: Furbearers at a Glance

Furbearers	
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	Entire Phase 1 and 2
Seasons of Use near the Access Road	Year round
Key Habitats	Various, wherever suitable habitat exists
Existing Harvest Pressure	Low
Traditional Knowledge	
▪ No known reports	

Grey Wolves are hunted and trapped for their fur and are important to the local and regional economies in the north. The Grey Wolf is a habitat generalist, occupying habitats with an abundance of prey. Wolf densities in the Dehcho, particularly areas near Trout and Celebita lakes, are considered to be relatively high (Larter 2004b). Across the boreal forest zone of the NWT, estimates reach as high as one wolf per 101 km^2 (Van Zyll de Jong and Carbyn 2000). An estimated 30 to 75 Grey Wolves were expected to occur in and around NNPR, and were considered widely occurring (Parks Canada 1984). A pack, ranging in size generally from two to sixteen individuals (ENR 2014b), maintains a home territory, which varies in size depending on prey densities. Within this territory, wolves construct dens to raise their pups; the denning period typically beginning by early May. Inside the original boundaries of NNPR, Grey Wolf dens were associated with waterbodies, and an occupied wolf den was once reported near the Prairie Creek-South Nahanni River confluence (Parks Canada 1984). Grey Wolf dens are reused in consecutive years, and wolves at the den site are sensitive to human disturbances.

There have not been any formal Grey Wolf studies conducted for the Prairie Creek Mine and its access road; however, several wolves have been observed incidentally during aerial surveys and in the camp observation logs (Golder 2010). Wolves have been reported at the Prairie Creek Mine and Harrison Creek, near the Mine site airstrip, and along the access road (Golder 2010). During this time, the number of Grey Wolves detected ranged from one to a pack of five (Golder 2010). Grey Wolves are expected to occur throughout the entire Prairie Creek all season access road.

Beavers are a common harvest species in the NWT; they are traditionally harvested for their pelt, hide, and meat. Beavers occur primarily at low elevations, where wetlands, slow moving streams, ponds, and lakes are present. Their distribution and abundance are dependent on habitat quality, and they are sensitive to water level changes, especially in the fall and winter. Based on available habitat along the all season access road, Beaver are assumed to range primarily from Phase 1 KP 64-86 and the entire length of Phase 2. However, their abundance is expected to be higher along the Tetcela River and Fishtrap Creek valleys, and east and west of the Nahanni Range where there are more wetlands, then compared to the mountainous regions.

Low concentrations of cadmium have been documented in the kidney and livers of Beaver collected from the Slave River and Mackenzie deltas (INAC 2004). Cadmium is naturally present across the NWT, and finds its way into the food web from the weathering of rocks and subsequent plant uptake (INAC 2004). Cadmium may also be released into the environment from burning fuels and refuse. Concentrations are low and are not considered harmful to Beavers or to the people eating them.

Marten are expected to occur throughout the forested areas traversed by the all season access road east of the Mackenzie Mountains (Phase 1 KP 64-86 and entire length of Phase 2). They favour mature coniferous forest stands with complex downed and overhead structures; however, all habitats may be occupied if abundant prey and cover exist. Marten were considered common inside the original boundaries of NNPR (Parks Canada 1984).

Marten prefer forests with a high canopy cover, and in general, do not travel across open areas that are 200 m wide or greater (Salmo Consulting Inc. et al. 2004). Marten populations are generally cyclic in response to their dominant prey populations. Like many furbearers, Marten are particularly sensitive to disturbance during their denning period (March or April), when litters are born in dens within rock piles, tree roots, deadfall, or peat banks. Marten are considered to be relatively tolerant to human disturbances and activities, but are vulnerable to overharvest (Salmo Consulting Inc. et al. 2004).

In the NWT, Wolves are classified as both big game and furbearers. All NWT residents are permitted to harvest as many Grey Wolves as they have tags for, and non-residents may hunt within an outfitting zone (ENR 2014b). All residents require a licence to trap.

Non-residents hunting within the Mackenzie Mountains harvest, on average, approximately 15 Grey Wolves a year; however, 24 were harvested in 2012 (the highest recorded harvest since records began in 1991 (Larter and Allaire 2013). Harvesters within these outfitter zones did not harvest Wolverine (Larter and Allaire 2013).

4.3.4 Waterfowl and Trumpeter Swan (*Cygnus buccinators*)

Table 4-23: Waterfowl at a Glance

Waterfowl	
NWT Population Summary	
Conservation Status	All ranked as Secure or Sensitive in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Over harvesting, habitat loss
Health, Parasites, and Contaminants	Contaminant levels depend on the species and migration habits; however, waterfowl in the Dehcho are considered healthy and nutritious (Deh Cho First Nations ND)
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	Entire Phase 1 and 2 with higher densities assumed to occur from Phase 1 KP 62-86 and the entire length of Phase 2 (KP 86 to the Liard Highway)
Seasons of Use near the Access Road	Spring, summer, and fall
Key Habitats	Lakes, ponds, wetlands, rivers, streams, and oxbows
Existing Harvest Pressure	Low
Traditional Knowledge	
▪ No known reports	

In the NWT, flocks of various waterfowl species are frequently observed migrating each spring and summer. Many waterfowl species remain in the Dehcho region and likely along the all season access road route for the purposes of breeding. Some species may only use this area for spring and/or fall staging for a short period of time, before continuing on with their migration, and others may migrate through the area without staging.

Waterfowl select habitats that provide secure nest sites, and safe areas for rearing young and molting adults. Specific nesting habitat requirements vary with species, and can range from tree cavities, mats of vegetation in the water or at the water's edge, and the ground in wooded uplands. Waterfowl have a high fidelity to breeding sites, returning to the same nest site each year in the spring. Within the NWT and the Dehcho, waterfowl generally breed throughout the boreal forest at higher densities than mountain valleys. However, waterfowl can be expected to occur and breed wherever their habitat requirements are met. Consequently, they are expected throughout much of the low lying habitats along all season access road including productive shallow waters of

lakes, ponds, wetlands, rivers, and streams. Although low densities of waterfowl may be expected along Prairie, Sundog, and Funeral creeks (as well as other mountain streams), the Tetcela River and Fishtrap creek valleys (from Phase 1 KP 62-86 and Phase 2 KP 86-97), the wetlands west of the Nahanni Range (Phase 2 KP 103-123), the wetlands east of the Nahanni Range (Phase 2 KP 142-147), and the oxbows and streams from the Liard River to the Liard Highway (Phase 2 KP 156-158 and 161-184) are expected to support higher densities.

During spring and fall migration, waterfowl may occur in higher densities along the all season access road, where suitable habitat exists. The timing of the spring migration for the all season access road is unknown; however, it is assumed to begin by mid to late April and continue until the last week of May (EBA 2003; Latour 2003). Fall migration is more prolonged (ranging from late August and into October) as migrants gradually travel south and peak migration, as seen in the spring, is more relaxed.

Suitable staging habitat is likely restricted to the low elevation habitats along the Tetcela River valley, east of Nahanni Range, and near the Nahanni Access Road and Liard Highway since ice cover likely remains at the Prairie Creek Mine and Nahanni Plateau during spring migration.

Within the NNPR, Yohin and Rabbitkettle lakes are considered important waterfowl breeding habitats (Parks Canada et al. 2009). Yohin Lake, approximately 20 km southwest from the all season access road, supports a small nesting population of Trumpeter Swans (*Cygnus buccinators*). Rabbitkettle Lake, in the Ragged Range near the western edge of NNPR, supports several species of loons and grebes (Parks Canada et al. 2009).

Trumpeter Swans are considered Not At Risk (1996) in Canada and are ranked as Sensitive in the NWT. There are no known threats to their population in the NWT. Favorable habitat for both nesting and foraging includes freshwater marshes and large boreal ponds and lakes. Requirements for nesting habitat include approximately 100 m for take-off from the water, accessible forage, and low human disturbance (Mitchell and Michael 2010). Trumpeter swans that breed in the Greater Nahanni Ecosystem are part of the Rocky Mountain Population known to overwinter in the northwestern USA (Montana, Wyoming, and Idaho). Like many waterfowl species, swans are territorial on their breeding grounds.

In 2005, Trumpeter Swan surveys were conducted across the NNPR and Dehcho Region. In total 415 Trumpeter Swans were detected, including 37 broods (Beyersbergen 2007). During these surveys, Trumpeter Swans were observed throughout the survey area, with the highest concentrations being in the Tetcela River valley and at Yohin Lake (Beyersbergen 2007). During the June 2006 aerial survey along the all season access road, a “few swans” (not recorded to species, but assumed to be a Trumpeter Swan) were observed on ponds nearest to Phase 1 KP 64 (Mosquito Lake) and 75 (Golder 2010).

Threats to waterfowl include potential overhunting and habitat loss.

4.3.5 Raptors

Table 4-24: Raptors at a Glance

Raptors	
NWT Population Summary	
Conservation Status	All ranked as Secure or Sensitive in the NWT
Trend	Population trend unknown in NWT or Dehcho
Size	Population size unknown in NWT or Dehcho
Sensitivities and Threats	Disturbances during the breeding season
Health, Parasites, and Contaminants	No baseline conditions known

Table 4-24: Raptors at a Glance

Raptors	
Relationship with the Prairie Creek All Season Road	
Presence along the All Season Road	Entire Phase 1 and 2
Seasons of Use near the Access Road	All seasons
Key Habitats	All habitat types
Existing Harvest Pressure	None
Traditional Knowledge	
▪ No known reports	

Raptors are a diverse group of species with varying distributions, population densities, habitat requirements, and life histories. As predators, raptors can be expected to occur wherever their prey species occur, including birds, small mammals, young ungulates, and carrion. In a given area, raptor abundances may fluctuate in direct response to their primary prey's distribution and abundance.

Raptors have species-specific habitat requirements. Some raptors are breeding residents to the Prairie Creek Mine and its access road, whereas others may be present as a migrant or a year-round resident (e.g., Gyrfalcon [*Falco rusticolus*]). The distribution and abundance of overwintering raptors, such as Gyrfalcons, are dependent on locally abundant prey such as ptarmigan, grouse, and snowshoe hare.

Raptors can be expected to occur and nest near the entire all season access road route, wherever their habitat requirements are met. Suitable nest sites and food resources are the main factors that naturally limit breeding raptors in an area. Raptors exhibit nest site fidelity, returning to the same nest site each year whether this includes a nest in a tree, on a cliff, on the ground, or a nest previously constructed by another species. It is during the mating and incubation stages that raptors are most susceptible to human disturbances, and may desert a nest as a direct result of human activity.

A single known raptor nest, occupied by a Golden Eagle (*Aquila chrysaetos*) in 2010, was documented approximately 5 km southeast of the Prairie Creek Mine (ENR 2014a). Raptor nests within 1 km of the Prairie Creek Mine and its associated Project footprint are unknown.

Data within ENR's WIMS presents six raptor species nest within the region. Within the original boundaries of NNPR, three Bald Eagle (*Haliaeetus leucocephalus*) nests are known near Yohin Lake, and one Peregrine Falcon, four American Kestrel (*Falco sparverius*), one Red-tailed Hawk (*Buteo jamaicensis*), and one Northern Harrier (*Circus cyaneus*) nests have been documented along or near the South Nahanni River (ENR 2014a). A single Golden Eagle nest was also reported at the western portion of the NNPR (Parks Canada 1984). Peregrine Falcon is discussed in Section 4.2.10.

During the Prairie Creek Mine and access road field surveys, a single Gyrfalcon and several Golden Eagles were reported (Golder 2010). The only observation of a Gyrfalcon was in January near Funeral Creek, and five Golden Eagles were observed in March and July west of the Prairie Creek Mine, near the eastern most edge of the Nahanni Plateau, north of the Grainger Gap, and along the Silent Hills (Beak 1981). An eagle, not identified to species, was also observed in June 2006 (Golder 2010).

4.4 Vegetation

4.4.1 Objectives from the TOR

Consistent with the MVEIRB ToR for the all season road and associated infrastructure, this section serves to provide a description of the existing vegetation resources within the study area (within 50 m of the proposed development – as defined by the MVEIRB), including:

1. vegetation and vegetation assemblages;
2. any classification system followed, as appropriate ;
3. identification of species or assemblages that are rare, valued, protected or designated (e.g., vulnerable, threatened, endangered);
4. location and abundance of rare plants;
5. historic and current human use of vegetation, including subsistence and commercial harvesting, (e.g., berry picking, forestry);
6. existing baseline contaminant concentrations in harvested species or vegetation (e.g., berries) that may change as a result of the all season road and as available;
7. locations and quantities of merchantable timber;
8. listing and location(s) of existing invasive species; and
9. frequency of forest fires and post-fire vegetation succession.

4.4.2 Background Information Sources

The description of vegetation conditions in this report is based primarily on the most currently available Earth Observation for Sustainable Development of Forests (EOSD) vegetation classification descriptions and data, correlated to the extent feasible with the information reported in Golder (2010) and previous studies carried out for the Prairie Creek Mine site area and for the access road. These previous studies include the following:

- Preliminary Environmental Evaluation for Mine, Mill and Camp. May 1980. Report prepared for Cadillac Explorations Limited, Prairie Creek Project, NWT by Ker, Priestman & Associates Ltd., Victoria, BC.
- Preliminary Environmental Evaluation for Winter Access Road. May 1980. Report prepared for Cadillac Explorations Limited, Prairie Creek Project, NWT by Ker, Priestman & Associates Ltd., Victoria, BC.
- Environmental Evaluation for Cadillac Explorations Ltd. Prairie Creek Project, NWT. October 1980. Report prepared for Cadillac Explorations Limited by Ker, Priestman & Associates Ltd. Victoria, BC.
- Prairie Creek Project Vegetation & Wildlife Studies, 1981. Report prepared for Cadillac Explorations Ltd. September 198 by Beak Consultants Limited, Richmond, BC.
- Prairie Creek Project Vegetation and Wildlife Initial Evaluation. December 1994. Report prepared for Rescan Environmental Services Ltd. by Robertson Environmental Services.
- Rare Plant and Wildlife Survey, Prairie Creek Mine Area and Winter Road, NT. Report prepared for Canadian Zinc Corporation by EBA Engineering Consultants Ltd. (EBA). 2010.

- Vegetation and Wildlife Assessment Report, Prairie Creek Mine, Northwest Territories. Report prepared for Canadian Zinc Corporation by Golder Associates Ltd. (Golder). 2010.
- Reclamation assessment, invasive and rare plant survey 2010 Prairie Creek Mine access road, NT. Report prepared for Canadian Zinc Corporation by EBA Engineering Consultants Ltd. (EBA). 2011.
- EOSD Vegetation Classification (25m) data for the NWT. Accessed in November 2014 from http://www.enr.gov.nt.ca/programs/forest-resources/inventory-and-analysis.

4.4.3 Conditions Prior to Site Development

The study area is located primarily within the Taiga Cordillera and Taiga Plains Ecozones of the Northwest Territories and is characterized by several significant topographic features (e.g., Mackenzie Mountains, the Nahanni Ranges and the Liard floodplain) resulting in an array of growing conditions, and consequently, numerous vegetation species assemblages (Ecosystem Classification Group 2007). Wild fires occasionally occur in the region and have influenced forested ecosystems throughout much of the landscape. However, the Prairie Creek watershed had not been influenced by any form of human activity, apart from possible First Nations use such as trapping or hunting parties, prior to mineral exploration (Golder 2010).

Mineral exploration and associated infrastructure, including the existing winter access road has affected a small area of the land base of the Prairie Creek watershed and overall Project area, and apart from local influences, has not affected the physical nature or biological composition of natural plant associations or communities in this watershed or ecosystems adjacent to the existing winter access road.

4.4.4 Vegetation Cover Description

The vegetation units described and summarized below, represent vegetation cover types, based on predominant physical conditions and species composition (also referred to as vegetation or habitat “units”). As previously indicated, Tetra Tech EBA has used the most currently available EOSD vegetation classification descriptions and data and correlated these descriptions to the extent feasible with the information reported in Golder (2010), which was based on Robertson Environmental Service’s (RES) (1994) summary of the earliest studies conducted by Beak (1981, 1982). Relevant information on wildlife use of these habitat units is also provided, as noted during previous investigations of the project area (primarily from Beak [1981]).

4.4.4.1 Previously Mapped Vegetation Cover Units

Detailed vegetation cover mapping prepared as part of vegetation and wildlife studies conducted by Beak for the original 181 km winter access road in 1981 included the delineation of dominant vegetation associations through aerial photograph review and aerial surveys. Vegetation associations identified as part of these surveys were characterized in terms of dominant vegetation species during a field reconnaissance during the same time period. As mapping for the original winter access road was presented at a scale of 1:250,000, the naming convention used by Beak for each map unit reflects the dominant vegetation associations recorded for each unit; however, each map unit generally contains several associated sub-dominant community types, as described by Beak in the 1981 vegetation and wildlife report. Beak community classifications, and an additional community classification described by RES (1994) are described below, as presented in the vegetation and wildlife report prepared for the current winter access road (Golder 2010; pg 6-10).

Spruce/Lichen

This vegetation unit is distributed entirely within the Mackenzie Mountains, extending from the valley floor to the upper slope extensions of relatively stable colluvial slopes. This unit’s approximate elevation range is

975-1280 m above sea level (ASL). Its most conspicuous feature is the cream-coloured ground cover provided by a thick layer of lichen, primarily reindeer lichen (*Cladina stellaris*). Forest cover is variable, depending on aspect and topography, with the greatest tree densities in draws and on south, southwest, and west-facing slopes.

In the Funeral-Sundog Pass area, the spruce/lichen vegetation unit is more sparsely stocked in its tree cover than where it occurs in the Prairie Creek area; this is explained in part by the steep, narrow valley of the Funeral-Sundog Pass area, which influences thermal conditions, plus its greater extent of talus, and hence less total plant cover.

Subalpine Shrub

In the Mackenzie Mountains, this vegetation unit occupies a mid-elevation zone lying between the spruce lichen and alpine tundra vegetation units. Vegetation was sampled from two sites, one in the Prairie Creek drainage and the other in the Funeral-Sundog Pass drainages by Beak (1981). Both sites were characterized by a thin organic layer, a variable shrub cover (10 to 100%) dominated by dwarf birch (*Betula nana*), Labrador tea (*Ledum groenlandicum*), and willow (*Salix glauca*). Herb cover was limited (5-30%), but the ground cover was 60 to 100% and dominated by reindeer lichen at one site, and *Cetraria* and *Alectoria* lichens at the other site (Funeral-Sundog Pass area).

Alpine Tundra

This vegetation unit comprises a substantial area, and provides much of the characteristic features of the Mackenzie Mountains. It comprises all land above tree line, and thus was found to be highly variable in plant cover and type (Beak 1981). Characteristic vegetation, based on greatest coverage, was lichen (*Cetraria nivalis*), mountain-avens (*Dryas integrifolia*), heather (*Cassiope tetregona*), and creeping willow (*Salix nivalis*).

Pine Parkland

A small component of the pine parkland vegetation unit occurs within the Mackenzie Mountain portion of the Prairie Creek Mine site study area (Beak 1981). This unit occurs in a low elevation valley immediately north of the Second Canyon between 425 m and 750 m ASL. Pine parkland was characterized by low tree layer cover (8 to 15%) consisting of jack pine (*Pinus banksiana*), black spruce (*Picea mariana*), white spruce (*Picea glauca*), and willow (*Salix arbusculoides*). The shrub layer (coverage 5 to 45%) was dominated by dwarf birch and Scouler's willow (*Salix scouleriana*) while the herb layer (coverage 15 to 65%) was dominated by bunchberry (*Cornus canadensis*), lingonberry (*Vaccinium vitus-idaea*), and twinflower (*Linnaea borealis*). The ground cover almost complete (100%) with primarily red-stemmed feathermoss (*Pleurozium schreberi*) and *Cladonia* lichens. No vegetation sampling was conducted in this area (Beak 1981).

Black Spruce Parkland

This unit extends from the eastern base of the Mackenzie Mountain ramparts eastward to the eastern edge of the Ram Plateau. In terms of the access road, it starts at KP 32 and extends more or less continuously to KP 64. The elevation range of this vegetation unit is 793 to 915 m ASL (Beak 1981).

Tree cover varies from 5% to 30% and is comprised mostly of black spruce, with patches of white spruce on well drained south aspects. Trees support a rich corticous lichen cover of *Alectoria* and *Pannelia* species. The shrub layer (20 to 45% cover) is primarily composed of dwarf birch and willow (*Salix glauca*). Cover of the herb layer is also moderate (10 to 45%); major species are kinnikinnik (*Arctostaphylos uva-ursi*) along with Labrador tea and blueberry (*Vaccinium* spp.). Ground cover is 100%, and is composed primarily of reindeer lichen and red-stemmed feathermoss (Beak 1981).

Riparian Alluvial

The riparian alluvial unit is essentially sparsely vegetated alluvial streams and rivers of the Ram River system. The braided streams in this unit are relatively wide in places, and on some of the in-stream islands which survive for several years, there may be colonization by willow, mountain avens, and various grasses and sedges.

Mixed Coniferous/Deciduous

The mixed coniferous deciduous vegetation unit covers the low elevations of the Tetcela and Fishtrap Creek drainages from KP 64 to 110 where the access approaches Grainger Pass. This is a post-fire successional forest, estimated to have resulted from a burn occurring between 1940 and 1950. Two subtypes were identified:

- the Tetcela Valley; and
- the Silent Hills (Beak 1981).

The western slopes of the Silent Hills are well drained, and the tree cover estimated at 78%. Of this, 80% was deciduous, primarily trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*), with the remainder (20%) white spruce (Beak 1981).

The Tetcela Valley transect was variable and included elements of black spruce parkland mixed with a dense mixed coniferous-deciduous forest. The vegetation succession appeared to be returning to black spruce parkland. In 1981, tree cover varied from 60 to 100%, and comprised birch, alder (*Alnus crispa*), and Scouler's willow with lesser amounts of black spruce and jack pine. Cover in the lower strata (shrub, herb, and moss layers) was considerably less than the tree cover (Beak 1981). The forest included a significant portion of black spruce snags.

Black Spruce Muskeg

This vegetation unit is distributed in lowland, waterlogged drainages which grade into open wetlands. It occurs in three areas:

- Fishtrap Creek, west of the Silent Hills within an elevation range of 244 to 305 m ASL;
- an eastern tributary of the Tetcela/Ram River system in the valley between the Silent Hills and the Nahanni Range at an elevation of approximately 490 m ASL, and;
- a lowland area west of the Grainger River near its mouth.

A representative habitat sampling site in 1981 was located in the Tetcela drainage and had predominantly shrubs (cover of 35 to 60%), comprised of black spruce and blueberry willow (*Salix myrtillifolia*), Labrador tea and dwarf birch (Beak 1981). Cover in the herb layer was 25 to 50% and comprised mostly of red bearberry (*Arctostaphylos rubra*), grass and Labrador tea. *Dicranum* moss and lichens provided a thick ground cover.

Burn

RES (1994) reported that since the Beak vegetation studies of 1981 and 1982, there had been two burns along the access road. The earliest was situated within black spruce parkland near KP 66, and appeared to be 5 to 10 years old (since 1981/82). No examination of regenerating vegetation was made at that time. The second burn took place in July and August of 1994 and is located immediately east of the Nahanni Range.

Grainger Tillplain

The Grainger tillplain unit is a rolling, drumlinized tillplain with little elevation range (approximately 460 to 670 m ASL) and an absence of forest cover (Beak 1981). The basic site types include depressions and drier meadows. The former are wet sedge meadows dominated by beaked sedge (*Carex rostrata)*. The drier meadows are composed of a shrub layer (80% cover) of dwarf birch, cinquefoil (*Potentilla fruticosa*), Labrador tea and sweet gale (*Myrica gale).* The herb layer is mostly comprised of sedges (*Carex* spp.), red bearberry, and horsetail (*Equisetum* spp.), and the ground cover is *Dicranum* moss. In other areas, there is a taller shrub community of alder, dwarf birch, and willow (*Salix planifolia*), or coniferous thickets of black spruce. RES reported that as of 1994, over 40% of this habitat type occurring along the access road had recently burned.

Floodplain/Tillplain

This is a heterogeneous unit comprising the following subunits: Grainger tillplain, lowland marsh, shrub, and mixed forest in three cover categories: <30%, 30 to 50%, and >50% (Beak 1982). Major tree species in this mosaic include trembling aspen, white spruce, black spruce, paper birch, jack pine and alder. The densest of the mixed forest communities, comprising more than 50% cover, is distributed along parts of the Grainger River (Beak 1982).

Aspen Liard Floodplain

This vegetation type borders the Liard River from KP 151 to 164.5, excluding the Liard River crossing itself. The climax tree species is white spruce, but frequent fires have led to a dis-climax of trembling aspen (Beak 1981). Within the aspen subunit, the canopy was estimated to reach a height of 20 m, with other understory trees between 12 m and 16 m. The shrub layer was predominantly alder and prickly rose (*Rosa acicularis*). There was limited ground cover (5%) owing to a thick layer of deciduous litter.

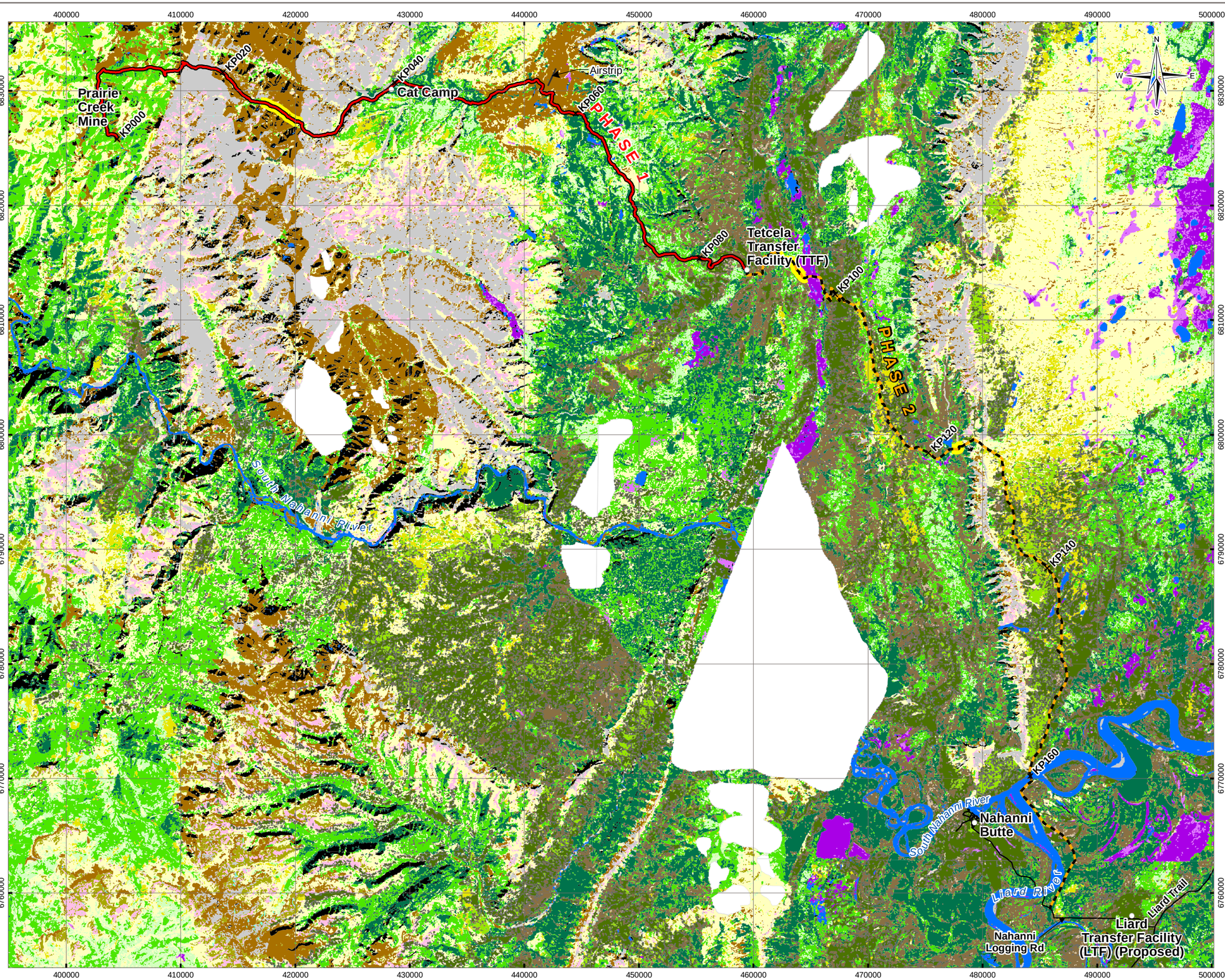
4.4.4.2 Current Earth Observation for Sustainable Development of Forests (EOSD) Cover Units

EOSD is land cover inventory for approximately 80% of the total land area in Canada, derived from Landsat satellite data and represents the highest spatial resolution satellite-derived map for land cover in Canada (25 metre resolution) (Government of Canada 2014). EOSD map units are represented by land cover classes which are categorized based on spectral differentiation of the land surface, including differentiation of vegetation community types based on dominant vegetation structural classes and density.

EOSD mapping of the study area is presented in Figure 2, and includes 20 potential EOSD land cover classes. Descriptions of EOSD land cover (Nelson and Wulder 2003; pg 14-15) classes are presented in Table 4-25.

Table 4-25: EOSD Land Cover Class Descriptions

Cover	Description
No Data	—
Shadow	—
Cloud	—
Snow/Ice Glacier/snow	—
Rock/Rubble	Bedrock, rubble, talus, blockfield, rubbley mine spoils, or lava beds.
Exposed Land	<5% vegetation. River sediments, exposed soils, pond or lake sediments, reservoir margins, beaches, landings, burned areas, road surfaces, mudflat sediments, cutbanks, moraines, gravel pits, tailings, railway surfaces, buildings and parking, or other non-vegetated surfaces.
Water	Lakes, reservoirs, rivers, streams, or salt water.
Shrub – Tall	At least 20% ground cover which is at least one-third shrub. Average shrub height > = to 2 m.
Shrub – Low	At least 20% ground cover which is at least one-third shrub. Average shrub height < 2 m.
Herb	Vascular plant without woody stem (grasses, crops, forbs, gramminoids). Minimum of 20% ground cover **or** one-third of total vegetation must be herb.
Bryoids	Bryophytes (mosses, liverworts, and hornworts) and lichen (foliose or fruticose, not crustose). Minimum of 20% ground cover **or** one-third of total vegetation must be a bryophyte or lichen
Wetland – Treed	Land with a water table near, at, or above the soil surface for enough time to promote wetland or aquatic processes. The majority of vegetation is trees.
Wetland – Shrub	Land with a water table near, at, or above the soil surface for enough time to promote wetland or aquatic processes. The majority of vegetation is low shrub.
Wetland – Herb	Land with a water table near, at, or above the soil surface for enough time to promote wetland or aquatic processes. The majority of vegetation is herb.
Coniferous – Dense	> 60% crown closure. Coniferous trees are 75% or more of total basal area.
Coniferous – Open	26-60% crown closure. Coniferous trees are 75% or more of total basal area.
Coniferous – Sparse	10-25% crown closure. Coniferous trees are 75% or more of total basal area.
Broadleaf – Dense	> 60% crown closure. Broadleaf trees are 75% or more of total basal area.
Broadleaf – Open	26-60% crown closure. Broadleaf trees are 75% or more of total basal area.
Broadleaf – Sparse	10-25% crown closure. Broadleaf trees are 75% or more of total basal area.
Mixed Wood – Dense	> 60% crown closure. Neither coniferous nor broadleaf trees account for 75% or more of total basal area.
Mixed Wood – Open	26-60% crown closure. Neither coniferous nor broadleaf trees account for 75% or more of total basal area.
Mixed Wood – Sparse	10-25% crown closure. Neither coniferous nor broadleaf trees account for 75% or more of total basal area.



LEGEND

Proposed All Season Road

- Phase 1
- Phase 2
- Existing Road
- Proposed All Season Road Realignment
- × All Season Road Kilometre Marker
- Proposed Airstrip

Land Cover Class

- Cloud
- Shadow
- Water
- Snow/Ice
- Rock/Rubble
- Exposed Land
- Bryoids
- Shrub Tall
- Shrub Low
- Wetland - Treed
- Wetland - Shrub
- Wetland - Herb
- Herb
- Coniferous Dense
- Coniferous Open
- Coniferous Sparse
- Broadleaf Dense
- Broadleaf Open
- Mixedwood Dense
- Mixedwood Open

NOTES

Base data source:
Road alignment provided by AllNorth (Jan 22, 2015)
Land Cover, circa 2000-Vector (Natural Resources Canada, accessed through geobase.ca)
Existing roads from CanVec (1:50,000)

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL SEASON ROAD DEVELOPER'S ASSESSMENT REPORT

Land Cover Classification

PROJECTION UTM Zone 10	**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:325,000 (5 2.5 0 5 Kilometres)			TETRA TECH EBA
FILE NO. MIN03058-01_002_Figure03_LC.mxd			
PROJECT NO. ENVMIN03058-01.002	**DWN** MEZ / **CKD** SL / **APVD** RH / **REV** 0		**Figure 3**
OFFICE Tt EBA-VANC	**DATE** February 20, 2015		

Q:\Vancouver\GIS\ENVIRONMENTAL\MIN\MIN03058-01\Maps\002\MIN03058-01_002_Figure03_LC.mxd modified 2/20/2015 by morgan.zondervan

4.4.4.3 Concordance of the Beak (1981) and EOSD Map Units

As the majority of the Beak (1981) map units were field verified, this dataset contains the most accurate characterization of vegetation community composition currently available for the proposed all season road study area. However, as a portion of the proposed all season road varies from the original (1981) winter road route, a portion of the proposed all season road is not encompassed by the Beak (1981) vegetation community mapping. Therefore, it is considered prudent to characterize vegetation communities for this portion of the proposed all season road using available data sets (EOSD) while maintaining the level of detail (with respect to floristic composition) provided by historic data sets (i.e., Beak 1981) to allow for an accurate assessment of potential project related effects to vegetation and other resources.

Concordance of the Beak (1981) and EOSD map units was determined (to the greatest extent feasible) by comparing the Beak community descriptions (Section 4.4.4.1) with the EOSD land cover class descriptions (Section 4.4.4.2) and identifying similarities between the two based primarily on the presence and relative percent cover of dominant structural layers. Available mapping of the two classification systems within the proposed development area were then cross-referenced to confirm agreement between the two classification systems.

As previously discussed, the naming convention used by Beak for each map unit reflects the dominant vegetation associations recorded for each unit; however, each map unit generally contains several associated sub-dominant community types. Therefore, multiple EOSD land cover classes may be applicable for a given map unit as described by Beak. Table 4-26 presents the applicable EOSD land cover classes that correspond to given Beak community descriptions. It should be noted that the map unit (Burn) described by RES (1994) is not included in this table as a detailed description of dominant structural layers is not available.

Table 4-26: Concordance of the Beak 1981 Community Mapping and EOSD Map Units

Map Unit	Dominant Vegetation Association(s) (Beak 1981)	Sub-dominant Vegetation Association(s) (Beak 1981)	Corresponding EOSD Classification(s)
Spruce – Lichen	Low density (7-8%) coniferous stands; lichen communities and exposed talus slopes	Low shrub communities	Exposed land; coniferous-open; bryoid
Subalpine Shrub	Low shrub communities	Exposed rock (talus and bolder); herbaceous communities; and bryophyte communities	Shrub-low; coniferous-open; exposed land; bryoid; rock/rubble
Alpine Tundra	Low shrub and herbaceous communities		Exposed land; rock/rubble; bryoid; shrub-low; herb
Pine Parkland	Low density jack pine stands (8-15% cover)	Depressional black spruce forest	Coniferous-sparse; coniferous-open; coniferous-dense; mixedwood-dense
Black Spruce Parkland	Low to medium density black spruce stands (5-30% cover)		Coniferous-sparse; coniferous-open; coniferous-dense
Riparian Alluvial	Shrub communities and deciduous stands (balsam poplar *Populus balsamifera*)		Shrub-low; shrub-tall; herb; broadleaf-open; broadleaf-dense

Table 4-26: Concordance of the Beak 1981 Community Mapping and EOSD Map Units

Map Unit	Dominant Vegetation Association(s) (Beak 1981)	Sub-dominant Vegetation Association(s) (Beak 1981)	Corresponding EOSD Classification(s)
Mixed Coniferous/Deciduous	Mixedwood stands of aspen, paper birch and white spruce	Low and high density coniferous forest (primarily black spruce with some pure jack pine stands); and tall shrub	Mixedwood-dense; mixedwood-open; coniferous-dense; coniferous-open; coniferous-sparse; shrub-tall
Black Spruce Muskeg	Black Spruce Bog		Wetland-treed; wetland-shrub
Grainger Tillplain	Sedge wetlands and low shrub communities	Tall shrub communities; deciduous stands (primarily balsam poplar); and low density coniferous stands	Wetland shrub; wetland herb; shrub-low; shrub-tall; broadleaf-open; broadleaf-dense; coniferous-open; coniferous-sparse
Floodplain/Tillplain	Co-dominant mixedwood stands of aspen and white spruce	Deciduous forest (aspen and paper birch; jack pine stands; black spruce muskeg; and shrub communities	Mixedwood-open; mixedwood-dense; broadleaf-open; broadleaf-dense; coniferous-open; coniferous-dense; wetland-treed; wetland-shrub; wetland-herb; shrub-low; shrub-tall
Aspen Liard Floodplain	Climax white spruce and early succession aspen stands	Low shrub communities (including waterlogged soils and bogs)	Coniferous-open; coniferous-dense; broadleaf-open; broadleaf-dense; shrub-low; shrub-tall; wetland-treed; wetland-shrub; herb

4.4.4.4 Mapped EOSD Vegetation Communities and Associated Vegetation Conditions

Available EOSD mapping was compared to the proposed route for the all season road to determine the expected vegetation communities present within the study area (i.e., 50 m buffer to both sides of the alignment), and the relative proportion of these communities within the study area. A total of 17 EOSD land class types were identified within the proposed all season road study area (all footprint components combined) (Table 4-27). Additional commentary describing existing vegetation conditions relative to the MVEIRB ToR is provided below.

Table 4-27: EOSD Land Class Types Present Within the All Season Access Road Study Area

EOSD Land Cover Class	EOSD Land Class Within the Phase I Study Area (ha) *	Percentage of the Phase I Study Area Encompassed by Cover Class (%)*	EOSD Land Class Within the Phase II Study Area (ha)*	Percentage of the Phase II Study Area Encompassed by Cover Class (%)*
Broadleaf-dense	34.4	4.0	315.6	35.4
Broadleaf-open	10.9	1.3	98.8	11.1
Bryoids	5.7	0.7	0.9	0.1
Coniferous-dense	86.2	10.1	96.6	10.8
Coniferous-open	193.1	22.6	57.0	6.4
Coniferous-sparse	31.1	3.6	7.0	0.8
Exposed land	210.2	24.6	0.0	0.0
Herb	0.3	0.0	3.2	0.4

Table 4-27: EOSD Land Class Types Present Within the All Season Access Road Study Area

EOSD Land Cover Class	EOSD Land Class Within the Phase I Study Area (ha) *	Percentage of the Phase I Study Area Encompassed by Cover Class (%)*	EOSD Land Class Within the Phase II Study Area (ha)*	Percentage of the Phase II Study Area Encompassed by Cover Class (%)*
Mixedwood-dense	50.2	5.9	156.9	17.6
Mixedwood-open	5.7	0.7	9.8	1.1
Rock/rubble	70.4	8.2	0.1	0.0
Shadow	14.2	1.7	0.1	0.0
Shrub-low	115.7	13.6	53.0	5.9
Shrub-tall	14.7	1.7	68.4	7.7
Water	9.8	1.1	6.4	0.7
Wetland-shrub	0.7	0.1	0.4	0.0
Wetland-treed	0.4	0.0	17.9	2.0
Total	**853.5**	**100.0**	**892.0**	**100.0**

*- Values rounded for reporting purposes

EOSD mapping of the study area indicates the presence of a variety of vegetation communities, which, based on the review of the corresponding Beak (1981) community descriptions, vary significantly in terms of vegetation species diversity and structural diversity. This variability can be attributed to the influence of numerous factors including elevation, topography, climatic variability, soil substrate, nutrient/moisture availability, and fire regime (amongst others).

Fire activity is strongly influenced by characteristics of the surrounding landscape including topography and fuel availability. Based on a study conducted by Bothwell et al. (2004), forest fuels in the regional context of the study area are predominantly described as low-density coniferous forests and non-fuel (wetlands, shrub lands and rock) forest cover types. This description is generally consistent with the EOSD mapping results tabulated above. Results of the Bothwell et al. (2004) study suggest that the fire behaviour in the region (e.g., Nahanni National Park Reserve) is influenced by fuel continuity, associated with mountainous terrain, and may explain a lower proportion of large (>200 ha) fires, relative to other areas examined as part of the study. The mean fire return interval calculated for the region was 28 years, while a fire cycle of 1,142 years was determined for fires greater than 200 hectares.

Given the differences in structural diversity and community composition associated with the vegetation community types determined through analysis of EOSD data and concordance with the Beak (1981) community descriptions, it is anticipated that vegetation community types present within the study area will vary substantially with respect to the availability and abundance of materials utilized by the local human community. Two of these potential uses, specified for assessment by the MVEIRB, include the potential use of the landscape for timber harvest activities and the potential use of the landscape for berry harvesting activities.

The Deh Cho Land Use Planning Committee commissioned a study of logging potential of commercially viable forests in the Deh Cho territory (PACTeam Canada 2003), which encompasses the all season road study area. The study was conducted using various metrics to assess logging potential, including the assessment of forest cover mapping to identify suitable stands for logging and the economic viability of conducting logging operations (e.g., access constraints). Based on the results of the study, the majority of the land encompassing Phase 1 of the all season access road study area is currently considered to have low to no potential for commercially viable forestry operations, while the area encompassing Phase 2 of the all season access road is considered to have high to very high potential for commercially viable forestry operations. A portion of this area, from Nahanni Butte to Nahanni National Park Reserve, was identified as being one of the most productive sites in the territory relative to the production of white spruce saw timber.

Based on the review of applicable literature (Cambell and Luckert 2012) it is recognized that berry harvesting represents an important food source for local First Nation communities and offers a substantial economic offset. Based on 1997 values, a per capita replacement cost of $201.14 was calculated for blueberries harvested by the Nahanni Butte community. The results of the Beak (1981) vegetation assessment for the original winter road alignment identified blueberry species (*Vaccinium* spp.), at varying levels of abundance, within several vegetation communities; generally characterized as forested. Based on lower productivity associated with higher elevation sites (e.g., reduced growing season, nutrient availability) it can be assumed that forested sites at lower elevations with the study area will generally provide the most productive sites with respect to blueberry production within the proposed all season road study area.

4.4.5 Plant Species At Risk

The Northwest Territories General Status Ranking Program is an evaluation of species status within the NWT. Species ranked as 'May be at Risk' or 'At Risk' are considered the highest priority for further assessment [Environment and Natural Resources (ENR) 2014a]. As part of the background research conducted to assess the presence of plant species at risk in proximity to the proposed all season access road, Tetra Tech requested occurrence data for vascular plant, bryophyte and lichen species (currently ranked as a species at risk in the NWT) which have been historically observed within a 50 km radius of the study area; recorded as part of the NWT ENR virtual herbarium database (ENR 2014g).

The results of the database search indicate that 16 vascular plants species, one lichen species and 13 bryophyte species currently ranked as 'may be at risk'; one vascular plant species ranked as 'sensitive' and one vascular plant species ranked as 'undetermined' by the NWT General Status Ranking Program have been historically identified within a 50 km radius of the CZN study area. A summary of the database search results, including the NWT General Status Rank, NatureServe global status rank (if applicable) (NatureServe 2014) and approximate recorded distance from the CZN study area boundary is provided in Table 4-28.

Table 4-28: Plant Species at Risk Historically Observed in Proximity to the Study Area

Common Name	Scientific Name	NWT Status[1]	Global Status[2]	Recorded Distance from CZN Study Area
Vascular Plants				
snow fleabane	*Erigeron nivalis*	May be at Risk		2 occurrences – greater than 42.6 km
Porsild's whitlow-grass	*Draba porsildii*	May be at Risk	G3G4	40.2 km
Beringian hairy potentilla	*Potentilla villosula*	May be at Risk	G4	23.4 km
Raup's willow	*Salix raupii*	May be at Risk	G2	24.9 km
velvetleaf blueberry	*Vaccinium myrtilloides*	Sensitive	G5	5.0 km
Canada violet	*Viola canadensis*	Undetermined	G5	6 occurrences – greater than 24.1 km
Nahanni aster	*Symphyotrichum nahanniense*	May be at Risk	G2	19.8 km
Mackenzie sedge	*Carex mackenziei*	May be at Risk	G4G5	20.0 km
Peck's sedge	*Carex peckii*	May be at Risk	G5	24.1 km
Smooth cliff-brake	*Pellaea glabella*	May be at Risk	G5	2 occurrences – greater than 34.8 km
Alaska parsley-fern	*Cryptogramma sitchensis*	May be at Risk	G4	26.2 km
Mingan moonwort	*Botrychium minganense*	May be at Risk	G4G5	29.6 km

Table 4-28: Plant Species at Risk Historically Observed in Proximity to the Study Area

Common Name	Scientific Name	NWT Status[1]	Global Status[2]	Recorded Distance from CZN Study Area
green spleenwort	*Asplenium trichomanes-ramosum*	May be at Risk	G5	48.0 km
Yukon fleabane	*Erigeron yukonensis*	May be at Risk	G2G4	34.8 km
white-flowered hawkweed	*Hieracium albiflorum*	May be at Risk	G4G5	28.4 km
seaside angelica	*Angelica lucida*	May be at Risk	G5	49.0 km
Loesel's twayblade	*Liparis loeselii*	May be at Risk	G5	2 occurrences – greater than 18.8 km
choke cherry	*Prunus virginiana*	May be at Risk	G5	4 occurrences – greater than 24.0 km
Lichens				
aboreal bottle-collection lichen	*Tholurna dissimilis*	May be at Risk	G4G5	48.1 km
Bryophytes				
bigspore arctic granite moss	*Andreaeobryum macrosporum*	May be at Risk	G2G3	5 occurrences – 18.5 km
twinkle mountain-moss	*Arctoa fulvella*	May be at Risk	G3G5	24.9 km
long-necked candlesnuffer	*Encalypta longicolla*	May be at Risk	G3	3 occurrences – greater than 17.0 km
blunt candlesnuffer	*Encalypta mutica*	May be at Risk	G3	3 occurrences – greater than 17.0 km
trim silk moss	*Entodon concinnus*	May be at Risk	G4G5	18.5 km
torque rock moss	*Grimmia torquata*	May be at Risk	G3G5	38.0 km
Mueller feather-moss	*Isopterygiopsis muelleriana*	May be at Risk	G5	38.0 km
alpine plagiobryum moss	*Plagiobryum demissum*	May be at Risk	G3G5	18.5 km
Zier's plagiobryum moss	*Plagiobryum zierii*	May be at Risk	G4G5	38.0 km
six-ranked haircap moss	*Polytrichum sexangulare*	May be at Risk	G4	2 occurrences – greater than 38.0 km
crisp rhabdoweisia moss	*Rhabdoweisia crispata*	May be at Risk	G5	38.0 km
polar limestone moss	*Seligeria polaris*	May be at Risk	G3G5	18.5 km
Velenovsky's hilpertia moss	*Tortula scotteri*	May be at Risk	G1	49.6 km

[1] NWT General Status Ranking (ENR 2014b)
[2] NatureServe global status ranking (NatureServe 2014)

Results of the ENR virtual herbarium search indicate that no vegetation species at risk occurrences have been historically recorded within five kilometres of the CZN study area (ENR 2014g). It should be noted that these results do not necessarily negate the potential presence of vegetation species at risk within the study area, but they do provide valuable insight with respect to the types of vegetation species which may require further consideration given their presence in the regional context of the study area. Of the species listed above, two species (Nahanni aster and Raup's willow) are currently considered globally imperiled (G2 global status ranking – NatureServe 2014) and one species (Velenovsky's hilpertia moss) is considered critically imperiled (G1 global

status ranking – NatureServe 2014). As such, further commentary with respect to these species has been provided in Sections 4.4.6, 4.4.7 and 4.4.8.

Rare plant surveys related to the Prairie Creek Mine Project and associated winter access road were initiated by EBA on behalf of CZN in July 2009 and further surveys were completed in August 2010 (EBA 2010; 2011).

In July 2009, rare plant surveys were conducted along the Prairie Creek Mine winter road; the proposed waste rock storage facility; and the area around camp and the beaver pond to the south.

A total of 340 plant observations, representing 193 species and 44 families of vascular plants, were documented during the 2009 field survey. No plants listed within the federal SARA were observed in the surveyed areas. However, one plant species, few flower meadow rue (*Thalictrum sparsiflorum*), listed as 'May Be At Risk' (ENR 2014b) was documented along the Prairie Creek winter road and an adjacent wetland.

Two additional plant species ranked as 'May Be At Risk' by the ENR were identified along the existing winter access road [Hornemann willowherb (*Epilobium hornemanni*) and linear-leaved willowherb (*Epilobium leptophyllum*)] have restricted distribution in the NWT with limited known occurrences, but are globally secure (Golder 2010). Six plant species ranked as 'Sensitive' by the ENR [alpine anemone (*Anemone drummondii*), bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atrosquama*), one-glume spike rush (*Eleocharis uniglumis*), alpine groundsel (*Packera pauciflora*) and yellow mountain heather (*Phyllodoce glanduliflora*)] identified adjacent to the Prairie Creek winter road have small regional distributions in the NWT with a small number of known occurrences, but are globally secure. It was concluded that impacts to these local occurrences (and potential additional occurrences near the access road) can be avoided or reduced by limiting the amount of additional land disturbance for upgrades and operation of the all access road.

In August 2010, the proposed Polje By-Pass re-alignment was surveyed for unique or important vegetation communities and rare plants. The habitat in which the proposed Polje By-Pass re-alignment traverses was burned by a forest fire in 1996. The vegetation community now comprises a jack pine regeneration stand approximately 14 years old. No rare plants or sensitive habitats were documented within the jack pine regeneration along the proposed Polje By-Pass alignment. It was concluded that this proposed re-alignment would not threaten rare plants or sensitive vegetation communities (EBA 2011).

4.4.6 Nahanni Aster (*Symphotrichum nahanniense*)

Nahanni aster is a perennial wildflower endemic to Canada and found only in the southern Mackenzie Mountains in the Nahanni National Park Reserve (COSEWIC 2014b). This species relies on specific habitat requirements and, as a result, the entire population of Nahanni aster is confined to six known sites, all of which are hot and warm springs with tufa (calcium carbonate deposits). The closest known site to the proposed CZN all season road occurs approximately 20 km from the proposed CZN all season road study area boundary.

Given the very small range, habitat specificity and population size of this species, it is considered susceptible to losses resulting from alterations to geothermal processes or landslide events. Nahanni aster is currently ranked as globally imperiled (G2) by NatureServe, special concern by COSEWIC and 'May Be At Risk' by ENR.

4.4.7 Raup's Willow (*Salix raupii*)

Raup's willow is currently considered globally imperiled (G2) by NatureServe and 'May Be At Risk' by ENR. This species has a very restricted range and is known from two sites in NWT, two sites in the Yukon, two sites in Alberta and three sites in British Columbia (ENR 2014h). The closest known occurrence of this species to the proposed CZN all season road occurs approximately 25 km from the proposed CZN all season road study area boundary.

This species is associated with a variety of habitats, including white spruce woodlands, trembling aspen woodlands, gravel floodplains, and black spruce treed bogs. Potential threats to the known occurrences of this species are not currently well understood; however, potential threats from development (specifically logging) have been identified as a potential concern to known populations of this species in Alberta (NatureServe 2014).

4.4.8 Velenovsky's Hilpertia Moss (*Tortula scotteri*)

Velenovsky's hilpertia moss is currently considered critically imperiled (G1) by NatureServe and 'May Be At Risk' by ENR. This species is known from two localities in NWT and British Columbia (ENR 2014h). The closest known occurrence of this species to the proposed CZN all season road occurs approximately 50 km from the proposed CZN all season road study area boundary.

Preferred habitat for this species includes exposed soil on high elevation slopes (NatureServe 2014).

5.0 EFFECTS ASSESSMENT – TRADITIONAL HARVESTING

This assessment of potential effects related to the upgrading of the current approved winter access road to an all season road addresses the traditionally harvested wildlife valued components for the Prairie Creek all season road construction, operation, and closure (activities summarized in Table 2-1). In accordance with the MVLWB and Parks Canada Land Use Permits and Water Licences, CZN is authorized to construct and operate a winter road that mostly follows the same route as the historical winter road constructed in 1981 and 1982. These authorizations permit the clearing of the winter access road, which will occur prior to the construction of this proposed all season road. As part of these authorizations, CZN concluded Impact Benefits Agreement negotiations with the NDDB and LKFN, and potential impacts on harvesting was one of the issues discussed. The all season road will generally follow the cleared winter access route, except in three locations that traverse wet areas that are conducive for winter road operations and an area of steep talus scree (Figure 2):

- 4 km section in Phase 1 (approximately from KP 24.5-28.5) (rerouted to avoid steep talus scree);
- 4 km section in Phase 2 (approximately from KP 90.5-94.5) (rerouted to avoid wet area); and
- 1 km section in Phase 2 (approximately from KP 122.5-123.5) (rerouted to avoid wet area).

Additional Project-related clearing, construction, and operations are required for the proposed airstrip and associated access road infrastructure, including 49 proposed borrow sources and their access roads.

The Project effects assessment focuses on important harvestable species. In this regard, information was drawn from the results of CZN's discussion with Leon Konisenta, an elder from the Nahanni Dehe Dene Band (NDDB) on January 27, 2010. Information on historical traditional harvesting and harvesting areas is contained in the confidential section of the Traditional Knowledge Assessment Report Addendum by Crosscurrent Associates Ltd. (August 2009).

For the purposes of this report, two sources of information were available from which to determine the important harvest species and harvest areas that were reviewed and are summarized in Section 5.1:

1. Mr. Konisenta provided information that is considered representative of important harvest areas and harvestable species; and
2. CZN DAR (CZN 2010), with the approval of the NDDB, provided suitable non-confidential information selected from the Traditional Knowledge Assessment Report Addendum.

The TOR outlines the geographical scope of any potential effects to harvesting at a 50 km minimum along the all season access road; however, a broader spatial scope was considered for select species.

The temporal scope of the effects assessment includes activities during the construction, operation, and closure phases, and those potentially posing the greatest adverse effects. Times when selected harvested species are most sensitive to human disturbances and the duration of potential effects with relation to the operational life of the access road are also considered. Table 5-1 summarizes the selected species for the assessment of traditional harvesting, the geographical and temporal scopes, and the rationale for selection.

Table 5-1: Summary of Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Inclusion into the Assessment and Geographic and Temporal Scopes
Boreal Caribou	Dehcho-South region*	Winter project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ Although potentially occurring near the all season road year round, Boreal Caribou are hunted opportunistically, mostly in the winter. Across the entire Dehcho region, an estimated 100-150 Boreal Caribou are harvested a year, thereby contributing to a very low component of the subsistence needs. ▪ Listed as Threatened under the NWT (2014) and federal (2003) SARAs. ▪ Total of 25 km of Phase 2 (KP 125-Nahanni Access Road) occurs along the edge of known range. Uncertainty exists whether Boreal Caribou also infrequently occur in the Tetecla River and Fishtrap Creek area. ▪ The winter season is a sensitive period of time for Boreal Caribou. Winter construction and operation of the access road previously assessed in Golder (2010).
Northern Mountain Caribou	Nahanni Complex summer range Moose Horn River subherd winter range	Summer Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ Based on their remoteness, they are currently harvested opportunistically by members of the Naha Dehe Dene Band (harvest records unknown). ▪ On average, 159 harvested a year by non-residents in the Mackenzie Mountain outfitter zones, and harvest levels are slowly increasing. ▪ Listed as Special Concern under SARA (2005) but assessed as Secure under the NWT. ▪ All season access road and airstrip are located outside known herd ranges; however, a few caribou have been observed in the Mackenzie Mountains mainly in the summer (late May-early September). ▪ Caribou predicted to most likely occur in elevated terrain within the Mackenzie Mountains near the Mine site, the lower Sundog Creek drainage, west of the Ram Plateau near the proposed airstrip, and the Silent Hills during the non-winter period. ▪ The all season access road is located outside their calving ranges.

Table 5-1: Summary of Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Inclusion into the Assessment and Geographic and Temporal Scopes
Moose	Outfitter zones	Fall and winter Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ Main harvested species by members of the Naha Dehe Dene Band. ▪ Second most popular harvest species targeted by non-residents hunting inside the Mackenzie Mountain outfitter zones, and harvest levels increasing. Known harvest levels from Mackenzie Mountain outfitters. ▪ Predominantly occur in the eastern half of Phase 1 (and airstrip) and all of Phase 2 access road development. ▪ Individual Moose remain year round within their relatively small home ranges ▪ Most sensitive to disturbances in the winter. ▪ Subsistence harvests occur predominantly in the fall.
Dall's Sheep	Outfitter zones	Project components, year round Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ Once harvested by members of the Naha Dehe Dene Band. General license holders harvest 20-30 Dall's Sheep a year from the entire Mackenzie Mountains, thereby contributing to a very low component of the subsistence needs. ▪ The most favoured target species for non-resident harvesters in the Mackenzie Mountain outfitter zones. Average annual harvest of 197 rams, and harvest levels increasing. Known harvest levels from Mackenzie Mountain outfitters. ▪ Trophy Dall's Sheep hunts from July 15 to October 31. ▪ Potential lambing areas located within 1 km of Phase 1 KP 2, 3, and 7. Similarly, the Nahanni Range and Ram Plateau provide suitable lambing areas. ▪ Most sensitive to disturbances on their winter ranges, in the eastern fringe of Nahanni Plateau and Nahanni Range north of the access road.
Wolverine	Within 50 km of the Project	Winter and early spring Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ An important furbearer for members of the Naha Dehe Dene Band, and may be trapped from late October to May. ▪ None harvested by non-resident hunters in the Mackenzie Mountain outfitter zones since 1991. ▪ Assessed as Special Concern by COSEWIC (2003) and ranked as Sensitive in the NWT. ▪ Present along the entire (all of Phase 1 and Phase 2) access road and airstrip year round. ▪ Most sensitive to disturbances in the winter when access to food resources are restricted and females with kits are occupying natal dens.

Table 5-1: Summary of Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Inclusion into the Assessment and Geographic and Temporal Scopes
Grey Wolf	Within 50 km of the project	Winter and spring Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ An important furbearer for members of the Naha Dehe Dene Band, and may be trapped from late October to May. ▪ Occasionally hunted by non-residents in the Mackenzie Mountain outfitter zones. Average annual harvest of 15, and harvest levels increasing. ▪ Present along the entire (all of Phase 1 and Phase 2) access road year round. ▪ Generally tolerant of human land-use developments and their activities, but most sensitive in the winter when access to food resources are restricted, and in the spring (May) when denning.
Beaver	Within 50 km of the Project	Late fall, winter, and spring Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ An important furbearer for members of the Naha Dehe Dene Band, and may be trapped during early winter and late spring seasons. ▪ Present year round from Phase 1 KP 64-86 and Phase 2 KP 86-Liard Highway. ▪ Most sensitive to water level changes, particularly in the fall and winter.
Marten	Within 50 km of the Project	Winter and spring Project components Entire life of the access road (road closure beings 6 years after Mine closure (approx. 2036), after which time access will be eliminated)	▪ An important furbearer for members of the Naha Dehe Dene Band, and may be trapped from late October to May. ▪ Present year round from approximately Phase 1 KP 64-86 and Phase 2 KP 86-Liard Highway. ▪ Generally tolerant of human land-use developments and their activities, but most sensitive if the den is disturbed when denning (March or April).

* As described in the Boreal Caribou Species Status Report (Species At Risk Committee 2012) the Dehcho-South Boreal Caribou study area extends south from the Mackenzie River and into British Columbia. This study area does not represent a separate population, but rather an achievable area to effectively study a species occurring at low densities across much of the boreal forest zone of the NWT.

Species not included in this effects assessment, but harvested for subsistence or economics, are generally not susceptible to human disturbances, unlikely to interact with the all season access road in sufficient numbers, are largely covered by the assessment of the selected species, or their populations are considered regionally abundant.

The Mackenzie Valley Review Board (MVEIRB) Terms of Reference (TOR) (dated September 12, 2014) identified the following key objectives to describe and evaluate potential effects of the all season access road on caribou, moose, sheep, furbearers, and fish[1] and other traditional harvesting (EA1415-01):

- Sensitive or important harvesting areas of habitat both inside and outside the Nahanni National Park Reserve;
- Direct and indirect alteration of habitat including all season road footprint impact;
- Sensory disturbance and predicted changes in behaviour (including habitat avoidance and effective habitat loss in relation to all season road facilities or activities), energetics, health, and condition;
- Wildlife movement patterns, home ranges, distribution, and abundance;
- Wildlife mortality due to harvesting and vehicle collisions;
- Disruption of sensitive life stages or habitat (e.g., migration, calving, denning, overwintering);
- Effect to population cycles;
- Effects to predator-prey relationships;
- Increased human-wildlife interactions;
- Contaminant levels in harvested species that could be impacted by the all season road;
- Changes in access, including increased access to the land and surrounding waters, as well as increased access to environmentally and culturally sensitive areas;
- Changes in hunting and fishing pressures from people who do not reside in the region, and how road-related changes in harvest pressures could impact the resource;
- Changes in the abundance and distribution of harvested resources, including caribou, moose, sheep, and other wildlife (e.g., furbearers, waterfowl) that would adversely affect harvesting;
- Distribution of harvest patterns, or loss or alteration of high-value harvest areas including:
  - Changes to harvest effort as perceived by harvesters;
  - Changes in harvester travel patterns;
  - Changes in harvest levels;
  - Changes in harvesters' costs; and
  - Changes in seasonal harvesting patterns.

[1] A fish assessment was not part of Tetra Tech EBA's scope of work.

- Competition among harvesters within and between communities as a result of increased access and loss or alteration to the land resulting from the project;
- Changes in the quality of harvested species (including contamination) that would adversely affect their consumption;
- Measures to avoid or minimize changes in the abundance, distribution, or quality of harvested species, or mitigate the consequences of such changes;
- Mechanisms to control project workforce-related hunting, fishing, or disturbance of wildlife;
- Other traditional harvesting activities such as for berries or medicinal plants; and
- Mechanisms of resource management agencies and other parties to manage hunting and fishing by:
  - Resident hunters and fishers;
  - Non-resident hunters and fishers; and
  - Aboriginal harvesters.

5.1 Current Knowledge on Harvested Wildlife and Harvesting Areas

The following is an excerpt from the DAR (CZN 2010) outlining the information from the Traditional Knowledge Assessment Report Addendum and Mr. Konisenta regarding harvested wildlife and important harvesting areas:

Mr. Konisenta information:

- Caribou: Traditional harvesting used to include caribou, particularly in the early 1960s. Some animals were harvested in the Second Gap area. However, no caribou have been harvested for approximately 20 years;
- Moose: Harvesting of moose used to be common. Harvesting occurred near Nahanni Butte, around the Swan Point area (along the Liard River, approximately 6 km downstream from the proposed Liard River crossing) and along the Liard Highway. In the fall, members would also travel up the South Nahanni River to the 'flats' to hunt moose. Harvested numbers were plentiful, numbering 25-30 animals in some years. Members did not need to travel too far to find moose, and could use the available access routes. Moose numbers have dwindled, and Moose are now rarely found along the easy access routes. Mr. Konisenta attributes this partly to the introduction of bison to the area;
- Dall's Sheep: Members used to harvest a few Dall's sheep annually from the Nahanni Range in proximity to the village. None are harvested now; and
- Furbearers: Trapping used to be very common in the Liard River lowlands, and west of the Nahanni Range to the Wolverine Pass area. Animals trapped included Lynx, Mink, Marten, Wolverine, Fox, Beaver, and River Otter. In 1978, about 600 Marten were caught. However, there has been no trapping for six years because of a combination of fewer animals, lower pelt prices, and rising costs (fuel for skidoos). Trapping was also common in the Yohin Lake, lower Fishtrap Creek and Netla River areas. Trapped animals were mainly Marten, Beaver, and Muskrat. Between 30 and 50 animals were trapped in good years. This trapping has also dwindled, but still occurs periodically because of the easier access.

Traditional Knowledge Assessment Report Addendum:

- Lower portion of the South Nahanni River valley: is a rich ecological area, well utilized for harvesting, and an area of high traditional occupancy. River travel allowed access from late spring, after break-up, through to the fall.

- Deadman Valley: located at the confluence with Prairie Creek and the South Nahanni River (at least 25 km from the all season access road). High traditional use area for hunting Moose and Dall's Sheep. The sheep licks (mineral licks), near the confluence, are hunted, particularly in the fall. From here, people also travelled up Prairie Creek to set trap lines.

- First Canyon: located approximately 14 km downstream from the Prairie Creek-South Nahanni River confluence. Most hunting is carried out while travelling up the river, keeping an eye on the lower edges of the valley for sheep.

- Lower South Nahanni River and surrounding wetlands (referred to as the Splits): High quantity of traditional place names indicating high use within living and recent generations. There is an abundance of harvested species (e.g., Moose, Beaver, and Dall's Sheep) here, as well as tributaries providing access to additional critical harvesting areas to the north and south, including Yohin Lake and Fishtrap Creek.

- Tetcela River, Fishtrap Creek, and Bluefish Creek valleys: Although documented use of traditional harvesting and traditional trails throughout the region, and likely along the entire all season access road (as overland travel was common), these wetland valleys received the heaviest traditional use. A settlement was once located at Fishtrap Creek, and harvesting occurred throughout the area including winter trapping for Beaver, Cross-fox, Lynx, Marten, Mink, Wolverine, Grey Wolf, Woodchuck, Squirrel, Weasel, and Ermine, and spring harvesting of migratory birds as well as Beaver. Moose were also harvested, as they were known to overwinter in this valley area. The plateau areas were specifically used during the winter months as key travel corridors to the north towards the North Nahanni River, Cli Lake, and the pass through the Nahanni Range to Little Doctor Lake, and as a trap line for Beaver, Lynx, Marten, Muskrat, Grey Wolf, Wolverine, Cross-fox (i.e., Red Fox), and Mink.

- Nahanni Range: prime harvesting area for Dall's Sheep, likely due to the presence in the area of a sheep lick. Sheep are seen all along the high country and at Second Gap, particularly in the summer. In the spring, they calve in the area. The sheep stay on top of the mountains during the winter where snow is absent.

- Grainger River watershed from Nahanni Range Second Gap to the Liard River (lower portion of the all season access road): the area is relatively flat and dominated by wetlands and mixed forest cover. A known mineral lick occurs here (Moose lick hill). This area is particularly good habitat for beaver and for woodland caribou, which are known to be in the area at different times of the year, particularly along the lower levels of the Nahanni Range in the spring time. It appears that the caribou move down into the lowlands for the winter, where moose are also found. This area is known for extensive traditional use of the lowland area between the Nahanni Range and Liard River, particularly for trapping and big game harvesting purposes, most of which would occur during the winter. Along with Woodland Caribou, Moose, and Dall's Sheep, the furbearers traditionally harvested in this area include Beaver, Lynx, Marten, Muskrat, Grey Wolf, Wolverine, Cross-fox, Mink, and Weasel. Spring hunting expeditions also occurred into the area.

At present, little harvesting, including hunting and trapping activities, occur proximal to the all season access road due to restricted access. Harvesting areas near the all season access road are assumed to be principally associated with the Liard and South Nahanni rivers, as well as the Liard Highway that provide access to immediately adjacent lands.

Based on fixed kernel analysis of these lifetime harvest sites, Boreal Caribou are harvested primarily near the communities including a small harvesting area north of the Liard River near Nahanni Butte and the southern portion of the proposed all season access road (Gunn et al. 2004).

In 1984, Parks Canada reported hunting across the southern Mackenzie Mountains have been minimal to non-existent, and concluded that the hunting pressure inside the NNPR boundaries was very low and did not pose any adverse effects to wildlife populations. Harvesting inside the original boundaries of the NNPR were reportedly "minimal to non-existent", with hunters accessing the park along the South Nahanni River (Parks Canada 1984). Inside the NNPR boundary, year round hunting and trapping activities were concentrated along the eastern most boundary closest to Nahanni Butte and into Yohin Lake, seldom occurring beyond the entrance to the First Canyon (approximately 14 km downstream from the Prairie Creek-South Nahanni River confluence) (Parks Canada 1984). However, Parks Canada wardens reported occasional summer hunting and trapping excursions further into NNPR as far as Virginia Falls, and Dall's Sheep were occasionally harvested from the Prairie Creek mineral licks (at the confluence with the South Nahanni River) (Parks Canada 1984).

There are historical trap lines near the all season access road at Grainger Gap. A NDDB member (R. Vital) has a cabin on the west side of the Gap. The next nearest trap line is to the south of the Liard Highway in the Arrowhead Hills (pers. comm. Steve Gooderham November 24, 2014). Local area trapping and subsistence harvest data are unknown.

5.2 Effects to Harvesting and Harvesting Areas

The alignment of the Prairie Creek all season road will generally follow the winter access road alignment, which was modified to address concerns from the Naha Dehe Dene Band about wildlife issues and from Parks Canada regarding re-routing around the unique polje karst features. The permitted winter road (and likewise this proposed all season access road), was re-routed from the original 1980's winter access road to avoid environmentally and culturally sensitive areas identified through consultations.

Current harvesting is restricted in the area of the proposed all season access road, with the winter access road allowing for winter access only. During the EA for the new winter road, the Naha Dehe Dene Band considered the potential impacts on their harvesting activities in the areas in and around the seasonal access road. They are of the opinion that the winter road has the potential to improve their harvesting activities because of the improved access. This is the greatest impediment to their harvesting at present. Although traditionally important, little harvesting, including hunting and trapping activities, is assumed to occur at present any distance beyond the Liard and South Nahanni rivers. Harvested species and general harvest levels are assumed based on information provided by Mr. Konisenta and the Traditional Knowledge Assessment Report Addendum.

Boreal Caribou subsistence hunts and furbearer trapping occur primarily in the winter. The existing winter access road provides access to suitable furbearer and Boreal Caribou range; therefore, the all season access road is considered to provide little additional benefit to winter harvest and trapping activities in terms of facilitation of traditional harvesting. With the development of the proposed all season access road, year round access will allow harvesting of other species that have previously been limited (e.g., Northern Mountain Caribou, Moose, Dall's Sheep). However, this must be counter-balanced by the concern that improved access will encourage hunting by non-residents, considered in the next section.

With the addition of the proposed all season access road, harvesters could access the surrounding area on a year round basis, providing an economic and cultural value to the members of the Naha Dehe Dene Band until closure of the access road (Table 5-2). The Naha Dehe Dene Band were also directly involved in the re-alignment of the road to avoid areas they consider sensitive to wildlife. Therefore, mitigation has effectively been applied to limit impacts to specific sensitive and existing harvesting areas. No further mitigation is recommended.

Table 5-2: Project Effects on Predicted Harvesting and Harvesting Areas

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Positive	Low	Moderate	Moderate	Moderate	Moderate	High
Northern Mountain Caribou	Both	Positive	High	Moderate	Moderate	Moderate	Moderate	Moderate
Moose	Both	Positive	High	Moderate	Moderate	Moderate	Moderate	High
Dall's Sheep	Both	Positive	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Wolverine	Both	Positive	Low	Moderate	Moderate	Moderate	Moderate	High
Grey Wolf	Both	Positive	Low	Moderate	Moderate	Moderate	Moderate	High
Beaver	Both	Positive	Low	Moderate	Moderate	Moderate	Moderate	High
Marten	Both	Positive	Low	Moderate	Moderate	Moderate	Moderate	High
Overall Significance								
Moderate								

Confidence in this assessment is moderate since local harvesting areas, harvesting and trapping levels, and propensity to harvest "less preferred" species (e.g., Dall's Sheep) are assumed and the winter road will provide better winter hunting and trapping access. The measurable parameter for effects to harvesting and harvesting areas is qualitative based on the belief of members of the Naha Dehe Dene Band that the road supports local harvesting and access to harvesting areas.

Based on the predicted overall positive effects predicted, the all season access road is not predicted to impede the harvest or change sensitive and existing harvesting areas. Positive residual effects are anticipated.

5.3 Effects on Wildlife from Harvesting Pressure

Current levels of harvesting (includes both trapping and hunting) along the all season access road is very low, as access restricts use. Areas adjacent to the Liard and South Nahanni rivers that are accessible by boat in the summer and snowmobile in the winter are likely utilized. Although the South Nahanni River allows access into the NNPR, the reported harvest levels inside the park are low. The permitted winter road currently permits winter access from the Nahanni Access Road to the Prairie Creek Mine.

Within the original boundaries of the NNPR, non-resident hunters are not permitted to hunt; only those holding a NWT General Hunting Licence (primarily Aboriginal subsistence harvesters) are allowed (Larter and Allaire 2013). The expanded park boundary now encompasses 80% of Phase 1 and 42% of Phase 2 of all season access road, as well as portions of two outfitting zones (the Nahanni Butte D/OT/02 and South Nahanni D/OT/01) that are in operation for non-resident hunters.

The Nahanni Butte D/OT/02 and South Nahanni D/OT/01 outfitting zones cover much of the Mackenzie Mountains found within the Dehcho, and the proposed all season access road is located within both. Portions of the all season access road including the majority of Phase 1 and Phase 2 KP 86-142 (extending 40 km outside of the NNPR boundary) are within an outfitting zone. Although now mostly part of the NNPR, non-resident hunters continue to be allowed to hunt within these outfitting zones until their current outfitting permits with Parks Canada terminate in 2019. With the termination of the outfitting zones in 2019, no wildlife harvesting by non-resident hunters will be allowed across the entire NNPR. Outside the NNPR boundary, non-resident hunter harvests will continue to be permitted along a 40 km section of the all season access road (Phase 2 KP 102-142) that lies inside outfitting zone D/OT/02.

Hunter harvest reports from all Mackenzie Mountain outfitting zones (total of six other outfitting zones besides the Nahanni Butte and South Nahanni) have been reported from 1991 to 2012. During this time, an average of 366 outfitter non-resident hunting licenses have been sold for the Mackenzie Mountains per year (Larter and Allaire 2013). These non-residents have reported harvesting six species: Dall's Sheep, Northern Mountain Caribou, Moose, Mountain Goat, Grey Wolf, and Black Bear. Of these species, Dall's Sheep and Northern Mountain Caribou were most commonly harvested (averaging 197 and 159, respectively per year), followed by Moose (averaging 56 per year), Grey Wolf (averaging 15 per year), and Mountain Goat (averaging 9 per year, primarily from the Nahanni Butte and South Nahanni zones), and Black Bear (averaging less than 1 per year) (Larter and Allaire 2013).

With outfitting permits with Parks Canada terminating in 2019, non-resident harvests along approximately 100 km of the all season access road and at the proposed airstrip will be completely eliminated. Non-resident harvests will be constrained within a 40 km section of the all season road, where the D/OT/02 outfitting zone extends outside the NNPR boundary. Mountain Goat, Dall's Sheep and Moose would be likely targets by non-resident guided hunters, and to a much lesser extent Grey Wolf and Wolverine. NDDB elders (R. Vital, J.M. Konisenta) say Mountain Goats have not been seen north of the village and Dall's sheep are scarce also. Of the target species by non-residents, currently Moose are the only important subsistence harvest species.

Non-residents are permitted to harvest Dall's Sheep from 15 July to 31 October and Moose from 1 September to 31 October. These harvest periods coincide with those of the subsistence harvests.

In combination with subsistence harvests, non-resident hunter harvesting within this 40 km section of all season access road places moderate to high levels of harvesting pressure on Moose and Dall's Sheep. Moose are considered the primary subsistence harvest species, and non-resident hunter harvests of Moose are increasing. Dall's Sheep and Mountain Goat are less favoured subsistence species (assumption based on the reported 20-30 Dall's Sheep harvested annually from the entire Mackenzie Mountains and no reported Mountain Goat harvests). Dall's Sheep and Mountain Goats along this section of access road (Nahanni Range) may be particularly sensitive to overharvest due to their isolation from larger populations; however, subsistence harvest of Dall's Sheep and Mountain Goats are considered negligible.

CZN is in the process of engaging with the Naha Dehe Dene Band and government regarding control of the use of the access road. CZN commits to use means available to control road use with the assistance of the Naha Dehe Dene Band and to monitor un-authorized use of the road as primary mitigation. A Controlled Road Use Plan was approved for use of the winter access road; however, this will need to be upgraded for Mine operations and all season access to incorporate safety and security, communications, road use monitoring, and wildlife response and reporting. CZN believes this is important for safety reasons, and to minimize the potential for harvesting pressures on wildlife.

CZN's intent is to work with the Naha Dehe Dene Band to discourage use of the full access road by non-residents. When the road is open, the un-authorized road use will pose safety risks. CZN will be able to impose rules for its employees and contractors (e.g., no hunting or straying off the access road alignment) but does not have jurisdiction to impose rules on others. Parks Canada regulations for NNPR stipulate that "existing roads in NNPR are restricted access only and are not open to the public for motorized use", with exceptions for Aboriginal people pursuing their traditional harvesting rights (Parks Canada 2013), resulting in the exclusion of non-Project related and non-Aboriginal travel along approximately 51% of the all season access road.

Direct engagement with the proprietors of the Nahanni Butte D/OT/02 outfitting zone regarding access to the Nahanni Range portion of their outfitting zone (outside the NNPR boundary) and hunting agreements along and near the access road may be required. This includes total harvests from this portion of their outfitting zone.

The key issue is control of access by non-resident hunters. CZN previously committed to the operation of a security check-point where the winter road leaves the Nahanni Access Road. CZN will commit to the operation of the check-point year–round for the all season road. CZN will also engage with the NDDB regarding the most efficient location of the check-point outside of the winter period. The concern is that hunters could access the road via the Liard River, thus avoiding the check-point if it is located at the Nahanni Access Road. It may be more effective to locate the check-point on the north-west side of the Liard River and some distance from the river. The check-point would deter access, but access could not be legally denied.

CZN would operate a barge on the river for truck traffic, and this barge would be private, so would not be available to non-residents. However, this would not prevent non-residents from using their own boats. As a benefit to NDDB members, CZN could consider barge use by NDDB members, and even consider barge transits to the village from the crossing location which would facilitate road use by residents and/or access to the Liard Highway.

Besides the elimination of non-resident guided hunts inside NNPR boundaries, Parks Canada regulations restricting public use of roads (except Aboriginal people pursing traditional harvesting) inside the park, and CZN's security check-point and barge control near the beginning of the road, there are two other possibilities that may deter use of the road by non-residents:

- a no shooting corridor similar to that operating on the Ingraham Trail which prevents shooting within 1 km off the road alignment. The corridor is primarily for safety, but should be equally effective in deterring non-resident hunters who would have to travel more than 1 km off-road to hunt. CZN is exploring the adoption of a corridor with the GNWT, and has had initial engagement with the NDDB and LKFN on the matter. The NDDB have not yet taken a position, while the LKFN are supportive.

- Dehcho land claims discussions are on-going. A conclusion of these discussions could enable the area of the road to be designated private, which would allow the road to be gated and un-authorized access could be legally denied. This is the situation for the access road to Fortune Mineral's Nico Mine in the Tlicho Region. This would be the best outcome for the Prairie Creek road in terms of controlling non-resident hunting, but the timetable of land claims discussions is uncertain.

CZN is continuing to investigate the above two possibilities because they would provide additional mitigation. Therefore, the predicted effect on harvesting pressure with operation of the proposed all season access road is dependent on the magnitude of mitigation applied. As a base, we can assume that: 1) non-resident harvests will cease in the NNPR by 2019; 2) resident harvests outside the expanded boundaries of NNPR will increase; 3) non-resident harvests outside the NNPR will occur without either of the two additional mitigation possibilities noted above; and 4) subsistence harvest levels of Moose will increase and somewhat increase for Dall's Sheep from current levels, but the overall harvest in the region will decrease after 2019. The predicted effects of this base case are summarized in Table 5.3. If the two additional mitigation possibilities are also adopted, the predicted effects on Dall's sheep for Phase 2 and on Moose reduces to low, and the overall significance is low.

Table 5-3: Project Effects on Predicted Harvesting Pressure

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Moderate	High	Low	Moderate	High
Northern Mountain Caribou	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Moose	Both	Adverse	Moderate	Moderate	High	High	Moderate	Moderate
Dall's Sheep	Phase 1	Positive	Moderate	Moderate	High	Moderate	High	Moderate
Dall's Sheep	Phase 2	Adverse	Moderate	Moderate	High	Moderate	Moderate	Moderate
Wolverine	Both	Adverse	Low	Moderate	High	Low	Moderate	High
Grey Wolf	Both	Adverse	Low	Moderate	High	Low	Moderate	High
Beaver	Both	Adverse	Low	Moderate	High	Low	Moderate	High
Marten	Both	Adverse	Low	Moderate	High	Low	Moderate	High
Overall Significance								
Low								

Confidence in this assessment is moderate since the existing and future subsistence harvest levels of Moose and Dall's Sheep by members of the Naha Dehe Dene Band are unknown. In addition, the effects assessment assumes non-resident harvests will cease in the NNPR in 2019, thereby, eliminating all existing non-resident harvests throughout much of the all season road.

The measurable parameters for harvesting pressure are the total number of hunters and trappers reported accessing the all season road (at the control gate as part of the Access Control Plan or otherwise) a year, and the belief of the Naha Dehe Dene Band members whether the all season access road supports unacceptable hunting pressure on harvest species.

Based on the predicted adverse effects from harvest pressure and the current distribution of harvesting, without additional mitigation (e.g., 1 km no-shooting corridor, private road through the Dehcho Land Claim process), the all season access road is likely to result in a low level of residual effects to Moose and Dall's Sheep. These road-related changes in harvest pressures could affect subsistence and economic wildlife resources. With the application of either additional mitigation steps discussed, no residual effects are predicted.

5.4 Effects of Direct Habitat Loss on Harvested Wildlife

The approved winter road will be used during the Mine start-up phase and early operations, at least 2 years prior to the construction of an all season road. With the alignment of the all season access road essentially the same as the winter road alignment, only an additional 9 km (approximately 18 ha) of road will be been cleared to allow for the all season road, as well as 45.34 ha for the borrow sources and their access roads, and 7.62 ha for the proposed airstrip (total 70.96 ha). A total of 9 km of new alignments from the winter road route are required to bypass boggy or wet areas that are conducive for winter road operations, but need to be avoided, to the extent possible, by the proposed all season road alignment, and to avoid most of the steep talus in upper Sundog Creek.

Effects associated with clearing the road route and winter operations of the access road (including temporary camps and bulk fuel areas) have been permitted for the life of the Prairie Creek Mine. Therefore, the remaining Project-related effects are assessed for clearing 70.96 ha of total harvested wildlife habitat for the construction of the all season access road and airstrip (Table 5-4).

The alignment of the Prairie Creek winter access road was modified from the early 1980's alignment to address concerns from the Naha Dehe Dene Band about wetland/wildlife issues, and from Parks Canada regarding re-routing around the unique polje karst features. In addition, the approved winter road was re-aligned to upland habitat on the east side the Nahanni Range to avoid bisecting Woodland Caribou and Moose habitat.

The additional footprint for the all season access road and airstrip consist of direct loss of habitat potentially occupied occasionally by the assessed species. This direct loss of habitat will occur during construction and is reversible after closure.

Although a few Northern Mountain Caribou have been observed near the all season access road, primarily in the summer, the proposed access road and airstrip lie outside their defined annual range and are not considered important habitat for the local herds. Of the additional footprints proposed within Northern Mountain Caribou habitat (e.g., Nahanni Plateau), beyond the approved winter road, an additional 4 km of road (realigned to avoid steep talus scree) and six preferred borrow sources are proposed; totalling approximately 10 ha.

Similar to Northern Mountain Caribou, direct habitat loss within Dall's Sheep range is limited to the Phase 1 development phase KP 0-32, where 4 km of the access road is realigned to avoid steep talus scree and four borrow sources are proposed. In addition, a 1 km road section and two preferred borrows through the Nahanni Range (Phase 2 KP 122.5-123.5) are proposed; however, the Nahanni Range portions of the Project traverse through lower habitat at least 500 m in elevation below the Dall's Sheep habitat. Dall's Sheep habitat in the Ram Plateau is not part of the proposed all season access road route or airstrip (nearest approximately 4 km distance).

The airstrip, a 4 km road realignment (Phase 2 KP 90.5-94.5), and the majority of the preferred borrow sources proposed are located within the boreal forest zone east of the Mackenzie Mountains to the west of the Nahanni Range. This habitat is potentially suitable for Moose, Wolverine, Grey Wolf, and Marten.

No additional clearing is required within Boreal Caribou habitat east of the Nahanni Range, except for four preferred borrow sources and a 1.5 km borrow source road (total 15.41 ha) located in upland habitat at the edge of Boreal Caribou range.

The proposed all season access road and airstrip also avoid wetlands and ponds, as much as possible, thus inherently minimizing direct effects to Beaver habitat. However, water resources may be required during the construction and operation phases of the all season access road (e.g., dust suppression), but the water sources approved for winter road construction are lakes, and the volumes approved for extraction are less than 10% of lake volume. The same sources would be used for the all season road. Beavers are sensitive to water level changes, especially in the fall and winter when they are storing and using cached food, and overwintering in lodges. Significant changes to water levels in Beaver-occupied ponds may cause abandonment.

In the design of the approved winter road, the NBDB were directly involved in plans to re-align the road to avoid areas they consider sensitive to wildlife, such as wetlands. Similarly, borrow source locations for construction of the all season road were deliberately selected inside or immediately neighbouring the road right-of-way, as much as possible. Temporary camps and transfer facilities will be located inside borrow disturbance areas, whenever possible. Therefore, mitigation has effectively been applied in the design stages to limit impacts, including direct and indirect habitat loss, disturbance to wildlife, and mortality. No further mitigation is recommended due to the re-vegetation potential upon closure.

Table 5-4: Project Effects on Predicted Harvest Species Habitat Loss

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Low	High	Low	Moderate	Moderate
Northern Mountain Caribou	Both	Adverse	Low	Low	Moderate	Low	Moderate	Moderate
Moose	Both	Adverse	Low	Low	Moderate	Low	Moderate	High
Dall's Sheep	Both	Adverse	Low	Low	Moderate	Low	Moderate	High
Wolverine	Both	Adverse	Low	Low	Moderate	Low	Moderate	High
Grey Wolf	Both	Adverse	Low	Low	Moderate	Low	Moderate	High
Marten	Both	Adverse	Low	Low	Moderate	Low	Moderate	High
Beaver	Both	Adverse	Low	Low	Moderate	Low	Moderate	Moderate
Overall Significance								
Low								

Confidence in this assessment is high since the amount of habitat directly lost is relatively low compared to the winter road, and the proportion of habitat types (or land cover class) disturbed by the Project will not exceed 20% of their total area within 100 m of the road corridor (Section 7.3.1). The measurable parameter for direct habitat loss is total footprint of the all season access road and its facilities that deviate from the approved winter road and associated facilities.

Project related effects to wildlife habitat loss is reversible following decommissioning and reclamation of disturbances. No residual effects are anticipated from the direct habitat loss.

5.5 Effects from Project-Related Wildlife Disturbances

Indirect consequences of Project-related disturbances can occur as a result of road, airstrip, and borrow source construction, operation/extraction, and closure. These indirect consequences may be in the form of avoidance of the disturbance area and surrounding habitat (i.e., functional habitat loss due to the road itself, traffic, dust), as well as altered movements (e.g., habituation and attraction), and energetics when interacting with the road, borrow source, and/or airstrip.

Avoidance

Scientific evidence suggests avoidance behaviour of land use developments is dependent on the frequency and type of human activity, visual and noise disturbances, and season. Site infrastructure (e.g., storage sheds, forklift, small crew at the TTF, electrical power generator) required for the operation of the proposed Phase 1 all season access road and the TTF remains similar to that already permitted for use of the Prairie Creek Mine winter road, except for the season of use. With the arrival of concentrate trucks, forklifts will be used to load and unload concentrate bags inside the storage sheds. Similarly, noise levels will remain the same as winter operations; estimated at approximately 99 decibels (dBA), which is similar to a highway transport truck (Golder 2010). At 0.5 km from the road, this noise level (99 dBA) is expected to reduce to 35 dBA (Golder 2010) (the level between normal speech and a whisper). Noise disturbances from the operation of the all season road differ from the winter road in temporal extent, not noise level.

With the proposed all season road, there will be a reduction in daily traffic volumes during winter operations and general site activity compared to the winter road. The Prairie Creek winter road daily traffic volume (from late November to early April) will be approximately 37 vehicles, round trip, per day.

To compare, during winter operations, the proposed all season access road Phase 1 development will include approximately six trucks making two round trips per day (total 12 vehicles, round trip, per day) (as well as year round). Therefore, the Phase 1 all season road development will significantly reduce the number of daily vehicle-wildlife interactions over the winter as a direct result of minimizing the number of trips. This is particularly important considering the winter period is a time when many wildlife species are most sensitive to disturbances.

With the development of Phase 2, 16 trucks will make a single return trip daily (total of 16 vehicles, round trip, per day or approximately 1 concentrate truck every 0.75 hours), winter and summer. This traffic volume is still considerably less than the existing Prairie Creek Mine daily winter road volumes; however, traffic volumes proposed are extended throughout the year.

Studies have indicated traffic volumes at 15 vehicles per hour (equivalent to 90 trucks, round trip, per day) affected Boreal Caribou behaviour in Newfoundland and Alaska (Anderson et. al 2002). Although there has been no studies regarding Boreal Caribou responses to low traffic roads in the NWT, the proposed traffic volumes for the Phase 1 and 2 developments (including both scenarios) are below traffic volumes that have been known to induce adverse behavioral responses in Boreal Caribou elsewhere. In contrast, studies indicate Grizzly Bears cross low traffic volume roads and do not avoid high quality habitats nearby (COSEWIC 2012a; Chruszcz et al. 2003). However, because Grizzly Bears are more likely to cross low volume roads, mortality as a result of vehicle collisions may be greater (Chruszcz et al. 2003). This is mitigated to some degree by maintaining slow traffic speeds.

Northern Mountain Caribou were found to avoid habitat within 2 km of high use roads (defined as paved or winter plowed roads) and within 1 km of low use roads (defined as dirt or gravel roads) in northern British Columbia; however, the associated traffic volumes weren't considered (Polfus et al. 2011).

The use of the Prairie Creek Mine access road by non-mine related traffic (e.g., snowmobiles, all-terrain vehicles) will be controlled to the extent possible using a check-point. As such, the potential for disturbance associated with this use can be minimized. As well, speed limits will be enforced for safety and to minimize dust. Dust accumulation along gravel roads may reduce habitat quality. The majority of the large dust particles released from the construction, operation, and closure phases of the all season road are anticipated to settle out about 10 m from its source. However, dust deposition may extend up to 100 m away from the all season access road, potentially along the alpine tundra portions of Phase 1, depending on site conditions (e.g., wind) and particle size characteristics.

The construction phase of the all season access road and airstrip is expected to generate the greatest degree of disruption, at least temporarily; however this disruption will be localized to the sites of construction and will decline into the operations phase. Overall, the daily level of visual and noise disturbances from the proposed all season access road is likely reduced from levels predicted during winter road use.

Altered Movements

Wildlife may change their movement patterns and behaviour in association with the all season access road, its associated facilities, and the airstrip, as well as its traffic, embankment characteristics, and/or plowed snow banks. Any changes in their movements are related to their sensitivity to disturbances and human-activities, as well as the level of disturbance. However, wildlife sensitivity to human-related disturbances and activities vary depending on a number of factors including the species, individual, season, and past experiences. Some species

may be wary of the all season access road (and its activities or snow banks) and hurriedly cross or deflect from crossing at that particular location. Other species may utilize the roadway as a travel corridor and habituate to human activities. For example, Boreal Woodland caribou cross low traffic roads (and other linear features, such as the existing winter road and cutlines) year round; however, cows are less likely to cross with young calves. Therefore, the all season access road itself may alter the movements of Boreal Caribou cows with calves until the route is suitably re-vegetated.

Other species, such as Red Fox, Moose, Black Bear, and Grey Wolf are likely to travel along the access road corridor. Marten are also relatively tolerant to human disturbances and activities; but tend not to cross open areas (natural or man-made) that are 200 m wide or more (Salmo Consulting Inc. et al. 2004) (wider than the proposed access road and its facilities, and airstrip).

Moose are also considered relatively tolerant to human disturbances (Salmo Consulting Inc. et al. 2004), although they may still be affected by the visual and noise disturbances from vehicle traffic and unacceptably high snow banks. Available evidence suggests moose may avoid linear features and other land use developments by 100 to 500 m depending on the season, sex, surrounding habitat, especially if hunted (Salmo Consulting Inc. et al. 2004). Moose encountering vehicles travelling on the all season road or air traffic may show minor displacement behaviour and temporarily avoid the immediate area.

In contrast, Dall's Sheep are commonly observed at and near the Prairie Creek Mine and its associated activity sites in the summer. Dall's Sheep near Phase 1 of the all season access road may be habituated to Project-related disturbances.

Traffic on the all season access road may also encounter harvest species at or travelling to mineral licks known to occur within 11 kilometres of the Mine site, Phase 1 KP 10, Phase 2 KP 151, 156, 157, the Nahanni Access Road, and along the Liard Highway. Moose (and their predators) are main users of the mineral licks along Phase 2, Nahanni Access Road, and Liard Highway. Dall's Sheep (and their predators) on the Nahanni Range may use the known mineral licks nearest to Phase 2 KP 151-157, as well as near the Mine site and Phase 1 KP 10. Dall's Sheep, particularly ewe groups (with lambs and yearlings) commonly utilize mineral licks from June to early October; during this time, they are known to habituate to human activities (e.g., consistently observed at the Prairie Creek Mine site).

Several harvest species may also become attracted to the all season access road and its facilities. Attraction to foods and other materials stored at the facilities could occur if proper handling and storage procedures are not followed. Of the selected harvest species, Wolverine, Grey Wolf, and Marten have the potential to become attracted to the access road and its facilities to gain access to food, shelter, and security (e.g., from predators, insects).

Project-related disturbances leading to avoidance and altered movements during construction, operation, and closure may have energetic consequences and, if severe in magnitude and frequency (species dependent) (Anderson et al. 2002), may lead to individual health declines and possibly population declines. Anderson et al. (2002) summarized the results of studies completed on caribou near moderate and low traffic roads. Barren-ground Caribou responded to moderate traffic volumes (defined as 15 vehicles per hour) in northern Alaska by moving faster and for a farther distance than their responses to low traffic volumes (defined as less than 1 vehicle per hour; similar to the proposed all season access road traffic volume) (Anderson et al. 2002).

Based on the available information, a small number of individual harvest animals may be expected to be present in the vicinity of the all season access road and associated infrastructure year round, and may potentially directly encounter or be disturbed by localized road and airstrip-related noise or activities. Considering the existing

indirect habitat potentially lost as a result of the existing Prairie Creek Mine winter road and its activities, the proposed all season access road is not believed to noticeably amplify these adverse effects.

To mitigate project-related wildlife disturbances, measures in effect for the winter road will be maintained throughout construction, operation, and closure of the all season road, including:

- Strict use of CZN's Controlled Road Use Plan and Waste Management Plan to minimize traffic and other disturbances, maintain low speed limits, as well as to limit wildlife attractants;
- Reporting and evaluating wildlife sightings along the access road, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered;
- Snow removal practices along the access road and airstrip to manage high snow banks, so that wildlife can readily move off as vehicles approach and aircraft flyover; and
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so, particularly when in convoy) for all wildlife seen on or immediately adjacent to the road, giving wildlife the opportunity to move off.

All general mitigation measures proposed are summarized in Section 5.10.

The predicted effect of Project-related disturbances on harvestable wildlife, after mitigation is applied, is summarized in Table 5-5.

Table 5-5: Project Effects on Predicted Project-Related Disturbances

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Moderate	High	High	Moderate	High
Northern Mountain Caribou	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Moose	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Dall's Sheep	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Wolverine	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Grey Wolf	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Marten	Both	Adverse	Low	Moderate	Moderate	High	Moderate	High
Beaver	Both	Adverse	Low	Moderate	Moderate	High	Moderate	Moderate
Overall Significance								
Low								

Confidence in this assessment is moderate since traffic volumes along the all season access road are considered low (and below sensitive species known thresholds), but the sensitivity of harvested species to development-related activities differs with a number of factors (e.g., species, season, individual, project activity). The measurable parameter for Project-related disturbances is the number of direct human encounters with dangerous wildlife, number of reports of possible wildlife attraction and habituation to the Project, and overall Project and non-Project related traffic.

Based on the predicted overall low adverse effects predicted and the current distribution of harvesting, indirect habitat loss as a result of the all season access road and airstrip are not anticipated to adversely affect current

harvesting areas and effort. With adherence to mitigation, there are no residual effects anticipated that will adversely alter current harvesting.

5.6 Risks to Harvested Wildlife from Non-Harvest Mortality

The assessment of non-traditional mortality includes vehicle collisions, increased human interactions, and defense of life/property kills. It does not include mortality as a direct result of traditional subsistence harvest and non-resident hunter harvests.

Although the risk of collisions are low, all assessed wildlife species have the potential to encounter vehicle and air traffic as well as equipment operating at the TTF during Phase 1, year round throughout the entire length of the Project. The risk to each species differs depending on their inherent behaviours, abundance along the access road and airstrip, and seasonal use of the surrounding area. During winter operations, bears will be hibernating and Northern Mountain Caribou will have primarily migrated out of the area; therefore, they are not likely to interact with the Project during this time.

Throughout the year, some species may be more reluctant to remain on the roadway and airstrip for any length of time, rather opting to quickly cross (e.g., Boreal Caribou cow with calf) and other species may selectively occupy the roadway/airstrip for travel and securing food. For example, Black Bears may be attracted to the low traffic access road, particularly in the spring when plant emergence may be earlier than in the forest, thereby increasing their risk of vehicle collisions. Similarly, bears and Wolves may use the access road to travel, putting themselves at greater risk of mortality.

Wildlife can also be reluctant to move off the roadway/airstrip or become trapped in the winter if snow banks are built up too high, although year round, the all season access road and airstrip will have low traffic volumes. Traffic during construction, operation, and closure phases pose a low risk to wildlife. Across the NWT, vehicle collisions do not pose a major threat to Boreal Caribou (Species at Risk Committee 2012). Only “very small numbers” of accidental mortality from vehicle collisions have been reported across NWT to date (Species at Risk Committee 2012). The risk of wildlife-vehicle collisions is low due to suitably slow speed limits and low traffic volumes on the road.

Wood Bison are commonly a problem along the NWT highways, often causing significant damage to vehicles and risk to human and bison themselves. Wood Bison may be encountered along the southern portion of Phase 2 of the all season access road near the Liard River, along the Nahanni Access Road, and along the Liard Highway.

Potential attraction and habituation of bears, Grey Wolf, and Wolverine to food waste, human garbage, and sewage sludge is of particular concern since this can lead to an increase of human-wildlife encounters, risk to people, and associated wildlife relocation or mortality. As outlined in the CZN (2010) DAR, individuals that are attracted to the Project and become habituated can become highly problematic for industrial camps; the mortality risk for these individuals is higher. Across the north, existing mines and camps have successfully managed wildlife attractants with monitoring and modifications as required.

Mortality of furbearers may occur during clearing activities that occur in the winter denning and natal seasons. Accidental mortality at the den sites (hibernation and natal dens) is associated with clearing activities (construction phase only); however, an encounter with dens (hibernation and natal dens) while constructing the 9 km of all season road, borrow sources, and airstrip is considered rare. Since the all season access road and borrow sources are proposed to follow or closely follow the winter road route, few animals are believed to be denning in the area.

Once the roadway is cleared, the construction of the roadbed and operation of the access road may also affect Beavers. The construction of the roadbed has the potential to alter surface water drainage, thereby altering

downstream Beaver habitat. In addition, pumping from local water sources may be required periodically during the construction and operation phases for compaction and dust suppression. Beavers are sensitive to water level changes, especially in the fall and winter. Significant changes to water levels in Beaver-occupied ponds may lead to higher risk of predation if Beavers are forced to abandon the pond or direct mortality if significant water volumes are removed in the winter.

To mitigate to risk of mortality, measures that were previously proposed for the winter access road (and TTF) will be followed (CZN 2010; Golder 2010), including, but not limited to:

- Food and food wastes and other putrescible matter will be incinerated on a daily basis and always stored in a manner inaccessible to furbearers to reduce the risk of attraction and habituation to the access road, its facilities, and the airstrip;
- Strict use of CZN's Controlled Road Use Plan and Waste Management Plan to minimize non-Project related traffic and other disturbances, as well as to limit wildlife attractants;
- Reporting and evaluating wildlife sightings along the access road, airstrip, and at the TTF (especially Black Bear, Grey Wolf, and Wolverine), and if an attractant is identified, corrective management options for waste management will be considered;
- Snow removal practices along the access road and airstrip to manage high snow banks, so that wildlife can readily move off as vehicles/air traffic approach;
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so, particularly when in convoy) for all wildlife seen on or immediately adjacent to the road, to give them time to move away.
- Develop standard aircraft procedures for flying into and departing from the proposed airstrip to accommodate wildlife, if present on or near the airstrip;
- Maintain a minimum flight altitude of 600 m during all times, except during take-off and landings;
- Bear awareness (and other dangerous species) program to ensure employees and contractors are aware and informed of the risk level on Project entry for the first time and on a regular basis;
- Similar to the Prairie Creek Mine site, a structure for reporting human-dangerous wildlife encounters at the TTF and resulting incidents to inform Mine management and ENR staff;
- A protocol for dealing with problem wildlife, with a designated chain of responsibilities for ensuring worker safety and efficient and speedy resolution of incidents;
- Annual reporting of bear observations, movements, incidents, and how incidents were resolved;
- No significant changes in water levels permitted and/or adhering to the DFO Water Withdrawal Protocol if pumping water from a known Beaver pond in the fall and winter periods; and,
- Design and construct the all season access road with suitable culvert placement and sizes to maintain natural drainage patterns.

All general mitigation measures proposed are summarized in Section 5.10.

The predicted effect of Project-related mortality on harvestable wildlife, after mitigation is applied, is summarized in Table 5-6.

Table 5-6: Project Effects on Predicted Non-Harvest Mortality

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Low	Moderate	Low	Low	High
Northern Mountain Caribou	Both	Adverse	Low	Low	Moderate	Low	Low	High
Moose	Both	Adverse	Low	Low	Moderate	Low	Low	High
Dall's Sheep	Both	Adverse	Low	Low	Moderate	High	Low	High
Wolverine	Both	Adverse	Low	Low	Moderate	Low	Low	High
Grey Wolf	Both	Adverse	Low	Low	Moderate	Low	Low	High
Marten	Both	Adverse	Low	Low	Moderate	Low	Low	High
Beaver	Both	Adverse	Low	Low	Moderate	Low	Low	High
Overall Significance								
Low								

Confidence in this assessment is high since Project-related traffic volumes are low and below sensitive species known thresholds throughout the life of the all season road, the access control plan is expected to minimize non-Project related traffic, and applicable policies and plans will manage wildlife attractants and travel across the road. The measurable parameter for Project-related mortality is the total number of wildlife-vehicle collisions and defense of life and property kills a year.

Based on the predicted overall low mortality effects predicted and the current distribution of harvesting, mortality from non-harvesting related access road effects is not anticipated to adversely affect current harvesting areas and harvest species abundance. With adherence to mitigation, there are no residual effects anticipated that will adversely alter current harvesting.

5.7 Effects on Contaminant Levels in Harvested Wildlife

For the effects assessment of the construction, operations, and closure of the Prairie Creek Mine winter access road, CZN (2010) identified mineral concentrates and diesel fuel as the primary sources of potential wildlife effects in the event of a release. Special deliveries will also be required for consumables such as explosives and mill reagents. In the event of a release to the environment, a few resident animals may be affected if they ingest plants, soils, or water potentially affected with these products. While being transported along the access road from the Mine, concentrates will be bagged securely and handled carefully to minimize the risk of rupture or spillage. Given the high value of the concentrate, great care will be taken in transport, handling, and storage procedures as necessary.

In the previous EA, CZN advised that their intention is to ensure the bags of concentrate are clean on the outside after filling and during storage and transport. Transport trucks will similarly be clean by not entering the storage shed directly, and driving through a wheel-wash before leaving site. Truck boxes will have sides and a tail-gate, and the tops will be covered by tarpaulin for secondary containment of any dust. As part of the draft Contaminant Loading Management Plan, CZN also committed to sampling the soils of the road bed in a number of locations, both before and during haul operations. The intent is to confirm that no significant concentrate dust is being emitted. Since these measures would be continued for all season road operations, we believe they represent a suitably high level of mitigation to avoid effects due to contaminant levels. CZN may also use a bulk concentrate

transport method, consisting of a container with a sealed lid. This containerized approach is expected to be no worse than bags in terms of potential concentrate releases.

In the proposed Phase 1 development, the TTF will become the main concentrate storage location. The existing concentrate storage shed at the Mine may be moved to the TTF, and additional storage sheds are proposed to add to the existing infrastructure at the TTF (or existing sheds will be removed and replaced with a larger structure). Concentrates will be stored at the TTF inside these dry storage sheds until the following winter road operation window or until Phase 2 (all season access road from the TTF to the Nahanni Access Road) is constructed the following year.

During the winter operation period, fuel will be back-hauled into the Mine directly and there will be no need for temporary storage at the TTF. Diesel fuel, other hydrocarbons, mill process chemicals, and other potential mine-related and other supplies will be delivered to the Mine in industry standard tanks, containers or consumer packages. However, a truck fueling station with a 10,000 litre storage tank in a bermed and lined enclosure may be provided so that the Mine fleet can fuel up at the TTF instead of at the Mine, thus avoiding the haul of that additional fuel into the Mine.

With the construction and operation of the proposed Phase 2 development, the concentrates stored at the TTF from the previous year and those processed at the Mine in subsequent years will be transported year round along the entire all season road, with back hauls transporting fuel and other Mine-related supplies.

Wildlife that are most at risk of adverse effects from potential contaminant inputs to the environment due to the construction and operation of the all season access road are those with smaller home ranges, year round presence (particularly overwintering), and have a large proportion of their territory within 100 m (largest predicted dust deposition zone) of the all season road. Since the risk of accidental rollover is greatest during winter driving conditions, species overwintering in the immediate area of the access road are of most concern. Based on this criteria, two of the selected harvestable species, Beaver and Marten, are most at risk as they have relatively small winter ranges and a few individuals likely occur year round near the all season access road. Larger mammals that have larger home ranges and are present on an infrequent or seasonal basis (e.g., caribou, Moose, Dall's Sheep) are less likely to be exposed to potential road-related materials.

Potential effects on vegetation and soil chemistry, and subsequently on wildlife that forage on them, may occur during construction, operation, and closure of the access road and TTF. If a spill occurs, the effects would be localized and of short duration until the spilled material is recovered. Effects on waterbodies and the wildlife they support are a primary concern in the event of accidental spills and leakage of materials, as well from dust deposition during snow-free periods.

The majority of the large dust particles dispersed from the construction, operation, and closure phases of the all season road are anticipated to settle out about 10 m from source. However, dust deposition may extend up to 100 m away from the all season access road potentially along the alpine tundra portions of Phase 1, depending in part, on site conditions (e.g., wind) and particle size characteristics. Naturally occurring heavy metals, such as cadmium are found across the NWT and have found their way into the food chain to ultimately affect the consumption of wild foods.

A current public health advisory is in effect for cadmium levels found in Moose (kidney and liver tissue only) that occur in the southern Mackenzie Mountains and the Liard/Mackenzie river valleys. Similarly, caribou kidney and livers collected from the Southern Mackenzie Mountains also have high levels of naturally occurring cadmium; however, these levels remain safe for human consumption. Dall's Sheep metal levels are also high, but at levels suitable for consumption. Low but reportable concentrations of cadmium are also found in the kidney and livers of Beaver collected from the Slave River and Mackenzie deltas (INAC 2004).

Cadmium is naturally present across the NWT, and finds its way into the food web from the weathering of rocks and subsequent plant uptake (INAC 2004). Cadmium may be released further into the environment from dust deposition from the all season access road in the spring, summer, and fall. Existing concentrations of cadmium and other heavy metals are still considered low and are not considered harmful to wildlife or to the people eating them (with the exception of the Moose kidney and liver tissue public health advisory).

The GNWT (1998) dust suppression guidelines will be implemented at the TTF and along portions of the road and airstrip, as appropriate, to reduce dust generation during the snow free months. This will generally involve watering dust-prone areas as and when required, as well as adhering to speed limits on roads, which helps limit the re-suspension of particulate material.

Similarly, the Phase 1 road development within the Mackenzie Mountains include portions of steep terrain, as does the Phase 2 road development over the Silent Hills. Accidental rollover, particularly during winter months, poses the greatest risk for accidental release. An all season road will mean much less traffic in winter.

Appropriate materials management systems, spill contingency procedures (including truck driver training in spill response), dust management procedures, and transport safety procedures will be in place to minimize the risk of dust deposition, accidental spills or leakage, including rollovers, and subsequent cleanup of spills, should they occur. The existing spill management plan will be reviewed and improved, as necessary, prior to road and airstrip operation.

To mitigate to risk of possible contamination of harvest resources, measures that were previously proposed at the Prairie Creek Mine and winter access road (and its facilities) will be followed (CZN 2010; Golder 2010), including, but not limited to:

- Implement appropriate materials management systems to minimize the risk of accidental spills or leakage of concentrate, diesel fuel, other hydrocarbons, and other hazardous materials being shipped to the Mine site;
- Diligent management of dust along the access road, airstrip, and transfer facilities following the dust management plan;
- Follow the existing draft Contaminant Loading Management Plan and soil sampling along the road bed both before and during haul operations;
- Implement a winter driving policy requiring tire chains to be used on haul trucks in the mountains (KP 0-29) to increase traction; and
- Finalize and train staff on the existing spill management plan and procedures to quickly respond to an accidental spill. This plan will include provision for rapid deployment of cleanup crews and for contaminant and clean-up of spilled material and contaminated surfaces.

All general mitigation measures proposed are summarized in Section 5.10.

The predicted effect of Project-related effect on contaminant levels in harvestable wildlife, after mitigation is applied, is summarized in Table 5-7.

Table 5-7: Project Effects on Predicted Harvest Species Contaminant Levels

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Low	High	Low	High	High
Northern Mountain Caribou	Both	Adverse	Low	Low	High	Low	High	High
Moose	Both	Adverse	Low	Low	High	Low	High	High
Dall's Sheep	Both	Adverse	Low	Low	High	Low	High	High
Wolverine	Both	Adverse	Low	Low	High	Low	High	High
Grey Wolf	Both	Adverse	Low	Low	High	Low	High	High
Marten	Both	Adverse	Low	Low	High	Low	High	High
Beaver	Both	Adverse	Low	Low	High	Low	High	High
Overall Significance								
Low								

Confidence in this assessment is moderate since the risk of Project-related effects on contaminant levels in wildlife are predicted to be low with adherence to mitigation; however, existing contaminant levels in many harvest species remains unknown. No residual effects resulting from Project-related wildlife contamination are anticipated. Since no residual effects are anticipated, and the natural levels of heavy metals are known to occur in harvestable species at varying concentrations across the north, no measurable parameter for Project-related effects to the consumption quality of harvest species is proposed.

Based on the predicted overall low risk of contaminant related effects, the proposed all season access road is not anticipated to contribute to the consumption quality of harvest species.

5.8 Effects to Predator-Prey Relationships of Harvested Wildlife

Although not the only predator in the region, Grey Wolves are considered the primary predator of adult ungulates in the Dehcho. A number of other predators (e.g., Grizzly Bear, Golden Eagle), prey on ungulate calves and Beavers. Densities of predators in the Dehcho are generally unknown. Grey Wolf densities are considered relatively high near Trout Lake; however, they are unknown near the all season access road. Aerial surveys conducted for the Prairie Creek Mine and access road infrequently detected Grizzly Bear, Wolverine, and Golden Eagle in the area.

Predation can be a significant factor in determining prey abundance and distribution. To minimize the risk of encountering a predator, prey species have evolved several strategies such as remaining solitary or in small groups, occupying habitats where alternate prey densities are low, and birthing in isolation near protective cover. Human developments, such as roads, may challenge prey strategies and alter predator behavior. Some predators (e.g., bears, wolves) use roads for travel, a strategy that increases prey encounter rates (Anderson et al. 2002) and, therefore, predation risk to harvested species. For example, the Species At Risk Committee (2012) identified that Boreal Caribou are at greater risk of predation and harvesting if they occur within 400 m or of a road or seismic line. With the approved winter road development, the proposed all season road and airstrip will not significantly alter predator travel.

Predation can also be a major source of ungulate calf mortality, which can have a direct effect on the populations (Anderson et al. 2002). Possible Dall's Sheep lambing areas exist within approximately 1 km from Phase 1 KP 2, 3, and 7. These sections of the all season access road currently exist as all season quality from past construction and access road approvals. Therefore, the proposed all season access road is not anticipated to alter existing predation that may possibly occur on Dall's Sheep lambs. Similarly, the access road has been re-aligned

specifically to avoid sensitive wildlife areas (identified by the Naha Dehe Dene Band members) and wetlands. The proposed airstrip and all season access road includes approximately 10 km of new vegetation clearing west of the Nahanni Range, outside designated Boreal Caribou range.

Predator-prey dynamics may be altered after a forest fire or human disturbance (e.g., the all season access road). In particular, Moose favour these early regenerating habitats and respond with increasing populations, thereby, correspondingly increasing their predators' populations. Large blocks of forests at the proposed airstrip location and along the all season access road are in various stages of regeneration after fires in the 1940s, 1970s and 1990s. In the north, Boreal Caribou prefer forests at least 100 years old and, in comparison, Moose are thought to benefit from young forests less than 30 years of age. Therefore, based on the fire history of the local area, regenerating habitats are aging beyond Moose preferences (youngest known burn area is approximately 25 years old). As the regenerating habitats age, this level of predator-prey dynamic should eventually be restored to pre-existing disturbance levels.

Similarly, human disturbances may attract predators seeking food and shelter, thereby increasing encounter rates with prey near areas of human activity. Predators, such as Red Fox, Wolverine, Grey Wolf, and bears have been known to source food from litter, people purposely feeding, and unsecure containments.

Mitigation for possible adverse effects to the predator-prey relationships have been incorporated into the design of the airstrip and all season road by locating the proposed infrastructure on or near existing disturbances, and re-aligning the all season road around important wetlands and wildlife areas. Additional mitigation includes:

- Managing the small portion of the winter road not used for the all season access to prevent predator and non-Project related travel of the corridor, if necessary; and,
- Implementing a waste management plan that prohibits littering, purposely feeding wildlife, and storing attractants accessible to wildlife.

All general mitigation measures proposed are summarized in Section 5.10.

The predicted effect of clearing an additional approximately 10 km of airstrip and access road on the predator-prey dynamics, after mitigation is applied, is summarized in Table 5-8.

Table 5-8: Project Effects on Predicted Harvest Species Predator-Prey Relationships

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Boreal Caribou	Phase 2	Adverse	Low	Moderate	High	High	Moderate	High
Northern Mountain Caribou	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Moose	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Dall's Sheep	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Wolverine	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Grey Wolf	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Marten	Both	Adverse	Low	Moderate	High	High	Moderate	Moderate
Beaver	Both	Adverse	Low	Moderate	High	High	Moderate	Low
Overall Significance								
Low								

Confidence in this assessment is high since the amount of clearing for the realignment of the all season road (three road sections, each less than 4 km in length) is negligible compared to the approved winter road and outside sensitive Boreal Caribou defined range. It is not plausible to measure effects to predator-prey dynamics as a direct result of the all season access road and airstrip considering its direct association with the existing winter road corridor.

With adherence to mitigation, no residual effects resulting from Project-related effects to predator-prey dynamics is anticipated.

5.9 Effects to Traditionally Harvested Plants

5.9.1 Berries and Medicinal Plants

Given the differences in structural diversity and community composition associated with the vegetation community types present within the study area, it is anticipated that these vegetation community types will vary substantially with respect to the availability and abundance of materials utilized by the local human community. Such uses are assumed to include the harvest of plants for traditional medicinal use and the harvest of berries for human consumption.

Based on the review of applicable literature (Cambell and Luckert 2012) it is understood that berry harvesting represents an important food source for local Aboriginal communities and offers a substantial economic offset. Based on 1997 values, a per capita replacement cost of $201.14 was calculated for blueberries harvested by the Nahanni Butte community. It can be assumed that such replacement costs have increased when considering inflation and the likelihood of an increasing human population.

Given that the full range of traditional uses of local vegetation species for medicinal and consumption purposes, and preferred areas for harvesting such species cannot be appropriately quantified as part of this assessment, Tetra Tech's approach for assessing potential project related impacts to traditionally important plant species was conducted by examining potential effects to the landscape supporting such species, rather than a detailed account of potential effects to a specific plant or group of plants. This approach allows for a quantifiable determination of habitat loss relative to the CZN study area. This approach assumes that all vegetation communities within the study area are of equal importance with regards to traditionally important plant species; however, as previously discussed, vegetation community types within the CZN study area likely vary in their relative importance with respect to the harvest of traditionally important plants given differences in species diversity and site productivity.

Negative, direct project related effects to habitat potentially capable of supporting traditionally important plants will occur as a result of project development which will require the removal of surface vegetation; however, these effects will be partially mitigated by limiting the amount of new disturbance required for construction by constructing the majority of the all season road within the confines of the approved winter road route. The approved winter road will be fully cleared of woody vegetation prior to construction of the all season road, with the exception of 9 km of additional clearing located outside of the approved winter road route.

The extent of direct effects will be confined to the constructed road right of way (maximum 20 m wide) and the footprint of borrow areas and the airstrip, which will be limited in frequency to once during project construction. For Phase 1 of the all season road, surface area encompassed by the road surface will be 85.6 ha, while Phase 2 will encompass 89.4 ha. The footprint area for both phases of the project, including the road footprint, borrow areas, borrow access roads, camps and the airstrip is 236.5 ha. Based on the calculated areas for EOSD land cover classes present within the 100 m wide study area, the proportion of land cover classes disturbed by each phase of the project will not exceed 20 % of the respective land cover class area.

It is expected that project related effects to traditionally important plants will be reversible following decommissioning and reclamation of proposed disturbances. Based on the rating criteria used for this assessment, the significance of direct project related effects to vegetation communities capable of supporting traditionally important plants is anticipated to be low. Following reclamation, no residual effects to traditionally important plant species are anticipated.

Negative, indirect effects to habitats potentially capable of supporting traditionally important plants would be anticipated to occur primarily during the operations phase of the project. During this time period, vehicle operation along the roadway has the potential to generate road dust which, based on the review of applicable literature (summarized in Section 7.3.5), has the potential to alter physical and chemical properties present in off-site vegetation communities, and therefore, potentially altering the health and vegetation composition of such sites. Similarly, the potential for spills of deleterious substances associated with vehicle use of the roadway during operation (and construction) may affect vegetation communities in a similar manner, as well as resulting consequences to the suitability of traditionally important plants for human consumption. The extent, magnitude and duration of such effects are considered moderate given the potential for off-site effects to traditionally important plants during the operational phase of the project. Frequency of effects would be considered moderate as potential effects will occur at regular intervals throughout the operational phase of the project; however, a low volume of traffic is anticipated during operation of the roadway. Any such indirect effects are considered reversible assuming adherence to appropriate mitigation standards.

A third potential indirect consequence of road construction may include the introduction of invasive plant species. Such species have the potential to alter the community composition of off-site vegetation communities and out-compete desirable native vegetation species. The extent, magnitude and duration of such effects are considered moderate given the potential for off-site effects to traditionally important plants during the operational phase of the project. Frequency of effects would be considered moderate as potential effects may occur at regular intervals throughout the operational phase of the project. Any such indirect effects are considered reversible assuming adherence to appropriate mitigation standards.

A positive consequence of road construction would be the improved access to areas of plant harvesting proximal to the road.

The following mitigation measures are recommended to reduce or eliminate potential indirect project related effects to traditionally important plants:

- Dust suppression strategies (e.g., water or approved dust suppressant products) in accordance with the GNWT dust suppression guidelines;
- Preparation of an Emergency Response Plan for spill containment and management along the access road;
- Fuel storage facilities that meet industry standards for tank construction, location and spill containment;
- Hydrocarbon and chemicals that are hauled along the access road or stored at the TTF are in industry standard containers with appropriate spill containment and management measures in place; and
- Development and implementation of an invasive species management plan to ideally prevent, or if necessary, control the establishment of invasive species in off-site vegetation communities adjacent to the roadway.

With adherence to the mitigation measures described above, the significance of indirect project related effects to traditionally important plants is anticipated to be low. No residual effects to traditionally important plant species are anticipated as a result of the project.

5.10 Traditional Harvesting Mitigation and Best Management Practices

The general mitigation and best management practices considered for the proposed all season access road include previous commitments for the approved winter access road (CZN 2010; Golder 2010), together with specific measures for the proposed all season access road. Proposed mitigation and best management practices include the development and/or implementation of the following:

- A no hunting policy for all Project employees and contractors while working and/or at the Mine site;
- CZN's Controlled Road Use Plan;
- Suitable speed limits on the Prairie Creek All Season Road;
- Discourage use of engine retarder breaks;
- A winter driving policy requiring tire chains to be used on haul trucks in the mountains (Phase 1 KP 0-29) to increase traction;
- A wildlife and wildlife habitat mitigation and monitoring plan that includes annual engagement with members of the Naha Dehe Dene Band to monitor measureable parameters of effects;
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so, particularly when in convoy) for all wildlife seen on or immediately adjacent to the road, to allow them to move away;
- Policy that all Project-related transportation activities are to give the right-of-way to any wildlife that such activity may encounter;
- Develop standard aircraft procedures for flying into and departing from the proposed airstrip to accommodate wildlife, if present on or near the airstrip;
- Maintain a minimum flight altitude of 600 m during all times, except during take-off and landings;
- Dust suppression strategies (e.g., water or approved dust suppressant products) in accordance with the GNWT dust suppression guidelines;
- Follow the existing draft Contaminant Loading Management Plan and soil sampling along the road bed both before and during haul operations;
- An education program of wildlife related policies and mitigation to all Project employees and contractors, including a bear awareness program to ensure employees and contractors are informed of bears and other potentially dangerous wildlife and the level of risk;
- Policy for all Project employees and contractors to avoid all known or suspected den and nest sites;
- An alert system to warn personnel of Woodland Caribou and other sensitive wildlife in the local area by relaying sighting information to vehicles/aircraft and equipment operators and on-site personnel;
- Wildlife record logs to be completed by all Project employees and contractors for all wildlife sightings (e.g., Dall's Sheep, caribou, Wood Bison, and carnivores) with respect to species, location along the access road and airstrip, numbers observed, and reaction to Project activity. If a problem area is identified, corrective measures will be considered.

- ENR's Woodland Caribou Best Management Practices for Industrial and Commercial Activities (once developed) to be incorporated into the wildlife monitoring program, where feasible, to manage or mitigate habitat impacts and sensory disturbances on Woodland Caribou;
- Snow removal practices along the access road and airstrip to manage high snow banks, so that wildlife can readily move off as vehicles/aircraft approach;
- A structure for reporting human-dangerous wildlife encounters at the TTF and resulting incidents to inform Mine management and ENR staff;
- A protocol for dealing with problem bears, with a designated chain of responsibilities for ensuring worker safety and efficient and speedy resolution of incidents;
- A Waste Management Plan that prohibits littering, purposely feeding wildlife, and storing attractants accessible to wildlife. Incinerate all waste foods and human garbage consistent with current industry good management practices to minimize wildlife attraction to the local area. Adaptive management will be applied to waste management practices. If wildlife are found to be attracted to the site (i.e., problem wildlife) additional management practices, if required, will be adopted;
- An Emergency Response Plan for spill containment and management along the access road;
- Fuel storage facilities that meet industry standards for tank construction, location and spill containment;
- Appropriate materials management systems to minimize the risk of accidental spills or leakage of concentrate, diesel fuel, other hydrocarbons, and other hazardous materials being shipped to the mine site. This includes ensuring hydrocarbon and chemicals that are hauled along the access road or stored at the TTF are in industry standard containers with appropriate spill containment and management measures in place;
- Staff training on the existing spill management plan and procedures to quickly respond to an accidental spill. This plan to include provision for rapid deployment of cleanup crews and for contaminant and cleanup of spilled material and contaminated surfaces;
- Managing the small portion of the winter road not used for all season access to prevent predator and non-Project related travel of the corridor, if necessary;
- Preservation of natural drainage patterns along the haul road to maintain the natural function and processes of peatland habitats adjacent to the haul road;
- A policy to avoid significant changes to water levels while pumping water from a known Beaver pond in the fall and winter periods;
- Maintain sufficient buffer distances between development activities (e.g., re-fuelling and material storage) and waterbodies, where possible;
- Non-mine vehicles, including all-terrain vehicles (ATVs) and snowmobiles will be prohibited on site;
- Pets will be prohibited along the all season access road; and
- Development and implementation of an invasive species management plan to ideally prevent, or if necessary, control the establishment of invasive plant species in off-site vegetation communities adjacent to the roadway.

6.0 EFFECTS ASSESSMENT – NAHANNI NATIONAL PARK RESERVE

The NNPR is Canada's third largest national park, encompassing over 30,000 km^2 and approximately 85 km of the proposed all season access road route. This assessment of potential effects related to upgrading of the current approved winter access road to an all season road addresses wildlife and vegetation valued components present inside the NNPR (activities summarized in Table 2-1). In accordance with their MVLWB and Parks Canada Land Use Permits and Water Licences, CZN is authorized to construct and operate a winter road that generally follows the same route as the historical winter road access constructed in 1981/82. These authorizations permit the clearing of the winter access road, which will occur at least 2 years prior to the construction of this proposed all season road.

The alignment of the Prairie Creek winter access road has already been modified to address concerns from the Naha Dehe Dene Band about wetland/wildlife issues, and from Parks Canada regarding re-routing around the unique polje karst features. Effects associated with clearing the road route and winter operations of the access road have been permitted for the life of the Prairie Creek Mine. All but 9 km (or 18 ha) of clearing along the all season access road is required beyond that approved under the winter road; 8 km (or 16 ha) will be within the NNPR boundary, along with the airstrip (7.62 ha), borrow sites (18.18 ha) and their access roads (0.80 ha), and the 2 ha expansion of the TTF. Therefore, the remaining Project-related effects are assessed for the removal of 42.60 ha of harvested wildlife habitat along the access road and airstrip within the NNPR during winter clearing activities.

The goals of the Park Management Plan are to maintain the quality of the land, water, air, and wildlife, while expanding visitor experience and encouraging the discovery of NNPR to visitors and respecting traditions and cultural values. To do so, Parks Canada has developed species monitoring measures (e.g., population density, composition, occupancy) that provide a general assessment of the parks ecological integrity. Of these, Parks Canada monitors Species at Risk, forest bird communities, Grizzly and Black bears, Moose, Northern Mountain Caribou, Dall's Sheep, and Trumpeter Swan (Parks Canada et al. 2009).

Diverse and abundant wildlife populations, especially Parks Canada's ecological indicators, are also symbols of Canadian wilderness and of a healthy ecosystem, and are important for visitors. The Project effects assessment focuses on selected wildlife species currently monitored inside NNRP. In the assessment, the geographical scope of any potential effects to wildlife within the NNPR must be sufficient to assess potential impacts at a local population level, with due consideration to seasonal and migratory movements, and lifecycle requirements of each species.

The temporal scope of the effects assessment includes activities during the construction, operation, and closure phases considered to potentially pose the greatest adverse effects, as well as times when selected wildlife species are most sensitive to human disturbances and the duration of potential effects with relation to the operational life of the access road. Table 6-1 summarizes the selected species for the assessment of potential Project-related effects to NNPR, the geographical and temporal scopes, and the rationale for our selection.

The all season access road and airstrip are located outside the defined annual ranges of the Boreal and Northern Mountain caribou occurring within the NNPR; however based on modeling and aerial and ground-based surveys along the proposed road, the Nahanni Complex and Redstone Northern Mountain caribou occur in low numbers, primarily in the summer in the Nahanni Plateau, the lower Sundog Creek drainage, west of the Ram Plateau, and the Silent Hills. Therefore, Boreal Caribou are not part of this effects assessment to NNPR.

Table 6-1: Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Selection
Northern Mountain Caribou	Nahanni Complex summer range	Winter Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Listed as Special Concern under SARA (2005), but assessed as Secure under the NWT ▪ Requires substantially large home range, mostly outside the zone of influence of the all season access road and airstrip ▪ Sufficient population information is known on the Nahanni Complex herd within NNPR upon which to base the effects assessment ▪ Sensitive to human disturbances ▪ Monitored by Parks Canada in the NNPR to assess the general ecological integrity of the park. Caribou herds considered in decline
Moose	NNPR	Winter Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Secure in the NWT ▪ Population density estimates known around Nahanni Butte and southeast portion of the NNPR ▪ Monitored by Parks Canada in the NNPR to assess the general ecological integrity of the park
Dall's Sheep	NNPR	Project components, year round Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Secure in the NWT ▪ Potential lambing areas located within 1 km of Phase 1 KP 2, 3, and 7. Similarly the Nahanni Range and Ram Plateau provide suitable lambing areas. ▪ Those with ranges isolated from the larger Mackenzie Mountain population considered most sensitive to disturbance ▪ Most sensitive to disturbances on their winter ranges, in the eastern fringe of Nahanni Plateau and Nahanni Range north of the access road. ▪ Mineral licks visited from early June to October. ▪ Monitored by Parks Canada in the NNPR to assess the general ecological integrity of the park.
Mountain Goat	NNPR	Winter Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ May Be At Risk in the NWT, and not assessed by COSEWIC ▪ Their Nahanni Range distribution is isolated from the core Mackenzie Mountain range ▪ Generally sensitive to human disturbances, particularly while on their winter range

Table 6-1: Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Selection
Grizzly Bear	NNPR	Spring, summer, and fall Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Assessed as Special Concern by COSEWIC and ranked as Sensitive in the NWT ▪ Requires substantially large home range ▪ Sufficient population information is known within NNPR to assess effects ▪ Generally sensitive to human disturbances during the non-denning periods ▪ Monitored by Parks Canada in the NNPR to assess the general ecological integrity of the park. Population considered stable in NNPR
Trumpeter Swan	NNPR	Spring, summer, and fall Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Not At Risk in Canada and ranked as Sensitive in the NWT ▪ Small localized population found only inside NNPR within the NWT ▪ Summer breeder representative of other waterfowl species ▪ Monitored by Parks Canada in the NNPR to assess the general ecological integrity of the park
Harlequin Duck	NNPR	Spring, summer, and fall Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Ranked as May Be At Risk in the NWT ▪ Small localized population known inside NNPR approximately 135 km northwest of the Prairie Creek Mine ▪ No population information known in the NWT ▪ Sensitive to human disturbances in the summer
Common Nighthawk	5 km from Project	Summer and fall Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Listed as Threatened under SARA and ranked as At Risk in the NWT ▪ No population information known in the NWT ▪ Maintains small territories that vary in size depending on habitat quality and nest site availability ▪ Late spring arrival and early fall departure from the NWT

Table 6-1: Selected Assessment Species and Geographical and Temporal Scopes

Species	Geographic Scope	Temporal Scope	Rationale(s) for Selection
Olive-sided Flycatcher	1 km from Project	Summer Project components Entire life of the access road (road closure 6 years after Mine closure (approx. 2036)	▪ Listed as Threatened under SARA and ranked as At Risk in the NWT ▪ Maintains small territories ▪ Only present in the NWT from late May to early August ▪ No population information known in the NWT

Species not included in the NNPR effects assessment are unlikely to interact with the Project in substantial numbers due to their low densities across the region (e.g., Short-eared Owl), are generally numerous (e.g., Marten) and their habitats common across the Dehcho (e.g., Rusty Blackbird), not considerably susceptible to Project-related disturbances (e.g., Collared Pika, Bank and Barn swallows), and effects may be addressed by the assessment of another species (e.g., Wolverine effects largely covered through the Grizzly Bear effects assessment). Table 6-2 summarizes the rationale. A concentrated determination of effects to species not selected for the NNPR effects assessment is provided in Section 7.0.

Table 6-2: Rationale for Species Not Selected for Assessment

Species	Rationale(s) for Exclusion from the NNPR Effects Assessment
Collared Pika	▪ Little information is known about their distribution and abundance within NNPR to develop the effects assessment ▪ Not considerably susceptible to Project-related disturbances, except at small localized areas
Boreal Caribou	▪ NNPR lies outside the defined range of Boreal Caribou, although they may rarely occur west of Nahanni Range into the NNPR
Wood Bison	▪ Generally numerous and their population is increasing, and not found in the NNPR along the road alignment ▪ Relatively tolerant to road related disturbances
Wolverine	▪ Effects and mitigation largely inferred through the Grizzly Bear effects assessment ▪ Naturally occur in low densities and over large home ranges depending on prey abundance
Myotis species	▪ All three species Ranked as May Be At Risk in the NWT and Little Brown Myotis and Northern Myotis assessed as Endangered by COSEWIC ▪ Not considerably susceptible to Project-related disturbances since the all season access road avoids karst topography, which may support important bat overwinter hibernacula ▪ No population information known in the NWT to develop the effects assessment
Horned Grebe	▪ Not considerably susceptible to Project-related disturbances since the all season access road avoids wetlands as much as possible
Peregrine Falcon	▪ Not considerably susceptible to Project-related disturbances since 95% of the all season access road routes at least 1.5 km from potential cliff nesting habitat ▪ Relatively tolerant to road related disturbances
Yellow Rail	▪ No known observations of Yellow Rails occurring within or the NNPR or Dehcho region ▪ Not considerably susceptible to Project-related disturbances since the all season access

	road avoids wetlands as much as possible ▪ Fluctuating annual breeding distribution based on water levels, therefore difficult to assess for effects
Short-eared Owl	▪ Irruptive distribution and fluctuating density which is difficult to assess for direct Project-related effects
Bank and Barn Swallow	▪ Not considerably susceptible to Project-related disturbances. Project-related effects may be positive, as both species occupy human-made nesting substrates
Rusty Blackbird	▪ Habitat considered common across the Dehcho ▪ Not considerably susceptible to Project-related disturbances since the all season access road avoids wetlands as much as possible
Western Toad	▪ Little information is known about their distribution and abundance within NNPR to develop the effects assessment

Based on the scope of this report, the NNPR effects assessment is restricted to wildlife and vegetation related effects outlined in the TOR, including:

- Ecosystem and habitat loss;
- Wildlife habitat fragmentation and barriers to movement and gene flow;
- Ability of habitat or species to recover;
- Changes to wildlife and vegetation species distribution and abundance;
- Invasive species; and,
- Ecosystem functioning.

6.1 Ecosystem and Habitat Loss

As part of proposed project activities, habitat loss within the NNPR will occur as a direct result of vegetation clearing to accommodate the proposed all season road access route and other associated infrastructure (e.g., borrows and camp locations). It is anticipated that such effects will be mitigated by constructing the proposed all season access road within the ROW of the approved winter access road, which will limit the amount of additional clearing required for construction of the project.

Effects to the relative abundance of habitat types within the NNPR as a result of project development were quantified by comparing the mapped vegetation community types (EOSD Cover Units) present within the study area to the proposed project disturbance footprint. Table 6-3 presents the anticipated habitat loss within the NNPR as a result of proposed project construction. For comparative purposes, Table 6-3 also presents the area of each respective EOSD cover type within the project study area, which for the purpose of this assessment encompasses a 50 m buffer surrounding proposed project related disturbances.

Table 6-3: Summary of Terrestrial Ecosystems Potentially Disturbed by Project Construction within the NNPR

EOSD Land Cover Class	Phase I Road Area (ha) *	Phase II Road Area (ha) *	Airstrip Area (ha)*	Borrow Site Area (ha)*	Borrow Site Access Road Area (ha)*	Tectela Transfer Facility (ha)*	Cleared Area Outside of Winter Road Route (Phase I) (ha)*	Cleared Area Outside of Winter Road Route (Phase II) (ha)*
Broadleaf-dense	3.43	5.82	0.00	1.63	0.00	0.00	0.00	0.45
Broadleaf-open	0.11	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Bryoids	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coniferous-dense	6.38	1.96	0.00	1.01	0.06	0.35	0.00	1.19
Coniferous-open	17.30	1.43	0.00	2.93	0.36	0.00	2.01	0.92
Coniferous-sparse	2.77	0.10	0.00	0.90	0.07	0.00	0.09	0.13
Exposed land	11.38	0.00	7.62	3.39	0.00	0.00	0.52	0.00
Herb	0.05	0.00	0.00	0.00	0.00	0.00	0.00	
Mixedwood-dense	5.14	5.15	0.00	2.81	0.00	1.65	0.00	2.05
Mixedwood-open	0.51	0.01	0.00	0.00	0.00	0.00	0.00	0.02
Rock/rubble	5.77	0.00	0.00	1.93	0.00	0.00	0.00	0.00
Shadow	1.58	0.00	0.00	0.78	0.00	0.00	0.00	0.00
Shrub-low	11.42	0.00	0.00	2.57	0.31	0.00	1.34	0.00
Shrub-tall	1.68	0.05	0.00	0.10	0.00	0.00	0.00	0.00
Water	0.29	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Wetland-shrub	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Wetland-treed	0.00	1.79	0.00	0.04	0.00	0.00	0.00	0.00
Total	**68.49**	**16.36**	**7.62**	**18.18**	**0.80**	**2.00**	**3.96**	**4.78**

*- Values rounded for reporting purposes

The proposed disturbance area encompassed by the road surface (Phase I and Phase II combined) and other proposed disturbances within the NNPR will be 117.5 ha. Based on the calculated areas for EOSD land cover classes present within the 100 m wide study area, the proportion of land cover classes disturbed by the project will not exceed 20% of the respective land cover class area.

Given the low proportion of habitat loss relative to available habitat within the study area and the mitigation of project related effects by reducing clearing requirements by constructing within the approved winter road route, the extent, magnitude, duration and frequency of potential project related effects are considered low, and reversible following decommissioning and reclamation of project related disturbances. The overall significance of effects with respect to habitat loss within the NNPR is considered low and no residual effects are anticipated as a result of project construction.

6.2 Effects on Wildlife Habitat Fragmentation and Movement

The NNPR encompasses the majority of the South Nahanni River watershed, a large naturally diverse area that allows for natural ecological processes. The current level of habitat fragmentation inside the NNPR is very low

and limited to the 1980's Prairie Creek Mine winter road that has naturally re-vegetated, the approved winter access road, and the visitor trails, campgrounds, and park stations, as well as natural forest fires.

The approved winter access road will be constructed at least 2 years prior to the proposed all season road. Once the winter access is constructed, an additional 8 km of right-of-way is proposed to be cleared inside the NNPR (an additional 1 km outside the park boundary), plus an airstrip (7.62 ha) and preferred borrow sources (18.98 ha, including a borrow source access road). The preferred borrow sources are proposed directly within the road right-of-way, as much as possible, and require limited access. Of the preferred borrow sources proposed within the NNPR, only one (1) requires an access road. This borrow pit access road (400 m in length) is proposed as a temporary winter access route near Phase 1 KP 47.

Habitat fragmentation may occur as a direct result of realigning 8 km of the all season access road, developing a single borrow source located off the existing road right-of-way, and the airstrip. Little habitat fragmentation will occur as a result of the proposed borrow sources since all but one borrow is directly connected to the approved winter road. Therefore, the all season access road, one borrow and its access road, and airstrip modestly increases habitat fragmentation beyond the existing winter access.

As fragmentation increases, the integrity of the habitat is reduced leading to changes in species diversity and localized movements; however, some species are considered more sensitive to habitat fragmentation than others. For instance, Salmo Consulting Inc. et al. (2004) report Moose populations appear to be more sensitive to overharvesting and other sources of mortality than compared to habitat loss and fragmentation. In contrast, Boreal Caribou (ranges outside the NNPR) are considered one of the most sensitive to linear disturbances.

As a measure of habitat integrity, linear corridor densities were estimated across the Dehcho in the Dehcho Cumulative Effects Assessment. Mapped linear corridor densities (e.g., seismic line and roads) along the all season access road within NNPR was <0.6 km/km^2 (Phase 1 and portions of Phase 2), with isolated patches consisting of older cutlines near the southern terminus of the access road outside the NNPR boundary at a density of 0.6-1.0 km/km^2.The mapped linear corridor density in the NNPR is the lowest density mapped, and is well below the Dehcho Land Use Planning Committee's (ND) cautionary threshold (1.0 km/km^2), which represents the lowest threshold at which development, upon reaching it, should be required to monitor impacts. The proposed all season access road, borrow sources, and airstrip will not significantly increase habitat fragmentation beyond the existing winter access road.

Habitat fragmentation outside the boundaries of NNPR is equally low, with several proposed NWT Protected Areas Strategy areas of interest and Draft Interim Dehcho Land Use conservation zones that permit regional wildlife movements.

Forest fires inside NNPR also lead to habitat fragmentation, and influence habitat availability and effectiveness for species. Within the area of the all season access road and airstrip, several large scale forest fires have occurred since the 1940's that have encompassed areas east of Nahanni Range, the Tetcela River and Fishtrap Creek valleys, and along the polje by-pass re-alignment. Accidental Project-related ignition of forest fires has the potential to occur along the length of the all season access road and at the airstrip. However, the access road clearing can also act as a fire break, as was the case on the Ram Plateau near Mosquito Lake.

For boreal forest birds (e.g., Olive-sided Flycatcher and Common Nighthawk) the effects of habitat fragmentation are generally unknown; however, habitat models suggest that the effects of habitat loss are far greater than increasing fragmentation (AXYS 2001). Along the all season access road and airstrip, available habitat for Olive-sided Flycatcher and Common Nighthawk (as well as other boreal forest birds) is not limiting, and movements across the proposed developments are not likely to be adversely altered.

Wildlife may change their local movement patterns and behaviour once disturbed by the all season access road, its facilities, and airstrip, as well as its traffic, embankment characteristics, and/or plowed snow banks. Any changes to their movements are directly related to their sensitivity to disturbance levels and human-activities. Wildlife sensitivity to human-related disturbances and activities vary depending on a number of factors including the species, individual, season, and past experiences. Some species may be wary of the all season access road (and its activities or snow banks) and hurriedly cross or deflect from crossing at that particular location. Northern Mountain Caribou, Moose, Dall's Sheep, and Grizzly Bear may alter their movements in response to the proposed road, airstrip, and their traffic; however, Grizzly Bear may be the most sensitive to the proposed all season access road and may show a higher degree of reluctance to cross. Although, the degree of reluctance varies, and CZN has observed grizzlies walking along the existing all season road several times in the Prairie Creek and Sundog Creek valleys. In the mountainous section (approximately Phase 1 KP 0-33) within Grizzly Bear, Northern Mountain Caribou, and Dall's Sheep range the road currently exists as all season quality.

The sensitivity of Grizzly Bears to roads is dependent on the existing degree of fragmentation, traffic volumes, season, gender, and surrounding habitat quality. Salmo Consulting Inc. et al. (2004) suggested traffic volume was the most important predictor of Grizzly Bear movements across roads. Therefore, it is important to maintain low traffic volumes (such as 16 concentrate trucks, per day (equivalent to 1 concentrate truck approximately every 0.75 hours), which is proposed along the all season access road) throughout the life of the Project.

Weaver (2006) indicated a large area in the Mackenzie Mountains, approximately 25 km north of the all season road, as having the largest expanse of high to very high predicted Grizzly Bear densities. Based on Weaver's (2006) predicted bear density map, the all season access road from KP 0 to 39 crosses perpendicular with potential bear movements while travelling to this predicted high use area. Low traffic volumes proposed are not expected to inhibit Grizzly Bear population recovery, since studies indicate Grizzly Bears (both sexes) cross low traffic volume roads (COSEWIC 2012a; Chruszcz et al. 2003; Salmo Consulting Inc. et al. 2004).

Harlequin Ducks are also sensitive to human-related disturbances. Within the forested zone, the approved winter road, and therefore, the all season access road travels parallel with and crosses 4 km of the Sundog Creek tributary, which is possible Harlequin Duck habitat (Phase 1 KP 37-41). Although traffic along the all season access road will parallel possible Harlequin Duck habitat, it will not substantially alter Harlequin Duck movements.

In contrast, Dall's Sheep are commonly observed at and near the Prairie Creek Mine and its associated activity sites in the summer. Dall's Sheep near Phase 1 of the all season access road may be habituated to Project-related disturbances. In addition, the all season access road is located at least 500 m below possible Mountain Goat habitat along the Nahanni Range and outside the defined range of Northern Mountain Caribou, and is not anticipated to significantly affect goats and caribou.

The all season access road (estimated at 20 m wide right-of-way) and the airstrip are not considered a full barrier to wildlife movement. They are permeable, year round, to all species assessed since the proposed developments remain narrow and Project-related traffic volumes are low. With only the proposed Phase 1 development, a total of approximately six trucks, averaging 30 km/hr, will make two return trips daily from the Mine to the TTF. With the development of Phase 2, 16 Project-related trucks averaging 30 km/hr, will make a single return trip daily from the Mine to the Liard Transfer Facility (LTF).

Northern Mountain Caribou, Moose, Dall's Sheep, and Mountain Goats travel several kilometres to reach mineral licks. During this time, they may encounter the proposed all season access road, as mineral licks are known within 11 km of the Mine site, Phase 1 KP 10, Phase 2 KP 151-157, the Nahanni Access Road, and along the Liard Highway. No mineral licks are known near the proposed airstrip. Dall's Sheep, particularly ewe groups (with lambs and yearlings) commonly utilize mineral licks from June to early October; however, they are also known to

habituate to human activities since they are consistently observed at the Prairie Creek Mine site. Since the traffic volumes are low, the all season access road is not considered a barrier to movements.

Forest clearing (resulting in a small level of habitat fragmentation) will occur during winter construction of Phases 1 and 2 and the airstrip, and is reversible after closure. Besides designing the all season access road and borrow source locations to follow the already permitted winter road corridor and right-of-way, no further mitigation associated with habitat fragmentation is recommended. Potential effects to wildlife movements will occur principally during construction and operation.

The use of the Prairie Creek Mine access road by non-mine related traffic (e.g., snowmobiles, all-terrain vehicles) will be controlled to the extent possible using a check-point. As such, the potential for disturbance associated with this additional use can be minimized or avoided. As well, suitable speed limits will be enforced to minimize disturbances.

To mitigate project-related wildlife disturbances, measures recommended to minimize effects from the winter road will be continued from construction to closure of the proposed all season road and airstrip, as well as additional measures specific for all-weather use. These include:

- Strict use of CZN's Controlled Road Use Plan to minimize traffic and other disturbances and maintain low speed limits;
- Reporting and evaluating wildlife sightings along the access road, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered;
- Snow removal practices along the access road and airstrip to manage high snow banks, so that wildlife can readily move off the roadway as vehicles approach;
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road to allow them to move away.
- Discuss main issues and considerations regarding wildlife populations and effects during the Technical Advisory Committee meetings proposed by CZN in EA0809-002; and
- Report annual updates and results of the Wildlife Mitigation and Monitoring Plan, Controlled Road usage, and inspections and enforcements.

All general mitigation measures proposed are summarized in Section 6.10.

With adherence to the mitigation, the predicted effects to habitat fragmentation and barriers to movements is summarized in Table 6-4.

Table 6-4: Project Effects on Predicted Habitat Fragmentation and Movement

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Northern Mountain Caribou	Both	Adverse	Moderate	Moderate	Moderate	Low	Moderate	High
Moose	Both	Adverse	Low	Moderate	High	Moderate	Moderate	Moderate
Dall's Sheep	Both	Adverse	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Mountain Goat	Both	Adverse	Low	Moderate	Moderate	Low	Moderate	High
Grizzly Bear	Phase 1	Adverse	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Trumpeter Swan	Both	Adverse	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Harlequin Duck	Phase 1	Adverse	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Common Nighthawk	Both	Positive	Low	Moderate	High	Moderate	Moderate	High
Olive-sided Flycatcher	Both	Positive	Low	Moderate	High	Moderate	Moderate	High
Overall Significance								
Low								

Confidence in this assessment is moderate since the amount of habitat fragmentation within the area of the proposed clearing is low (considering the majority of clearing has been approved for the winter road) and select species are expected to infrequently encounter the access road and airstrip (e.g., naturally low species densities, large home ranges, seasonal distribution). However, species' sensitivity to disturbances vary depending on a number of biotic and abiotic factors including season, gender, and harvesting pressure. The measurable parameter for Project-related disturbances is the number of Project-related encounters with wildlife and overall Project and non-Project related vehicle traffic recorded at the check-point annually.

Overall, the predicted adverse effects are moderate, but reversible after the Mine's life. With adherence to mitigation, there are low residual effects of low significance anticipated that will adversely alter local wildlife movements in NNPR

6.3 Effects on Wildlife Species Distribution and Abundance

Species avoidance and abundance effects from Project-related disturbances can occur as a direct result of road and airstrip construction, operation, and closure activities, as well as indirectly by providing hunting access. These consequences may range from minor to strong avoidance. In areas without hunting, avoidance to roads is either non-existent or very temporal in nature (Jalkotzy et al. 1997).

The use of the Prairie Creek Mine access road by non-mine related traffic will be controlled to the extent possible using a check-point and a private Liard River barge crossing. With these controls, potential effects can be minimized. However, subsistence harvesting activities along the road may directly change wildlife abundance along the access road, and if significant, may cause wildlife to avoid the road. These potential effects may also occur during the period of winter road operation before the all season road.

A few Northern Mountain Caribou may occasionally occur near the proposed all season access road and airstrip on an annual basis; however, these proposed developments are located outside their defined range. Northern Mountain caribou may occur on the Nahanni Plateau, the lower Sundog Creek drainage, west of the Ram Plateau, and the Silent Hills primarily during the non-winter period. Disturbance related effects on Northern

Mountain Caribou are considered low since the all season access road is not part of their core range (including their calving and primary winter range), and consequently, they may occur infrequently in the area. If present, Northern Mountain Caribou are likely to avoid the proposed access road and airstrip. Traditional knowledge and the Species at Risk Committee 2012 indicate that roads may affect Boreal Caribou as far as 1 km away (Species at Risk Committee 2012). Northern Mountain Caribou are assumed to be as sensitive to roads as Boreal Caribou. However, their exposures to Project-related disturbances are expected to be limited and sporadic, and traffic levels are low, infrequent, and predictable, particularly during operation, thereby minimizing potential disturbances.

The proposed all season access road and airstrip are located primarily in low elevation habitats, approximately 500 m below possible Mountain Goat habitat on the Nahanni Range. Further, on the Ram Plateau, possible Mountain Goat habitat is located at least 4 km from the proposed access road route and airstrip, and therefore, goats are not likely to be disturbed. Roads are thought to affect Mountain Goats within a 400 m zone of influence and aircrafts within 1 km (AXYS 2001). Subsistence harvests of Mountain Goats are negligible and are not expected to alter Mountain Goat distribution and abundance. In addition, non-resident harvests are expected to be terminated inside NNPR by 2019. Mountain Goats are generally reluctant to move from their mountain blocks and, therefore, their distribution and abundance across the landscape is expected to change little over time as a result of the access road, airstrip, and negligible hunting pressure.

In Kluane National Park, Moose are relatively tolerant of roads, aircraft, and related disturbances, and the predicted zone of influence to which Moose were adversely affected by roads and aircraft was approximately 100 and 200 m, respectively (AXYS 2001). Other available evidence suggests moose may avoid linear features and other land use developments by 100 to 500 m depending on the season, sex, surrounding habitat, and hunting pressure (Salmo Consulting Inc. et al. 2004). Linear features, such as the approved winter road, may disturb Moose that have home ranges along its length.

Since subsistence Moose harvesting is permitted inside NNPR (non-resident harvests to terminate by 2019), Moose may avoid the proposed all season access road and airstrip by 500 m or more, depending on the level of hunting pressure (less avoidance distance if negligible to low hunting pressure). This has the potential to directly affect Moose abundance in a localized area. Mr. Konisenta indicated to CZN (2010) that Moose harvesting was common along easily accessible corridors; however, Moose numbers have dwindled, and are now rarely found along these same easy access routes. Mr. Konisenta attributes this partly to the introduction of bison to the area; however, hunting pressure is also a likely root cause.

By managing hunting pressure, Moose avoidance and abundance affects along the proposed all season access road may be minimized. For example, a Boreal Caribou study modelled potential habitat use (including buffer distances from roads and cutlines) and compared this with known lifetime harvest kill sites and aerial survey sightings across the Dehcho. This study indicated that Boreal Caribou distribution has remained stable at the regional level within living memory (approximately 60 years) even with hunting (Gunn et al. 2004).

Dall's Sheep sensitivity to roads and aircraft in Kluane National Park was determined to be low, with the predicted zone of influence reaching as far as 200 and 500 m, respectively (AXYS 2001). Like Mountain Goats, Dall's Sheep are generally reluctant to move from their mountain block, and therefore, their distribution across the landscape changes little over time as a result of land use developments. A few Dall's Sheep have traditionally been harvested annually from the Nahanni Range in proximity to Nahanni Butte (outside NNPR). Although none are apparently harvested now, the proposed all season access road allows access for Dall's Sheep subsistence harvesting inside the NNPR in the Mackenzie mountains which has the potential to reduce the resident population. However, boat access to Dall's Sheep inside the NNPR via the South Nahanni River exists, with low hunting pressure to date.

In Kluane National Park, Grizzly Bears were found to be the least tolerant of road-related disturbances (AXYS 2001). It was suggested Grizzly Bears are adversely affected 3 km from roads in the fall and 500 m in the spring

and summer (AXYS 2001). Even on a seasonally closed road (such as a winter only road) the zone of influence was approximately 600 m, and when the road re-opened, the zone of influence increased to 1,200 m (AXYS 2001). Therefore, the proposed all season access road has the potential to affect Grizzly Bear distribution, particularly for those bears with home ranges within the Mackenzie Mountains, as the boreal forest zone generally represents the periphery of individual home ranges that are less frequently occupied. CZN's recorded anecdotal sightings suggest the numbers of grizzlies in the immediate area is low (as expected for species with large home ranges), and those present are currently not perturbed by the road. This may change with the all season traffic, but note that the road from KP 0-33 is of all season quality already and is likely to be utilized in non-winter seasons for maintenance related to the winter road permits, thus any impacts to grizzly distribution may have occurred prior to the all season road. As such, Grizzly Bear distribution is not likely to be significantly affected by the all season road.

Trumpeter Swans are also highly sensitive to human activities and developments while at their breeding ponds (ESRD 2013). Intense or sustained levels of disturbances near active breeding ponds during the breeding season may result in nest loss, clutch failure, increased predation to young, and abandonment of the entire pond (ESRD 2013). Even low level repeated disturbances over time may result in reduced use or abandonment (ESRD 2013). As a result of their sensitivity, ESRD recommends all permanent or long-term developments (including roads) avoid habitat occupied by Trumpeter Swans by 500 m (ESRD ND). Breeding Trumpeter Swans have been observed primarily in the wetlands and ponds in the Tetcela River valley and at Yohin Lake, as well as near Phase 1 KP 64 (Mosquito Lake) and 75. Known or suspected Trumpeter Swan ponds and wetlands along the proposed all season access road are outside the recommended 500 m buffer, except at Phase 1 KP 64 (Mosquito Lake) and 75. Additional wetlands occupied by Trumpeter Swans may also occur within this 500 m buffer, particularly at Phase 1 KP 65.5 and Phase 2 KP 86 and 98. Although the proposed all season access road has been re-aligned to avoid wetlands and ponds, as much as possible, potential adverse effects to a few territorial Trumpeter Swans is of moderate magnitude and moderate likelihood of effect. However, their willingness to relocate will depend on the timing of disturbances. Upon spring arrival, Trumpeter Swans may select available territorial ponds further from the access road due to the low but regular traffic volumes, thereby, avoiding road-related disturbances during the sensitive nesting and rearing periods.

Harlequin Ducks and their habitat may be sensitive to traffic related disturbances and susceptible to dust-related changes to water pH and invertebrate abundance and diversity. Considerable disturbances at the nest site may lead to site abandonment. However, potential nesting habitat is limited near the proposed all season access road and the probability of occupation is low.

The proposed all season access road is not likely to affect Common Nighthawk and Olive-sided Flycatcher distribution and abundance. Both species may occupy the proposed roadway while feeding, and prefer forest clearings and habitat edges found along the access road and airstrip. Common Nighthawks have been known to nest and forage in and near human developments, and may eventually show some degree of tolerance.

Predation can also be a significant factor in determining prey abundance and distribution. Prey species have evolved several strategies such as remaining solitary or in small groups, occupying habitats where alternate prey densities are low, and birthing in isolation near protective cover to minimize the risk of encountering a predator. The integrity of prey species habitat plays a critical role in their strategies to avoid predation risk. Roads and other human developments decrease the integrity of habitats and increase predation risk to ungulates since predators may use roads to travel faster and access new habitats. However, in the subalpine and alpine zones where Northern Mountain Caribou and Dall's Sheep occur, access roads provide less advantage to predator travel. Similarly, in the boreal forest zone, the approved winter access road currently supports predator travel.

CZN's intent is to work with the Naha Dehe Dene Band to discourage use of the full access road by non-residents. CZN will be able to impose rules for its employees and contractors, but does not have jurisdiction to impose rules on others. Although, Parks Canada regulations for NNPR stipulate that "existing roads in NNPR are

restricted access only and are not open to the public for motorized use", with exception for Aboriginal people pursuing their traditional harvesting rights (Parks Canada 2013), thereby resulting in the exclusion of non-Project related and non-Aboriginal travel along approximately 51% of the all season access road. CZN also proposes to operate a private barge on the Liard River, which will not be available for non-resident use.

These potential effects can be mitigated by implementing the following:

- Strict use of CZN's Controlled Road Use Plan to minimize traffic and other disturbances and maintain low speed limits;
- Follow dust suppression strategies (e.g., water or approved dust suppressant products) in accordance with the GNWT dust suppression guidelines;
- Prohibit pumping water from ponds occupied by Trumpeter Swans during the nesting period;
- Educate staff and contractors on CZN's wildlife policies;
- Reporting and evaluating wildlife sightings along the access road and airstrip, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered;
- Report annual updates and results of the Wildlife Mitigation and Monitoring Plan, Controlled Road usage, and inspections and enforcements; and
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road, to allow them to move away.

All general mitigation measures proposed are summarized in Section 6.10.

The predicted effects on wildlife distribution and abundance in NNPR is summarized in Table 6-5.

Table 6-5: Project Effects on Predicted Species Distribution and Abundance

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Northern Mountain Caribou	Both	Adverse	Low	Moderate	Moderate	Low	Moderate	Moderate
Moose	Both	Adverse	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Dall's Sheep	Both	Adverse	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Mountain Goat	Both	Adverse	Low	Moderate	Moderate	Low	Moderate	High
Grizzly Bear	Phase 1	Adverse	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Trumpeter Swan	Both	Adverse	Moderate	Moderate	High	Moderate	Moderate	Moderate
Harlequin Duck	Phase 1	Adverse	Moderate	Low	Moderate	Low	Moderate	High
Common Nighthawk	Both	Positive	Low	Low	Moderate	Moderate	Moderate	Moderate
Olive-sided Flycatcher	Both	Positive	Low	Low	Moderate	Moderate	Moderate	Moderate
Overall Significance								
Moderate								

Measureable parameters are the number of key species (e.g., Grizzly Bear, Dall's Sheep, Moose, Trumpeter Swan) recorded along the all season access road and airstrip (similar to the camp logs) to assess the percent occupancy of species. Parks Canada (2009) uses a similar approach to monitoring Grizzly Bears observed by park visitors. This approach does not provide a measure of relative abundance, but it does provide a relative index of distribution and the number of human-wildlife encounters. In addition, the annual traffic volume reported at the check-point provides a relative measure of disturbance levels.

Confidence in this assessment is moderate since the level of non-Project related traffic is unknown but assumed to be restricted to a few local subsistence harvesters. Overall, low residual effects are anticipated.

6.4 Effects on Vegetation Species Distribution and Abundance

As significant effects to the relative abundance of terrestrial ecosystems within the NNPR are not anticipated as a result of the project, it can be reasonably assumed that the distribution and abundance of characteristic or 'common' vegetation species associated with these habitats are not likely to be significantly affected by project activities. However, populations of rare plants, which can be characterized by limited spatial distribution, limited size and/or limited densities, can be particularly vulnerable to disturbance.

Based on the results of an NWT ENR virtual herbarium database search, 16 vascular plants species, one lichen species and 13 bryophyte species currently ranked as 'may be at risk'; one vascular plant species ranked as 'sensitive' and one vascular plant species ranked as 'undetermined' by the NWT General Status Ranking Program have been historically identified within a 50 km radius of the CZN study area, the closest occurrence being located 5 km from the CZN study area.

Of the species identified as part of the ENR database search, two species (Nahanni aster and Raup's willow) are currently considered globally imperiled (G2 global status ranking – NatureServe 2014) and one species (Velenovsky's hilpertia moss) is considered critically imperiled (G1 global status ranking – NatureServe 2014), the closest occurrence of these species being located approximately 20 km from the CZN study area.

Rare plant surveys related to the Prairie Creek Mine Project and associated winter access road were initiated by EBA on behalf of CZN in July 2009, and further surveys were completed in August 2010 (EBA 2010; 2011).

In July 2009, rare plant surveys were conducted along the Prairie Creek Mine winter road; the proposed waste rock storage facility; and the area around camp and the beaver pond to the south.

A total of 340 plant observations, representing 193 species and 44 families of vascular plants, were documented during the 2009 field survey. No plant species listed within the federal SARA were observed in the surveyed areas. However, one plant species, few flower meadow rue (*Thalictrum sparsiflorum*), listed as 'May Be At Risk' (ENR 2014b), was documented along the Prairie Creek winter road and an adjacent wetland. As the species appears locally abundant within the study area, conversion of the winter road to an all season access is unlikely to threaten the viability of this species locally, considering confirmed observations were identified outside of the proposed development footprint.

Two additional plant species ranked as 'May Be At Risk' by the ENR were identified along the existing winter access road (Hornemann willowherb *Epilobium hornemanni* and linear-leaved willowherb *Epilobium leptophyllum*), have restricted distribution in the NWT with limited known occurrences, but are globally secure (Golder 2010). Six plant species ranked as 'Sensitive' by the ENR—alpine anemone (*Anemone drummondii*), bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atrosquama*), one-glume spike rush (*Eleocharis uniglumis*) alpine groundsel (*Packera pauciflora*) and yellow mountain heather (*Phyllodoce glanduliflora*) — identified adjacent to the Prairie Creek winter road have small regional distributions in the NWT with a small number of known occurrences, but are globally secure. It was concluded that impacts to these local occurrences

(and potential additional occurrences near the access road) can be avoided or reduced by limiting the amount of additional land disturbance for upgrades and operation of the all season access road.

In August 2010, the proposed Polje By-Pass re-alignment was surveyed for unique or important vegetation communities and rare plants. The habitat in which the proposed Polje By-Pass re-alignment traverses was burned by a forest fire in 1996. The vegetation community now comprises a jack pine regeneration stand approximately 14 years old. No rare plants or sensitive habitats were documented within the jack pine regeneration along the proposed Polje By-Pass alignment. It was concluded that this proposed re-alignment would not threaten rare plants or sensitive vegetation communities (EBA 2011).

Based on the findings of the ENR database search and results of the rare plant surveys conducted, the extent, magnitude, duration and frequency of potential project related effects to rare plant species resulting from conversion of the approved winter access road to an all season road are characterized as low and reversible. The overall significance of effects to rare plants within the NNPR is considered low. No residual effects to rare plants are anticipated assuming appropriate application of mitigation strategies related to indirect project effects resulting from dust generation, spills and the introduction of invasive species.

6.5 Effects from Invasive Wildlife Species

Invasive wildlife species are non-native species introduced into areas beyond their natural range by humans and are capable of causing harm to the environment and outcompeting native species. To date, there are no known invasive wildlife species present in the NWT.

However, alien wildlife species, are native species that have been introduced beyond their natural ranges due to their natural dispersal from surrounding provinces or territories. Example alien wildlife species to the NWT include the House Sparrow (*Passer domesticus*) and European Starling (*Sturnus vulgaris*).

Alien wildlife species, such as the House Sparrow and European Starling, expand their distributions into new ranges and out-compete desirable native wildlife. Preferred House Sparrow habitat includes human settlements in which it remains year round. House Sparrows are reported in the communities of Fort Simpson and Fort Liard; however, there are no known reports in Nahanni Butte and the NNPR (Sullivan et al. 2009). House Sparrows are known to outcompete native bird species from suitable nest sites. Similarly, the European Starling, preferring to remain year round, occurs in and near human settlements with a component of open, grassy areas. They are relatively aggressive birds and outcompete for nesting cavities. One European Starling was observed near Rabbitkettle Lake inside the NNPR, and there have also been a few observations near the communities of Fort Liard and Fort Simpson (Sullivan et al. 2009).

Construction of the approved winter access road may already increase the range extension of invasive wildlife species such as the House Sparrow and European Starling into areas not currently occupied (or assumed to not be occupied). The winter access road will be cleared at least 2 years prior to the construction of the all season access road; therefore, the all season access road will not pose any additional adverse effects to native species from the expanded distribution of alien wildlife.

Potential effects from invasive wildlife species as a result of the all season access road and its associated infrastructure and activities will remain similar to baseline winter road conditions. Mitigation measures are not considered necessary, beyond the general mitigation and best management practices (refer to Section 6.10).

Confidence in this assessment is high since the all season access road route will be cleared and alien wildlife (e.g., European Starling) has already been recorded inside the NNPR. Overall, predicted effects from alien wildlife species expansion into the NNPR on boreal forest birds is negligible to low. No residual effects are anticipated.

6.6 Effects from Invasive Vegetation Species

Invasive plants have the ability to aggressively establish and quickly spread in new environments. These adaptations coupled with their ability to out compete native species can affect plant species richness, diversity, and the composition and function of affected natural ecosystems (Haber 1997). The successful introduction and colonization of an area by invasive plant species relies, in part, on the presence of suitable habitat, access to a source of invasive plant material, and a means of dispersal.

The disturbances associated with development projects can unintentionally create growing conditions that facilitate the successful establishment of invasive plants. Exposed soil resulting from the removal of plant cover is particularly susceptible to colonization. Dirty equipment transported to site from other areas can act as a dispersal mechanism for invasive plant propagules that may have become lodged in tires and mud.

The most effective management of invasive plants is preventing their establishment into an area (Carlson and Shephard 2007; Schrader and Hennon 2005; USDA 2006; Polster 2005; Clark 2003). Removal once established is more costly and can be particularly challenging logistically in more remote northern areas.

In August 2010 EBA completed an invasive plant survey and reclamation assessment along the existing Prairie Creek Mine access road, and a rare plant survey along the proposed and now approved road re-alignments (EBA 2011). Surveys were conducted from August 9 to 13, 2010. The study area for these surveys included that section of the access road occurring within the boundaries of the expanded Nahanni National Park Reserve.

No invasive alien plant species were documented along the portions of the access road surveyed; consequently, they are not believed to be an issue at this time.

The Prairie Creek Mine site and existing winter access road have been in place since 1982, and Mine-related heavy equipment is already on site. In the future, any new equipment would be brought in along the access road on trucks or tractor trailer units. Similarly, Mine supplies and fuel will be brought in along the access road. Invasive plants are usually brought into a site (or along an access road) through dirty vehicles or heavy equipment operating during the non-winter period, when seeds of invasive plants can more readily be mixed with mud or dirt on vehicles or equipment, and then fall off along a road way or at a work site.

The risk of invasive species introduction during the construction and operation of Phase 1 (which occurs within the NNPR) of the all season access road will be minimal, as all equipment and vehicle traffic associated with this phase of the project will be brought into the site during the winter months. Operations during the summer construction season would be within a closed system, which is the time period that is most conducive to the spread and establishment of invasive species. The risk of invasive species introduction will increase upon completion of Phase 2 of the project which would allow for the transport of vehicles and equipment during the summer months, and thereby increase the potential for transport of invasive species into the study area. It is recommended that an invasive species management plan be developed prior to project construction to determine appropriate best management practices with respect to the prevention of invasive species establishment and invasive species control. The invasive species management plan should be developed in consultation with applicable stakeholders to ensure proposed mitigation efforts comply with existing regulations which may potentially limit the application of specific invasive species control measures (e.g. use of herbicides in National Parks).

The use of seed mixes for re-vegetation of disturbance areas may also introduce invasive species. Given this risk, CZN's approach (as defined in EA0809-002) for re-vegetation of disturbed areas will rely primarily on encroachment of native species from surrounding vegetation communities.

Given the low anticipated traffic volumes anticipated for the all season road and the application of additional mitigation strategies (which should include an invasive species management plan) the extent, magnitude, duration and frequency of potential effects from invasive species introduction are considered low and reversible.

Overall, the significance of effects from invasive plants is expected to be low. No residual effects are anticipated assuming the appropriate application of mitigation strategies

6.7 Effects on the Ability of Wildlife Species to Recover

Effects at individual and wildlife population levels are known to incur with increasing human developments and activities. Habitat loss and fragmentation, changes to movements and behaviour, and mortality are key examples of development-related effects that, if significant, have the potential to adversely affect the condition of species.

Minimizing habitat loss and fragmentation and avoiding sensitive wildlife areas and unique landscapes identified by the Naha Dehe Dene Band and Parks Canada were fundamental in the routing design of the winter road, and thus the all season access road. Similarly, limiting Project-related disturbances and traffic-wildlife encounters are inherent in the Project operations design. Wildlife-Project encounters, which have the potential to alter wildlife movements and increase mortality, are anticipated to occur most intensely during the construction and operation phases. At Project closure (approximately six years after Mine closure), Project-related wildlife encounters will be significantly reduced and habitats will be recovering, permitting the recovery of species populations.

Species, such as Grizzly Bear and Northern Mountain Caribou that have large annual ranges, low reproductive rates, and/or have specialized needs are often considered to have low ecological resilience and are less likely to recover from unacceptable effects (Salmo Consulting Inc. et al. 2004). A certain level of available habitat is required to maintain viable populations in a given land base. Grizzly Bears are believed to require at least 1,000 ha of available habitat (minimum patch size) (Salmo Consulting Inc. et al. 2004).

Grizzly Bears are known to have relatively low resilience (COSEWIC 2012). In NNPR, an expansive area that is predicted to support high to very high Grizzly Bear densities occurs approximately 25 km north of the all season access road (Weaver 2006). This area was suggested to be particularly important to support a viable grizzly population. Parks Canada estimated that 665 Grizzly Bears are currently present in the NNPR, and suggest 500 bears are required to maintain a viable population (Parks Canada et al. 2009; Weaver 2006).

Northern Mountain caribou have relatively low reproductive rates, are forage specialists, and have relatively high calf mortality. The proposed all season access road and airstrip are located outside the defined range of the caribou herds occupying NNPR. ENR (2014) explained that “trace occurrences” of Northern Mountain caribou are known in the area east of the Mine site to the Nahanni Range. Consequently, the all season access road is not located within a core caribou area. The proposed Project will not affect the ability of Northern Mountain caribou herds to recover as only a small portion of the herd is expected to be infrequently exposed to the proposed Project.

Species such as Moose respond quickly during habitat recovery, as twin births are common after forest fires or human disturbances (e.g., clear-cuts). Forest renewal after habitat disturbance and natural fire cycles will promote Moose recovery.

Other species, such as small mammals, have the highest ecological resilience as they mature early, have high reproductive rates, and are habitat and/or food generalists (Salmo Consulting Inc. et al. 2004).

The proposed all season access road will include a 4 km re-alignment within the boreal forest zone and an additional 4 km re-alignment in the Nahanni Plateau subalpine tundra (plus an additional 1 km outside park boundaries). Although the proposed all season access road may directly affect 4 km of boreal forest bird habitat within the NNPR, only a fraction of the regional populations will be exposed to the Project-related habitat loss and activities, and adverse

Project-related encounters as a result of traffic are considered inconsequential at the population level. Therefore, the Project is not anticipated to change the ability of boreal forest bird species present within NNPR to recover.

Trumpeter Swans have a relatively low resilience since they will not re-nest if a clutch is lost, have specific breeding and staging habitat requirements, and delayed maturity (ESRD 2013). The proposed all season access road mainly avoids wetlands and ponds, particularly those in the Tetcela River valley where breeding Trumpeter Swans concentrate. However, the access road alignment runs adjacent to the shoreline of Mosquito Lake, where "a few swans" (assumed to be Trumpeter Swans) were observed during the June 2006 aerial survey. Any Trumpeter Swan potentially breeding at this lake, and any other large pond within approximately 500 m of the all season access road, may be adversely disturbed by Project activity. Since Trumpeter Swans are territorial during the nesting season, it is likely that a single pair will occupy a breeding lake (ESRD 2013); therefore, minimizing the number of individuals affected for a given wetland disturbance. Although the proposed all season access road may affect a few Trumpeter Swans, it is not expected to adversely alter their ability to recover since the proposed road routes at least 500 m away from most core breeding ponds.

Potential Harlequin Duck nesting habitat is extremely limited near the proposed all season access road. Although Harlequin Ducks and their habitat are particularly sensitive to human-related disturbances, the likelihood of their occurrence near Project-related activities is low.

At a landscape level, species that occur in isolation from other larger populations are less resilient, have less ability to recover, and are less likely to persist over time. The long term maintenance and viability of a population is a balance between individuals removed from a population (e.g., dispersal, mortality) and those introduced (e.g., immigration and birth) (AXYS 2001).

Although infrequent, Dall's Sheep dispersal to new ranges has been reported, particularly involving young rams, although adult ewes have also been documented dispersing (Simmons 1982). Dall's Sheep occupying the Nahanni Range and Ram Plateau are spatially isolated from larger populations on the Nahanni Plateau and Mackenzie Mountains; however, infrequent dispersal is anticipated.

Similarly, The Ragged Range near the Yukon border was identified as core Mountain Goat range; however, smaller discontinuous, occupied areas exist along the South Nahanni River (Wilson and Haas 2012). Although Mountain Goats were not observed during the Prairie Creek Mine and access road aerial surveys, defined Mountain Goat range near the all season access road occurs along the Nahanni Range as well as further north onto the Ram Plateau and south onto the Headless Range. Mountain Goats, primarily juvenile males have been reported dispersing up to 93 km. Mountain Goats possibly occurring on the Nahanni Range and Ram Plateau are not completely isolated from the other populations along the South Nahanni River, and dispersal likely occurs.

Possible dispersal corridors for Dall's Sheep and Mountain Goats are unknown; however, preferred routes of travel may include the South Nahanni River and creeks with suitable canyons and steep topography. Nonetheless, the all season access road mainly travels parallel to potential dispersal corridors, and is not expected to impede dispersing individuals. In addition, low traffic volumes will be maintained which should minimize wildlife-vehicle encounters during operations.

Mitigation to possible changes in species ability to recover have been incorporated into the design of the all season road and its operations by routing it in direct association with the winter road, re-aligning around important wetlands and wildlife areas (where possible), and maintaining low traffic volumes. The following additional mitigation is proposed:

- Strict use of CZN's Controlled Road Use Plan to minimize traffic and other disturbances and maintain low speed limits;

- Prohibit pumping water from ponds occupied by Trumpeter Swans during the nesting period;
- Educate staff and contractors on CZN's wildlife policies; and
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so, particularly when in convoy) for all wildlife seen on or immediately adjacent to the road, to allow them to move away.
- Discuss main issues and considerations regarding wildlife populations and effects during the Technical Advisory Committee meetings proposed by CZN in EA0809-002; and
- Report annual updates and results of the Wildlife Mitigation and Monitoring Plan, Controlled Road usage, and inspections and enforcements.

All general mitigation measures proposed are summarized in Section 6.10.

The predicted effect from the proposed all season access road on wildlife species' ability to recover, after mitigation is applied, is summarized in Table 6-6.

Table 6-6: Project Effects on Predicted Ability of Wildlife Species to Recover

Species	Road Phase(s)	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Certainty
Northern Mountain Caribou	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Moose	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Dall's Sheep	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Mountain Goat	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Grizzly Bear	Phase 1	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Trumpeter Swan	Both	Adverse	Moderate	Moderate	High	Low	Moderate	Moderate
Harlequin Duck	Phase 1	Adverse	Moderate	Low	High	Low	Moderate	High
Common Nighthawk	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Olive-sided Flycatcher	Both	Adverse	Low	Moderate	High	Low	Moderate	Moderate
Overall Significance								
Low								

Confidence in this assessment is high since the proposed all season access road is not located in core habitat, traffic volumes are low, and access control will be implemented. A measurable parameter is the number of key species (e.g., Grizzly Bear, Dall's Sheep, Moose, Trumpeter Swan) recorded along the all season access road to assess the percent occupancy of species. This approach does not provide a measure of relative abundance, but it does provide a relative index of distribution and the number of human-wildlife encounters. In addition, the annual traffic volume reported at the check-point provides a relative measure of avoidance.

With adherence to mitigation, there are no residual effects restricting the recovery of species.

6.8 Effects on the Ability of Habitat to Recover

It is understood that the all season access road will be reclaimed within six years of the closure of the Prairie Creek Mine site. As part of the reclamation objectives for the project, it is anticipated that re-vegetation of the roadway, borrow sources and other disturbances associated with the development of the all season access road will occur primarily through encroachment of native species from surrounding vegetation communities.

A reclamation assessment of the original winter road was conducted by EBA (EBA 2011) to assess the progress of natural reclamation (re-vegetation) of the roadway. Based on the findings of the assessment, it was determined that natural re-vegetation of the roadway was occurring and species composition on the roadway was reflective of species present in adjacent undisturbed habitats. Given the similarity of habitats between the original winter access road and the proposed all season access road, it can be reasonably assumed that reclamation of disturbances along the proposed all season access would progress along a similar trajectory as the original winter road, assuming efforts are made to re-establish and/or maintain conditions on disturbed sites that are conducive to the re-establishment of native vegetation species.

As part of the DAR prepared for the approved winter road access, CZN has committed to constructing road infrastructure in accordance with standard industry best practice, including guidelines described in the *Northern Land Use Guidelines: Access Roads and Trails* (INAC 2008). It is anticipated that adherence to such practices will assist natural re-vegetation and re-establishment of disturbed habitats within the project area. All best management practices, including the salvage of topsoil, erosion control measures, and the maintenance of the existing hydrological regimes (using appropriately placed culverts or other methods) should be determined prior to construction.

Assuming adherence to standard industry best practices during construction, the extent, duration and frequency of potential project related effects to the ability of disturbed habitats to recover are considered low and reversible.

Overall, the significance of effects is expected to be low. No residual effects are anticipated assuming the appropriate application of mitigation strategies.

6.9 Ecosystem Functioning – Wildlife and Vegetation

Tetra Tech's scope of work for this assignment was limited to the assessment of potential project related effects to wildlife and vegetation resources, including potential effects to these resources within the confines of the NNPR. As such, discussion of potential effects to ecosystem functioning within the NNPR as part of this report is limited specifically to wildlife and vegetation considerations.

The preceding sections detail the assessment of potential project related effects to specific facets of ecosystems within the NNPR as they relate to wildlife and vegetation, including potential ecosystem effects pertaining to habitat loss, habitat fragmentation, species distribution and abundance, invasive species and the ability of habitats/species to recover from potential project related effects. The significance of effects for all for these ecosystem considerations was determined to be low to moderate, while residual effects were not anticipated or could be managed with appropriate mitigation strategies.

Given the low significance of project related effects to individual wildlife/vegetation considerations examined as part of the NNPR effects assessment and the high probability of successful management of residual effects associated with proposed project development, the significance of effects to the overall function of ecosystems as they pertain to wildlife and vegetation within the NNPR is considered low, assuming adherence to applicable mitigation strategies.

6.10 Nahanni National Park Reserve Mitigation and Best Management Practices

During EA0809-002, the original winter access route was optimized to reduce environmental and logistical risks. With direct consultation with the Naha Dehe Dene Band and Parks Canada, four re-alignments were included in the revised and approved winter road route to avoid unique karst terrain and areas considered sensitive to wildlife. Therefore, mitigation has effectively been applied to limit impacts, including direct and indirect habitat loss, disturbance to wildlife, and mortality within NNPR at the design stage.

The Nahanni National Park Management Plan (Parks Canada 2010) seeks opportunities to maintain the quality of the land, water, air, and wildlife, while expanding visitor experience and encouraging the discovery of NNPR by visitors and respecting traditions and cultural values. This park plan recognizes the Prairie Creek Mine and its access road within the NNPR expansion area, and provides mitigation to minimize potential effects to wildlife from the road (e.g., access control) as well as park-related activities involving potential visitor disturbances, trail development, and aircraft disturbances.

Besides the general mitigation and best management practices outlined in Sections 5.0-7.0, mitigation specifically outlined to avoid and/or minimize effects to the Nahanni National Park Reserve from Project-related construction, operation, and closure is provided:

- Adherence to standard industry best practices during construction;
- Strict use of CZN's Controlled Road Use Plan to minimize traffic and other disturbances and maintain low speed limits;
- Prohibit pumping water from ponds occupied by Trumpeter Swans during the nesting period;
- Snow removal practices along the access road to manage high snow banks, so that wildlife can readily move off the roadway as vehicles approach;
- Educate staff and contractors on CZN's wildlife policies;
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so, particularly when in convoy) for all wildlife seen on or immediately adjacent to the road, to allow them to move away;
- Discuss main issues and considerations regarding wildlife populations and effects during the Technical Advisory Committee meetings proposed by CZN in EA0809-002;
- Report annual updates and results of the Wildlife Management Plan, Controlled Road usage, and inspections and enforcements;
- Reporting and evaluating wildlife sightings along the access road and airstrip, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered;
- Hunting, trapping, harvesting, and fishing by site employees and contractors will be prohibited;
- Managing the small portion of the winter road not used for the all season access to prevent predator and non-Project related travel of the corridor, if necessary;
- Pets will be prohibited along the access road; and
- The appropriate regulatory agencies (i.e., GNWT ENR and Parks Canada) will be contacted to receive additional direction regarding new issues that arise.

7.0 EFFECTS ASSESSMENT – OTHER WILDLIFE AND WILDLIFE HABITAT, VEGETATION

7.1 Other Wildlife and Wildlife Habitat

In CZN's application for an all season road, two phases of development are proposed: Phase 1 all season road use from the Mine to the TTF; and Phase 2 all season road use from the TTF to the Liard Highway. The two phases combined represent the entire road application. However, the road bed from the Mine (KP 0) to KP 39 (Cat Camp) is already of all season quality. In addition, Cadillac's road LUP provided for all season use of that section.

An effects assessment has been prepared for the Prairie Creek Mine and new winter road route (Golder 2010; CZN 2010), that is highly relevant as a basis for consideration of any possible changes to predicted effects resulting from converting the existing winter access road to an all season road. Therefore, this all season access road effects assessment is consistent with the approach previously employed by CZN (2010) and Golder (2010), with the assessment of wildlife and wildlife habitat, and vegetation, including species at risk valued components.

This section of the effects assessment focuses on species that have not already been evaluated in the effects to traditional harvesting and traditionally harvested species, and to Nahanni National Park Reserve. These include:

- Collared Pika
- Wood Bison
- Little Brown, Northern, and Western Long-eared Myotis
- Horned Grebe
- Yellow Rail
- Short-eared Owl
- Peregrine Falcon
- Barn and Bank Swallows
- Rusty Blackbird
- Western Toad

Based on the TOR, the assessment of environmental impacts and cumulative effects are to focus on impacts to traditional harvesting and traditionally harvested species, effects of potential accidents and malfunctions, and impacts to Nahanni National Park Reserve. The TOR indicates these key lines of inquiries are considered topics of greatest concern. Outside of these key lines of inquiry, the following subjects of note (*Effects Assessment – Other*) may be assessed at a moderate level.

The TOR identified the following key objectives to describe and evaluate potential effects of the all season access road on other wildlife and wildlife habitat, including species at risk (EA1415-01):

- Methods to minimize Project effects on species including the strategies for mitigation and monitoring;
- Direct and indirect alteration of habitat including direct road footprint impact;

- Visual or auditory disturbance, including habitat avoidance and effective habitat loss in relation to all season road facilities or activities;
- Effect of construction and pre-construction activities;
- Wildlife mortality due to increased harvesting and vehicle collisions;
- Disruption of sensitive life stages or habitat (e.g., migration, breeding, calving, denning, overwintering);
- Wildlife movement patterns and corridors, home ranges, distribution and abundance;
- Effects to sensitive or important areas or habitat;
- Habitat fragmentation;
- Effects to population cycles;
- Effects to predator-prey relationships;
- Attraction of predators to birds and bird eggs;
- Increased human-wildlife conflicts (e.g., bear encounters);
- Mortality from collisions with temporary or permanent structures and wires;
- Potential disturbance to raptors nesting within 1 km of the proposed project footprint;
- Use of the project area by resident and migratory birds protected by the *Migratory Birds Convention Act,* 1994;
- How road-related changes in harvest pressures could impact the resource;
- Ability of habitat or species to recover;
- Response to edge effects; and
- Invasive species (vegetation and wildlife).

The following section follows the effects assessment steps summarized in Sections 4.1, 7.3.6, and 7.3.8 of the MVEIRB TOR for the Prairie Creek All season road.

7.1.1 Effects from Direct and Indirect Habitat Loss and Alteration on Other Wildlife

The proposed upgrades from the approved winter road to the all season access road and alternate airstrip require an additional footprint of approximately 70.96 ha (includes an additional 18 ha for the access road realignments, 45.34 ha for borrow sources and their access roads, and 7.62 ha for the airstrip). This is considered a relatively small area in the context of the existing winter road and the common habitats that occur in the region (Golder 2010). The additional clearing for the proposed all season road will include 4 km in Phase 1 and 5 km in Phase 2.

The proposed all season road has been re-aligned to avoid sensitive karst terrain, lowlands, wetlands, and ponds, as much as possible, which have the potential to support several species at risk. Consequently, direct impacts to Little Brown Myotis, Northern Myotis, Western Long-eared Myotis, Horned Grebe, Yellow Rail, Rusty Blackbird,

and Western Toad habitat have already been considered and avoided to the extent possible. Bats may overwinter, in hibernaculas in the karst terrain. Hibernacula are critical habitats, and are reused annually.

Bats are most sensitive to disturbance while overwintering. Traffic along the all season access road will continue through the winter, during bat overwintering periods; however, their disturbance from noise, vibration, and visual disturbances during this time will be negligible. COSEWIC (2013) indicates that noise from road disturbances deter foraging bats; however, the severity and disturbance distances are unknown. In both Manitoba and Newfoundland, a 200 m buffer between developments and known hibernacula have been recommended (COSEWIC 2013). Although no bat hibernacula are known near the all season access road, potential habitat such as the karst terrain, are a minimum of 350 m from the already permitted winter road route and airstrip. Not all karst terrain (including caves) provide suitable overwintering bat habitat, nor are all suitable overwintering habitat occupied by overwintering bats.

Indirect impacts to birds and bats from road dust and noise are relatively unknown. However, effects attributed to road dust are typically less than 10 – 20 m from the road, but may extend into habitats 100 m downwind depending on the adjacent landscape and habitat types (e.g., open wetland or pond). Similarly, airborne dust from the access road has the potential to alter Western Toad habitat. Introduced fine sediment into roadside ditches and nearby ponds has the potential to increase water turbidity and possibly degrade the habitat by inhibiting aquatic plant growth and macro-invertebrates, and altering water pH (Forman and Alexander 1998). Habitat alteration effects are considered low in magnitude and local in extent.

The sensitivity of boreal forest birds to noise, human presence and activities is relatively unknown, but some songbird species are thought to be negatively affected by noise. Human-induced noise may mask communication calls; consequently, some species may avoid nearby habitats. Some species remain in these habitats in lower densities, and may have lower nest success or productivity as a result (AMEC 2005).

Collared Pika habitat is naturally fragmented, with selective preference for boulder fields edged by alpine meadows. Suitable Collared Pika habitat exists in small isolated patches within the first 36 kilometres from the Mine site of Phase 1 of the all season access road. Much of this entire 36 km length of the all season access road exists as all-season quality from former construction and directly follows the new winter road route, which was already approved in EA0809-002. To upgrade the proposed all season road, a new 4 km length section is proposed. This road section and seven preferred borrow sources have the potential to affect Collared Pika habitat, particularly since Collared Pikas were observed and/or heard in talus between Phase 1 KP 15 to 22.

Since a relatively small length of access road will be constructed and Collared Pikas do not occupy all suitable talus habitat within their known range and remain within 10 m of the talus (except during dispersal in July), few Collared Pikas are expected to directly interact with the all season access road and possibly two borrow sources. The new section of access road is to avoid a stretch of boulder fields, but Collared Pikas habitat may occur at the proposed borrow sources (BP 14 and 16).

Although pikas do not hibernate, they remain under the protective and insulating cover of snow during winter. During the snow-free period (e.g., late spring, summer, and fall), a small number of collared pikas may be exposed to and disturbed by localized noise or traffic along the road. Similarly, collared pikas may be expected to forage along the road edge. Pika attempts to cross the road would be uncommon as pikas primarily remain within 10 m of protective cover (the road width itself is less than 10 m wide); however in July, juveniles dispersing from their natal territory may be infrequently exposed to vehicle traffic. The Phase 1 portion of the all season access road has the potential to directly and indirectly affect a few collared pikas that might occur near the road throughout construction, operation, closure, and reclamation phases.

The main way that the all season access road and associated infrastructure and activities may directly and indirectly effect Collared Pika habitat is through direct habitat loss at two borrow sources (BP 14 and 16), widening of the existing road, and changes in the late spring, summer, and fall daily movements including habitat avoidance and disturbance during operations. Direct and indirect habitat loss effects are considered moderate in magnitude and low in geographical extent and duration, as not all Collared Pika habitat remains occupied. The number and frequency of such exposures would be expected to be moderate and periodic. Overall significance is moderate. Confidence in this assessment is moderate due to the existing access road present within Collared Pika range, previous records of Collared Pikas near the road, and the inherent behaviour of pikas to remain within 10 m of the talus for protective cover.

Wood Bison may be sensitive to disturbance, particularly during the calving and post calving season (approximately April to August), and may be wary of human activities particularly the harvested herds. Nevertheless, Wood Bison are known to become habituated to traffic and human activities, and are known to enter Nahanni Butte. While in communities and other development areas, Wood Bison come into conflict with people and may damage property and become a safety hazard to people.

Wood Bison encountering the proposed all season access road may show minor displacement behaviour and move away from the immediate area. The construction phase, in particular, is expected to generate some degree of disruption, at least temporarily. The duration of exposures during construction are expected to be low, perhaps lasting a few minutes to a few months, and are reversible upon cessation of the activity or by moving away from the activity. Visual and noise disturbances from the access road and associated facilities are considered to be low in magnitude, local in extent, and reversible upon cessation of the activity or by moving away from the activity. The number and frequency of such exposures would be expected to be moderate and periodic. Confidence in this assessment is high since Wood Bison are considered very tolerant of traffic and land use working zones.

No direct loss of preferred Peregrine Falcon and Short-eared Owl nesting habitat is expected as a result of the 8 km of the proposed clearing activities. Peregrine Falcons are known to tolerate a moderate level of human-disturbances; however, breeding individuals not habituated to human activity may be affected by disturbances near the nest site. The nearest potential cliff nesting habitat to the proposed all season access road is in the karst terrain in Phase 1. Short-eared Owls may infrequently occur in the all season access road to feed during the construction, operation, and closure phases, and may conceivably be disturbed by localized vehicle traffic or aircraft noise and activity. Short-eared Owls are sensitive to disturbance during nesting, and may abandon nests as a result. However, they are irruptive breeders to the area and not anticipated to occur every year.

Golder (2010) considered mitigation for clearing the restricted access road and transfer facility footprint unnecessary. Similarly, reducing traffic volumes to the extent possible reduces the potential for Project-related indirect habitat loss effects. To mitigate project-related wildlife disturbances, measures in effect for the winter road will be maintained throughout construction, operation, and closure. Of those mitigation measures, those most noteworthy and specific to reducing Project-related disturbances to wildlife include:

- Strict use of CZN's Controlled Road Use Plan and Waste Management Plan to minimize traffic and other disturbances, maintain low speed limits, as well as to limit wildlife attractants;
- Surveying for and reporting the presence/absence of Collared Pikas (ranked as May Be At Risk in the NWT) at borrow sources BP 14 and 16 prior to Project-related disturbances, and consider additional mitigation should pikas be present;
- Reporting and evaluating wildlife sightings along the access road, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered;

- Snow removal practices along the access road to manage high snow banks, so that wildlife can readily move off the roadway as vehicles approach; and
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road to allow them to move away.

All general mitigation measures proposed are summarized in Section 7.1.7.

Overall, direct habitat effects as a result of the all season access road and its associated infrastructure are expected to be negligible to low in magnitude, local in geographic extent, reversible upon closure, and of low significance. Construction of the all season road, in particular, is expected to generate the greatest degree of disruption, at least temporarily, and infrequent disruption is expected during operations and closure. The disturbance from or avoidance of the all season road and associated activities may disturb wildlife since species sensitivities to roads and traffic are not well documented, and not clearly known. However, daily traffic volumes are predicted to be low and below sensitive species known thresholds. The duration of exposures, including during construction, are expected to be low, perhaps lasting a few minutes to a few months, and are reversible upon cessation of the activity and at road closure. The number and frequency of such exposures would be expected to be low and infrequent.

Confidence in this assessment is high since the access road is proposed along the existing winter road, as much as possible, avoids sensitive habitats for several species at risk, and operations will remain similar to baseline winter road conditions. With adherence to mitigation, no adverse residual effects are anticipated.

7.1.2 Effects on Wildlife Movement, Distribution, and Abundance

Indirect consequences of Project-related disturbances can occur as a result of road/airstrip construction, operation, and closure. The proposed Project limits the intensity of any potential disturbance by minimizing habitat loss and fragmentation, manages low traffic volumes and speeds, and reduces the proximity to important habitats. For example, 5 km of the 9 km of additional clearing for the proposed all season access road avoids wetland habitat, which directly avoids disturbances to Horned Grebe, Yellow Rail, Barn and Bank swallows, Rusty Blackbird, and Western Toad, should they be present. The proposed all season access road and airstrip will not affect wildlife movement, distribution, and abundance at these locations since there is no direct habitat loss and species have relatively small home ranges.

Consequences of Project-related disturbances can occur as a result of road construction, operation, and closure, and can vary in frequency, magnitude, and severity depending on several factors including the species involved, individual animal, season, and gender.

Some species maintain the same territories year after year (e.g., Peregrine Falcon); however, their tendency to move their territory as a direct result of habitat modification and disturbances for most species are unknown. Conservative action to reduce the Project footprint and Project-wildlife encounters helps to counter these unknowns.

Road and airstrip construction can lead to the creation of habitat edges through otherwise continuous forest. It is these edges, that result from the approved winter road, that provide a conduit for Brown-headed Cowbirds (*Molothrus ater*), a brood parasite that lays its eggs in another species' nest to the detriment of the other species reproductive potential, to penetrate (at least 200 m from the edge) into forests. Similarly, bird predators (e.g., Short-eared Owls, Common Ravens) concentrate their scavenging and hunting activities at habitat edges. While hunting along the access road, Short-eared Owls may infrequently encounter traffic; however, Short-eared Owl populations fluctuate annually in size and distribution and are not expected to occupy much of the access road route.

Wood Bison may become indifferent to the traffic and human activities associated with the all season access road and the transfer facilities. Wood Bison form small herds throughout the year and occupy open habitats, such as roadways to detect approaching predators. The Prairie Creek Mine access road and transfer facilities likely support Wood Bison security habitat. Consequently, Wood Bison may select and gather near the proposed Project infrastructure.

General mitigation measures that are proposed include:

- CZN's Controlled Road Use Plan;
- Speed limits on the Prairie Creek All Season Road;
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road, to allow them to move away;
- An education program of wildlife related policies and mitigation to all Project employees and contractors, including a bear awareness program to ensure employees and contractors are informed of bears and other potentially dangerous wildlife and the level of risk;
- An alert system to warn personnel of Woodland Caribou and other sensitive wildlife in the local area by relaying sighting information to vehicles and equipment operators and on-site personnel;
- Wildlife record logs to be completed by all Project employees and contractors for all wildlife sightings (e.g., Dall's Sheep, caribou, Wood Bison, and carnivores) with respect to species, location along the access road, numbers observed, and reaction to road activity. If a problem area is identified, corrective measures will be considered.

With adherence to mitigation, effects to wildlife movement, distribution, and abundance as a result of the all season access road and its associated activities is considered negligible to low in magnitude, reversible upon cessation of the activity or by moving away from the activity, and a low likelihood of occurrence. No residual effects are anticipated. Confidence in this assessment is high since direct loss of available habitat as a result of the proposed all season access road is low (9 km), many species occur infrequently or in small territories away from road activities, and traffic levels and speeds will be low.

7.1.3 Effects on Predator-Prey Relationships

Effects on predator-prey relationships including but not limited to Grey Wolf, Boreal Caribou, Moose, and Dall's Sheep are discussed in Section 5.2.7. This section focuses on other wildlife species not already addressed in the key lines of inquiry effects assessments.

Wolves are the primary predator of adult Wood Bison; Grey Wolf and Black Bears target calves and juveniles. Although Wood Bison are preyed upon, Moose are considered wolves' preferred prey species considering they are a smaller and more manageable size than bison. By supporting higher predator densities, an increasing Wood Bison population may indirectly influence predation rates on Moose. Mr. Konisenta suggests that Moose numbers have declined partly due to the introduction of bison to the area.

Similarly, predator-prey dynamics may be altered after a forest fire or human disturbance (e.g., the all season access road). In particular, Wood Bison favour these early regenerating grass and forb habitats and respond with increasing populations, thereby, correspondingly increasing their predators' populations.

Predators may incidentally take Collared Pikas, the assessed birds (e.g., Horned Grebe), and Western Toads. Predators, such as Red Fox, Wolverine, Wolves, and bears have been known to source food from litter, people purposely feeding, and unsecured containments. As predators are attracted to human disturbances, their encounter rates with prey occupying nearby habitats also increase.

General mitigation measures proposed in Section 7.1.7 will lessen any potential predator-prey effects, although no specific measures are recommended. Effects predator-prey relationships for the species assessed in this section are considered negligible to low in magnitude, moderate in geographical extent, expanding beyond the operational life of the access road, but occurring infrequently. Confidence in this assessment is high since the all season access road route will be already cleared (except for 9 km). No residual effects are predicted as a result of the all season access road affecting predator-prey relationships.

7.1.4 Effects from Invasive Species

Invasive wildlife species are non-native species introduced into areas beyond their natural range by humans and are capable of causing harm to the environment and outcompeting native species. To date, there are no known invasive wildlife species present in the NWT.

However, alien wildlife species, are native species that have been introduced beyond their natural ranges due to their natural dispersal from surrounding provinces or territories. Example alien wildlife species to the NWT include the House Sparrow and European Starling.

Alien wildlife species, such as the House Sparrow and European Starling, expand their distributions into new ranges and out-compete desirable native wildlife. The preferred habitat of the House Sparrow includes human settlements, in which it remains year round. House Sparrows are reported in the communities of Fort Simpson and Fort Liard; however, there are no known reports within Nahanni Butte and the NNPR (Sullivan et al. 2009). House Sparrows are known to outcompete native bird species from suitable nest sites. Similarly, the European Starling occurs in and near human settlements that have a component of open, grassy areas, preferring to remain year round. They are aggressive birds and outcompete native species for nesting cavities. One European Starling was observed near Rabbitkettle Lake inside the NNPR, as well as a few observations near the communities of Fort Liard and Fort Simpson (Sullivan et al. 2009).

A potential effect of constructing the approved winter access road may be to increase the range of invasive wildlife species such as the House Sparrow and European Starling into areas not currently occupied (or assumed to not be occupied). The winter access road will be cleared prior to the construction of the all season access road (except for 9 km); therefore, the all season access road will not pose any significant additional adverse effects to native species from the expanded distribution of alien wildlife.

Potential effects from invasive wildlife species as a result of the all season access road and its associated infrastructure and activities will remain similar to baseline conditions since the winter road route will be cleared prior to construction of the all season road. Mitigation measures are not considered necessary, beyond the general mitigation and best management practices.

Beyond designing the all season access road to follow the already permitted winter road corridor, no further mitigation associated with habitat fragmentation and associated invasive species advancement is recommended.

The predicted effects to invasive wildlife is considered low in magnitude, moderate in geographical extent, expending beyond the operational life of the access road, but occurring infrequently. Confidence in this assessment is high since the winter road will already be cleared and alien wildlife (e.g., European Starling) has already been recorded in the region. No residual effects are predicted as a result of the all season access road affecting invasive wildlife species.

7.1.5 Effects on the Ability of Wildlife to Recover

Habitat loss and fragmentation, changes to movements and behaviour, and mortality are key examples of development-related effects that, if significant, have the potential to adversely affect the condition of the species. A species' ability to recover from significant decline depends on a variety of factors including the species:

- Inherent biological traits, such as home range size, reproductive potential, habitat specialist or generalist;
- Balance between population growth (e.g., immigration and birth) and decline (e.g., emigration and mortality); and
- Occurrence in isolation of core populations.

For instance, Wood Bison have a relatively high resilience to many forms of disturbance; however, they are threatened by disease and overharvesting.

Several of these assessed species occur in the area of the proposed all season access road at the northern extent of their range. Although available habitat exists and human-made threats to these species in the NWT are limited, their populations are ranked from Secure (e.g., Bank Swallow) to May Be At Risk (e.g., Yellow Rail). Recovery of these species populations are largely dependent upon threats faced across their annual range, outside the NWT. Therefore, their population recovery is critically dependent upon conditions outside the all season access road zone of influence.

Minimizing habitat loss and fragmentation and avoiding sensitive wildlife areas and unique landscapes identified by the Naha Dehe Dene Band and Parks Canada were fundamental in the routing design of the all season access road. Similarly, limiting Project-related disturbances and traffic-wildlife encounters are inherent in the Project operations design.

No Project-related effects are expected to significantly cause the assessed species populations to decline, and the Project is not anticipated to affect the ability of these species to recover.

Further descriptions on the ability of wildlife in the NNPR to recover are discussed in Section 6.1.4.

7.1.6 Risks of Wildlife to Direct and Indirect Mortality

Species discussed in this section are not traditionally harvested in the area of the all season access road. Refer to Sections 5.2.1 and 5.2.2 for mortality effects associated with harvesting and harvesting pressure.

The predominant risk to wildlife mortality is direct animal-vehicle/aircraft collisions, although the risk is low considering the low traffic speeds (average 30 km/hr) and/or traffic volume. However, species that occupy or are attracted to the Project, and those that occur in highest abundance along the road and airstrip are at greater risk of Project-related mortality. Species, such as Collared Pika, Horned Grebe, Yellow Rail, and Rusty Blackbird that maintain small territories, occur in low densities, or do not venture far from their protective cover have a low risk of Project-related mortality.

Pika abundance within suitable talus patches vary considerably both temporally and spatially (COSEWIC 2011). In 2012, Collared Pikas were reported near the all season access road, and may be present at proposed borrow sources BP 14 and 16. Construction-related disturbances at these proposed borrow sources and other talus fields along the all season access road may result in direct mortality. Potential mortality as a result of construction activities is considered moderate in magnitude, low in duration and geographical extent, and a moderate likelihood of occurrence without mitigation.

Traffic along the access road poses the greatest risk of mortality to Wood Bison, Short-eared Owl, and Western Toad. Since traffic volumes and TTF activities can be a disturbance, are predictable, but have no negative

stimulus associated with them, Wood Bison may become indifferent to the traffic resulting in an increased risk of mortality. The Wildlife Collision Prevention Program (2014) reports the highest risk of bison-vehicle collisions in the NWT occurs from August to November and from sunset to sunrise. Mortality of Wood Bison a result of the Prairie Creek Mine access road traffic is considered moderate in magnitude and duration, low in geographical extent, moderate in frequency, and a low likelihood of occurrence since traffic volumes and speed limits will be low.

Larter and Allaire (2007) indicated that the Nahanni Wood Bison herd is known to commonly swim across the Liard River to access important habitat on either side of the river, particularly at Swan Point (approximately 6 km downstream from the proposed all season access road barge crossing) and Muskeg and Kotaneelee rivers (at least 130 km upstream from the all season access road barge crossing). A few bison are known to drown annually during spring break up and peak discharge from the mountains (Larter and Allaire 2007). Known Liard River crossing locations are well up and down-stream from the all season access road barge crossing. Effects to bison mortality and/or avoidance/disturbance from wave action and/or human disturbances is not anticipated. In addition, the barge crossing location is situated on the Liard River approximately 1 km up-stream from a 90 degree bend, which would act to dissipate wave action from barge crossings during summer months.

Short-eared Owls may hunt along the all season road, particularly since low traffic levels are proposed. This increases their encounter rate with vehicles and therefore, risk of collision. However, since Short-eared Owls irregularly occur in an area (a single known observation was recorded near Nahanni Butte), their risk of mortality as a result of the proposed Project is considered negligible.

Similarly, bats may forage along the all season access road during the summer. The risk of bat mortality as a result of vehicle collisions from low traffic volumes and low speeds is low.

Western Toads are particularly susceptible to mortality from high traffic roads due to migration to breeding ponds and dispersal post-breeding. Western Toads are not known to strongly avoid roads or traffic, consequently increasing their risk to road mortality, particularly in the spring and fall near breeding ponds. Bouchard et al. (2009) reported a 6% mortality rate for Northern Leopard Frogs while crossing roads with very low traffic volumes (11 mean vehicles per hour) and a 28% mortality rate at higher traffic volumes (58 mean vehicles per hour). Traffic volumes along the proposed access road are anticipated to be low, below the thresholds identified for Northern Leopard Frogs.

Additional ways the all season access road and associated infrastructure and activities may affect wildlife are through increased predation risk, direct nest loss, and drowning from wave action caused by the proposed barge across the Liard River. Predators, such as Red Foxes, eagles, gulls, and Common Ravens may be attracted to litter along the road or by deliberate feeding by employees. Once in the area, these predators will prey upon resident species. This attraction of predators may lead to the indirect death of several species, including Collared Pikas, Wood Bison, Horned Grebe, and Short-eared Owl.

Barn and Bank swallows have the potential to be directly affected by nest loss. Besides using natural nesting substrates (e.g., soil banks along rivers and streams), these species favour nesting in buildings, bridges, and sand and gravel pits, and are at risk of accidental nest mortality. Both species are known to occur in the area, principally along the South Nahanni and Liard rivers; however, their risk to road-related mortality is relatively low.

Maintaining low traffic volumes, low speeds (average 30 km/hr), and having re-aligned the access road route away from sensitive wildlife areas, will minimize Project-related mortality effects. Additional mitigation proposed includes:

- Strict use of CZN's Controlled Road Use Plan and Waste Management Plan to minimize traffic and other disturbances, maintain low speed limits, as well as to limit wildlife attractants;

- Surveying for and reporting the presence/absence of Collared Pikas (ranked as May Be At Risk in the NWT) at borrow sources BP 14 and 16 prior to Project-related disturbances, and consider additional mitigation should pikas be present;
- Cease barging activities if Wood Bison are observed crossing the river near the barge location;
- Educate employees and contractors to avoid disturbance to nests;
- Reporting and evaluating wildlife sightings along the access road, and if a problem area is identified, corrective management options for traffic and Project-related activities will be considered; and
- Policy giving wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road, to allow them to move away.

All general mitigation measures proposed are summarized in Section 7.1.7.

With adherence to mitigation, direct and indirect mortality effects as a result of the all season access road and its associated infrastructure are expected to be negligible in magnitude, local in geographic extent, infrequent, reversible upon closure, and of low significance.

Confidence in this assessment is high since the access road is proposed as a low traffic-low speed road, avoids sensitive habitats for several species at risk, and species abundances are likely low in the immediate vicinity of the road. Project-related activities that potentially lead to mortality will be reversible following closure of the proposed road, and as such, no residual effects are anticipated as a result of project related activities.

7.1.7 Other Wildlife and Wildlife Habitat Mitigation and Best Management Practices

Mitigation to limit effects to wildlife has effectively been applied at the design stage by engaging with the Naha Dehe Dene Band and Parks Canada to avoid sensitive wildlife and unique karst terrain areas, reducing traffic volumes from the approved winter road levels, and maintaining low speed limits.

Additional general mitigation and best management practices considered for the proposed all season access road incorporate previous commitments for the approved winter access road (CZN 2010; Golder 2010, 2012). Mitigation measures to further avoid or reduce effects on wildlife along the proposed access road include:

- Provide the Dehcho Land Use Planning Committee (and others as requested) the post-construction digital footprint of the all season access road and associated facilities to incorporate into ongoing cumulative effects monitoring across the Dehcho.
- Surveying for and reporting the presence/absence of Collared Pikas (ranked as May Be At Risk in the NWT) at borrow sources BP 14 and 16 prior to Project-related disturbances, and consider additional mitigation should pikas be present;
- Implement a no hunting policy for all Project employees and contractors while working on or off-site for CZN;
- Strict use of CZN's Controlled Road Use Plan;
- Implement and enforce speed limits on the Prairie Creek All Season Road;
- Discourage use of engine retarder breaks;

- Develop a winter driving policy requiring tire chains to be used on haul trucks on the KP 0-29 and KP 96-102 sections to increase traction;
- Amend the existing draft Wildlife Mitigation and Monitoring Plan, as necessary, to include the monitoring of measureable parameters of effects;
- Implement a policy and train employees and contractors to give wildlife the right-of-way, which obligates drivers to stop (when safe to do so) for all wildlife seen on or immediately adjacent to the road, to allow them to move away;
- Develop standard aircraft procedures for flying into and departing from the proposed airstrip to accommodate wildlife, if present on or near the airstrip;
- Maintain a minimum flight altitude of 600 m during all times, except during take-off and landings;
- Follow dust suppression strategies (e.g., water or approved dust suppressant products) in accordance with the GNWT dust suppression guidelines;
- Follow the existing draft Contaminant Loading Management Plan and soil sampling along the road bed both before and during haul operations;
- Provide an education program for wildlife related policies and mitigation to all Project employees and contractors, including a bear awareness program to ensure employees and contractors are informed of bears and other potentially dangerous wildlife, avoiding all known or suspected den and nest sites, and no littering or feeding wildlife;
- Employ an alert system to warn personnel of wildlife in the local area by relaying sighting information to vehicles and equipment operators and on-site personnel;
- Train all Project employees and contractors to record wildlife sightings (e.g., Dall's Sheep, caribou, Wood Bison, and carnivores) in the wildlife record logs with respect to species, location along the access road, numbers observed, and reaction to road activity. If a problem area is identified, corrective measures will be considered.
- Incorporate ENR's Woodland Caribou Best Management Practices for Industrial and Commercial Activities (once developed) to be incorporated into the wildlife monitoring program, where feasible, to manage or mitigate habitat impacts and sensory disturbances on Woodland Caribou;
- Strict snow removal practices along the access road and airstrip to manage high snow banks, so that wildlife can readily move off as vehicles/aircraft approach;
- Provide a structure for reporting human-dangerous wildlife encounters at the TTF and resulting incidents to inform Mine management and ENR staff;
- Managing the small portion of the winter road not used for the all season access to prevent predator and non-Project related travel of the corridor, if necessary;
- Implement a protocol for dealing with problem bears, with a designated chain of responsibilities for ensuring worker safety and efficient and speedy resolution of incidents;
- Preserve natural drainage patterns along the haul road to maintain the natural function and processes of peatland habitats adjacent to the haul road;

- Develop and implement a Waste Management Plan that prohibits littering, purposely feeding wildlife, and storing attractants accessible to wildlife. Incinerate all waste foods and human garbage consistent with current industry good management practices to minimize wildlife attraction to the local area. Adaptive management will be applied to waste management practices. If wildlife are found to be attracted to the site (i.e., problem wildlife) additional management practices, if required, will be adapted;
- Employ appropriate materials management systems to minimize the risk of accidental spills or leakage of concentrate, diesel fuel, other hydrocarbons, and other hazardous materials being shipped to the Mine site;
- Train staff on the existing Spill Management Plan and procedures to quickly respond to an accidental spill. This plan to include provision for rapid deployment of cleanup crews and for contaminant and cleanup of spilled material and contaminated surfaces;
- Strict adherence to policies to avoid significant changes to water levels while pumping water from a known Beaver pond in the fall and winter periods;
- Maintain sufficient buffer distances between development activities (e.g., re-fuelling and material storage) and waterbodies, where possible;
- Non-mine vehicles, including all-terrain vehicles (ATVs) and snowmobiles will be prohibited on site;
- Pets will be prohibited along the all season access road; and
- The appropriate regulatory agencies (*i.e.,* GNWT ENR and Parks Canada) will be contacted to receive additional direction regarding new issues that arise.

7.2 Vegetation

7.2.1 Effects of Land Clearing on Terrestrial Ecosystems

Effects to terrestrial ecosystems resulting from construction of the future all season road will be reduced as most of the proposed all season alignment will already have been cleared for the current approved winter access road (20 m right-of-way). The only exception is about 9 km of the proposed all season road that varies from the winter road alignment (see Figure 3). CZN is currently authorized to construct their new winter access road in accordance with existing LUP's and Water Licences from both the MVLWB and Parks Canada. The MVLWB issued LUP MV2012F0007and Water Licence MV2012L1-0005 on January 10, 2013 and Parks Canada issued LUP Parks2012-L001 and Water Licence Parks2012_W001 on August 26, 2013.

Under these authorizations, approximately 63 km of new alignment will be cleared for the upgrading of the existing winter access road. This will consist of a re alignment to avoid karst features and bisecting the poljes west of Mosquito Lake, a realignment between Fishtrap Creek and Grainger Gap, and a realignment of the road east of Grainger Gap, wherein the new alignment will be located closer to the eastern foot of the Nahanni Range (providing for an ice bridge crossing of the Liard River just east of the community of Nahanni Butte).

The proposed realignment of the access road will result in a shorter road (174.5 km compared to a previous 181.1 km) and a revised footprint. The resulting footprint is summarized by vegetation units in Table 7-1 and is based on a total length of 174.5 km and an assumed average road footprint width of 10 m. The 63 km of old access road footprint that will not be used has naturally re-vegetated since it was initially constructed in 1981. The overall significance of impacts to vegetation from the access road is expected to be low.

Table 7-1: Summary of Terrestrial Ecosystems Potentially Affected by Project Construction

EOSD Land Cover Class	Phase I Road Area (ha) *	Phase II Road Area (ha) *	Airstrip Area (ha)*	Borrow Site Area (ha)*	Borrow Site Access Road Area (ha)*	Tectela Transfer Facility (ha)*	Cleared Area Outside of Winter Road Route (Phase I) (ha)*	Cleared Area Outside of Winter Road Route (Phase II) (ha)*
Broadleaf-dense	3.4	32.0	0.0	4.2	1.1	0.0	0.0	0.4
Broadleaf-open	1.0	9.6	0.0	2.5	1.0	0.0	0.0	0.0
Bryoids	0.7	0.1	0.0	0.5	0.0	0.0	0.0	0.0
Coniferous-dense	6.4	9.6	0.0	1.1	0.1	0.4	0.0	1.9
Coniferous-open	20.7	5.6	0.0	3.6	0.6	0.0	2.0	1.0
Coniferous-sparse	2.8	0.5	0.0	0.9	0.1	0.0	0.1	0.1
Exposed land	21.8	0.0	7.6	3.7	0.0	0.0	0.5	0.0
Herb	0.0	0.3	0.0	0.0	0.0	0.0	0.0	
Mixedwood-dense	5.1	16.2	0.0	6.1	0.0	1.7	0.0	2.6
Mixedwood-open	0.5	1.0	0.0	0.3	0.0	0.0	0.0	0.0
Rock/rubble	6.4	0.0	0.0	3.5	0.0	0.0	0.0	0.0
Shadow	1.7	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Shrub-low	12.1	5.2	0.0	12.6	1.4	0.0	1.3	0.1
Shrub-tall	1.7	6.7	0.0	0.7	0.5	0.0	0.0	0.0
Water	1.2	0.6	0.0	0.3	0.0	0.0	0.0	0.0
Wetland-shrub	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wetland-treed	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Total	**85.6**	**89.4**	**7.6**	40.**7**	**4.7**	**2.0**	**4.0**	**6.2**

*- Values rounded for reporting purposes

The extent of direct effects will be primarily confined to the constructed road footprint (~10 m wide) and the footprint of borrow areas and the airstrip, which will be limited in frequency to once during project construction.

For Phase 1 of the all season road, the surface area encompassed by the road surface will be 85.6 ha, while Phase 2 will encompass 89.4 ha. The footprint area for both phases of the project, including the road footprint, borrow areas, borrow access roads, camps and the airstrip is 237.9 ha. Based on the calculated areas for EOSD land cover classes present within the 100 m wide study area, the proportion of land cover classes disturbed by each phase of the project will not exceed 20 % of the respective land cover class area. It is expected that project related effects to terrestrial ecosystems within the CZN study area will be reversible following decommissioning and reclamation of disturbances, and as such, no significant residual effects are anticipated as a result of project related activities.

7.2.2 Effects to Merchantable Timber Resources

The Deh Cho Land Use Planning Committee commissioned a study of logging potential of commercially viable forests in the Deh Cho territory (PACTeam Canada 2003), which encompasses the all season road study area. The study was conducted using various metrics to assess logging potential, including the assessment of forest cover mapping to identify suitable stands for logging and the economic viability of conducting logging operations (e.g. access constraints). Based on the results of the study, the majority of the land encompassing Phase 1 of the

all season access road study area is currently considered to have low to no potential for commercially viable forestry operations, while the area encompassing Phase 2 of the all season access road is considered to have high to very high potential for commercially viable forestry operations. A portion of this area, from Nahanni Butte to Nahanni National Park Reserve, was identified as being one of the most productive sites in the territory relative to the production of white spruce saw timber.

As a large proportion of Phase 1 and Phase 2 of the proposed all season access road will be constructed using the approved winter road route, the clearing of potential merchantable timber resources will be conducted prior to the all season access road construction, and as such, potential effects to merchantable timber resources in the study area will be minimized. Given the existing clearing requirements for construction of both Phase 1 and Phase 2 of the all season road, it is anticipated that a low volume of merchantable and/or waste timber will ultimately be available for use by the local community.

As clearing for the majority of Phase 1 and Phase 2 of the proposed all season access road will be confined to the proposed project ROW, which will generally follow the approved winter road route, the extent, magnitude, duration and frequency of potential project related effects are considered low and reversible following reclamation. The overall significance of effects to merchantable timber resources are considered low and no residual effects are anticipated as a result of project construction.

7.2.3 Effects from Fire

Based on a study conducted by Bothwell et al. (2004), forest fuels in the regional context of the study area are predominantly described as low-density coniferous forests and non-fuel (wetlands, shrub lands and rock) forest cover types. Results of the Bothwell et al. (2004) study suggest that the fire behaviour in the region (e.g., Nahanni National Park Reserve) is influenced by fuel continuity, associated with mountainous terrain, and may explain a lower proportion of large (>200 ha) fires, relative to other areas examined as part of the study. The mean fire return interval calculated for the region was 28 years, while a fire cycle of 1,142 years was determined for fires greater than 200 hectares.

It can be reasonably assumed that the risk of human caused fire in direct proximity to the proposed all season access road will increase given the potential for fire risks associated with vehicle malfunction and other human induced fire risks (e.g., smoking). These risks would be considered most pertinent during periods of low precipitation and associated decreases in fine fuel moisture content; typically associated with the summer months. Although fire is a natural disturbance within the boreal forest ecosystem, the alteration of natural forest fire cycles has the potential to disrupt long-range ecosystem management objectives (particularly associated with the Nahanni National Park Reserve), along with the potential dangers to local residents and interests of stakeholders in the region (including CZN).

Along with the potential risks posed by development of the all season access road, several positive benefits related to fire management practices in the region can be anticipated as a result of project development. These would likely include increased access to more remote areas of the region should fire control activities be warranted and the potential use of the road as a fire break in certain circumstances.

It is anticipated that potential fire risks associated with construction and operation of the all season access road can generally be avoided through the application of mitigation measures related to fire prevention and emergency response. It is recommended that all staff be trained in appropriate fire prevention techniques, and appropriate emergency response procedures.

Assuming application of appropriate mitigation measures, and the low anticipated volume of traffic utilizing the proposed all season access, the extent, magnitude, duration and frequency of potential fire related effects are

characterized as low and reversible. The overall significance of effects is considered low and no residual effects are anticipated.

7.2.4 Effects of Access Road-Related Emissions on Vegetation

The air quality assessment presented in the DAR for the CZN Prairie Creek Mine (CZN 2010) indicated that construction and operation of the winter access road would result in the release of exhaust emissions from equipment, transport trucks, other trucks, and electrical power generation emissions (at the transfer facilities and Cat Camp). Emissions from equipment and trucks are primarily particulates (as carbon soot) and exhaust gases (SO_2, NO_x and SO_2) from burning diesel fuel. These emissions will be of low intensity compared to Mine-site emissions. With snow melt in the spring, the limited amount of particulates will settle onto ground cover vegetation and be absorbed into the organic substrate (CZN DAR 2010; Golder 2010).

During the snow free months, when the all season road will continue to operate at a low intensity, the emissions from trucks, other vehicles and stationary emission sources at the transfer facilities will be of a similar low intensity. As a result, these limited emissions are not expected to have a measurable effect on vegetation adjacent to the all season access road, Cat Camp or the transfer facilities. Overall, the significance of access road related air emissions on vegetation is expected to be low. No residual effects to vegetation are anticipated from road related air emissions.

7.2.5 Effects of Dust Generation on Vegetation

Road construction and use of the access road during the summer months, will generate dust. The potential effects of dust deposition on plant species varies with the deposition frequency, load and duration, as well as the physical and chemical properties of the dust and the plant species involved.

A variety of factors can influence dust deposition patterns, such as particle size, wind direction and velocity, terrain, vegetation density and structure (e.g., tall vs. short), vehicle size, speed, and traffic volumes. Several studies of the effects of road dust on vegetation have highlighted the variability in particle transport, with effects being detected 100 m away (Auerbach et al. 1997), 200 m away (Santelmann and Gorham 1988; Angold 1997), and up to 400 m away (Lamprecht and Graber 1996). Walker and Everett (1987) discovered that up to 75% of the total dust load can generally be deposited within the first 10 m of the road, irrespective of site conditions.

Studies carried out by the United States Environmental Protection Agency (US EPA 1995) also highlight the influence of particle size on dust deposition patterns. Larger particles (e.g., those with an aerodynamic diameter >100 µm) tended to settle within 10 m of the source, while particles with moderate sizes (e.g., with diameters between 30 – 100 µm) settled out within 100 m. Particulates with aerodynamic diameters <15 µm were transported over much greater distances because they were less influenced by gravitational settling

Dust particles that settle directly onto plants can have both a physical and physiological effect. Dust can block stomata, smother leaf surfaces, and increase leaf surface temperature, all of which can reduce the overall photosynthetic efficiency in the plant (Thompson et al. 1984; Pyatt and Haywood 1989; Farmer 1993).

The surrounding environment can also be modified by an increase in dust deposition. Studies have reported changes in substrate properties such as soil pH, soil nutrient regime, earlier snowmelt due to changes in surface albedo, and depth of permafrost thaw (Walker and Everett 1991; Auerbach et al. 1997; Gunn 1998). Longer-term studies have shown that these substrate changes can influence subsequent changes in plant community composition, most notably, a decline in Sphagnum and lichen species abundance and vigour and an increase in graminoids nearer the dust source (Myers-Smith et al. 2006; Auerbach et al. 1997).

Plant groups such as lichens and Sphagnum moss species tend to have a higher sensitivity to disturbance and are often used as indicators of environmental conditions (Myers-Smith et al. 2006; Markert 1993; Tyler 1989; Spatt and Miller 1981). Documented declines in lichen abundance in studies of road dust deposition have been attributed primarily to the sensitivity of lichens to the physical and chemical properties of the dust, as well as being out-competed by other species that are responding more favourably to the changes in local growing conditions (Myers-Smith et al. 2006; Auerbach et al. 1997). Declines in Sphagnum abundance were largely attributed to changes in soil pH, from acidic to more neutral conditions (Myers-Smith et al. 2006; Auerbach et al. 1997).

The primary dust-related effects resulting from the year round use of the all season road are anticipated to occur within about 10 m of the main development footprint, as this is where the majority of the large dust particles are expected to settle out. However, dust-related effects may occur at greater distances from the roadway depending, in part, on site conditions and particle size characteristics.

Plant species expected to be affected by dust settling along the all season road are generally common and will be "washed" during annual snow melt and summer rainfall events. The GNWT (1998) dust suppression guidelines will be implemented at the TTF and along portions of the road located in environments which are more prone to adverse effects from road dust accumulation (e.g., wetlands), as appropriate, to limit dust generation during the snow free months. Dust management will generally involve watering dust-prone areas as and when required, as well as adhering to speed limits on roads, which helps limit the re-suspension of particulate material.

With the diligent application of these mitigation measures, the significance of dust generation from the construction and operation of the all season road and associated traffic on adjacent vegetation is expected to be low. No residual effects resulting from project related dust generation are anticipated.

7.2.6 Effects on Harvested Plants

There is no direct information with which to assess the potential for impacts related to cultural uses of plant species in the Prairie Creek Mine site area or along the access road. However, CZN was informed by an elder of the Nahanni Butte Dene Band that plants are primarily harvested in proximity to the settlement of Nahanni Butte (David Harpley, pers. comm. in CZN DAR 2010; Golder 2010).

As previously discussed in Section 5.6, effects to habitats capable of supporting traditionally important plants within the CZN study area may potentially occur as a direct result of habitat clearing during construction and indirectly from the generation of road dust, potential spills of deleterious substances and introduction of invasive species. All criteria used for assessing potential effects to traditionally important plants were generally rated as low and not significant, considering the use of an existing disturbance (winter access road) for construction of the majority of the all season road and the low anticipated volume of traffic associated with use of the all season road. Assuming the appropriate application of mitigation measures during the life of the project, no residual effects to traditionally important plant species are anticipated from the project.

7.2.7 Effects on Rare Plants

As previously reported, results of the ENR virtual herbarium search indicate that no vegetation species at risk occurrences have been historically recorded within five kilometres of the CZN study area. Of the species identified during the search, two species (Nahanni aster and Raup's willow) are currently considered globally imperiled (G2 global status ranking – NatureServe 2014) and one species (Velenovsky's hilpertia moss) is considered critically imperiled (G1 global status ranking – NatureServe 2014). The nearest known occurrences of these species to the CZN study area are 20 km, 25 km, and 50 km respectively. Potential project-related effects to these species are considered unlikely given the spatial isolation of known populations from the proposed project.

Rare plant surveys related to the Prairie Creek Mine Project and associated winter access road were initiated by EBA on behalf of CZN in July 2009 and further surveys were completed in August 2010 (EBA 2010; 2011).

In July 2009, rare plant surveys were conducted along the Prairie Creek Mine winter road; the proposed waste rock storage facility; and the area around camp and the beaver pond to the south.

A total of 340 plant observations, representing 193 species and 44 families of vascular plants, were documented during the 2009 field survey. No plant species listed within the federal SARA were observed in the surveyed areas. However, one plant species, few flower meadow rue (*Thalictrum sparsiflorum*), listed as 'May Be At Risk' (ENR 2014b), was documented along the Prairie Creek winter road and an adjacent wetland. As the species appears locally abundant within the study area, conversion of the winter road to an all season access is unlikely to threaten the viability of this species locally, considering confirmed observations were identified outside of the proposed development footprint.

Two additional plant species ranked as 'May Be At Risk' by the ENR were identified along the existing winter access road (Hornemann willowherb *Epilobium hornemanni* and linear-leaved willowherb *Epilobium leptophyllum*), have restricted distribution in the NWT with limited known occurrences, but are globally secure (Golder 2010). Six plant species ranked as 'Sensitive' by the ENR—alpine anemone (*Anemone drummondii*), bog birch (*Betula pumila*), lesser black-scaled sedge (*Carex atrosquama*), one-glume spike rush (*Eleocharis uniglumis*) alpine groundsel (*Packera pauciflora*) and yellow mountain heather (*Phyllodoce glanduliflora*) - identified adjacent to the Prairie Creek winter road have small regional distributions in the NWT with a small number of known occurrences, but are globally secure. It was concluded that impacts to these local occurrences (and potential additional occurrences near the access road) can be avoided or reduced by limiting the amount of additional land disturbance for upgrades and operation of the all season access road.

In August 2010, the proposed Polje By-Pass re-alignment was surveyed for unique or important vegetation communities and rare plants. The habitat in which the proposed Polje By-Pass re-alignment traverses was burned by a forest fire in 1996. The vegetation community now comprises a jack pine regeneration stand approximately 14 years old. No rare plants or sensitive habitats were documented within the jack pine regeneration along the proposed Polje By-Pass alignment. It was concluded that this proposed re-alignment would not threaten rare plants or sensitive vegetation communities (EBA 2011).

Based on the results of the rare plant surveys conducted, the extent, magnitude, duration and frequency of potential project related effects to rare plant species resulting from conversion of the existing winter access road to an all season road are characterized as low and reversible. The overall significance of effects is considered low. No residual effects to rare plants are anticipated assuming appropriate application of mitigation strategies related to dust generation, spill prevention and the introduction of invasive species.

7.2.8 Introduction of Invasive Plants

Trends in invasive alien plant species presence and establishment in the north are being monitored with increasing interest by scientists and regulatory agencies alike. Invasive alien plant species are those that have been introduced into areas beyond their natural range by humans and are capable of causing significant harm to the environment, economy, or society (GNWT and NWT Biodiversity Team 2010). Though the incidence of invasive plant species in the north is still much lower compared to areas further south, the prospect of climate change and increased development could lead to more frequent, unintentional introductions.

Recent studies in northern climates have shown that invasive plants are becoming more prevalent; however, it is unclear whether this is due in part or in combination to a true increase in plant species, the conduct of more

surveys specifically targeting invasive species, or increased development in remote areas (Shrader and Hennon 2005; Carlson and Shephard 2007).

Invasive plants have the ability to aggressively establish and quickly spread in new environments. These adaptations coupled with their ability to out compete native species can affect plant species richness, diversity, and the composition and function of affected natural ecosystems (Haber 1997). The successful introduction and colonization of an area by invasive plant species relies, in part, on the presence of suitable habitat, access to a source of invasive plant material, and a means of dispersal.

The disturbances associated with development projects can unintentionally create growing conditions that facilitate the successful establishment of invasive plants. Exposed soil resulting from the removal of plant cover is particularly susceptible to colonization. Dirty equipment transported to site from other areas can act as a dispersal mechanism for invasive plant propagules that may have become lodged in tires and mud.

The most effective management of invasive plants is preventing their establishment into an area (Carlson and Shephard 2007; Schrader and Hennon 2005; USDA 2006; Polster 2005; Clark 2003). Removal once established is more costly and can be particularly challenging logistically in more remote northern areas.

In August 2010 EBA completed an invasive plant survey and reclamation assessment along the existing Prairie Creek Mine access road, and a rare plant survey along the proposed and now approved road re-alignments (EBA 2011). Surveys were conducted from August 9 to 13, 2010. The study area for these surveys included that section of the access road occurring within the boundaries of the expanded Nahanni National Park Reserve.

No invasive alien plant species were documented along the portions of the access road surveyed; consequently, they are not believed to be an issue at this time.

The Prairie Creek Mine site and existing winter access road have been in place since 1982, and Mine-related heavy equipment is already on site. In the future, any new equipment would be brought in along the access road on trucks or tractor trailer units. Similarly, Mine supplies and fuel will be brought in along the access road. Invasive plants are usually brought into a site (or along an access road) through dirty vehicles or heavy equipment operating during the non-winter period, when seeds of invasive plants can more readily be mixed with mud or dirt on vehicles or equipment, and then fall off along a road way or at a work site.

The risk of invasive species introduction during the construction and operation of Phase 1 of the all season access road will be minimal, as all equipment and vehicle traffic associated with this phase of the project will be brought into the site during the winter months. Operations during the summer construction season will be within a closed system, which is the time period that is most conducive to the spread and establishment of invasive species. The risk of invasive species introduction will increase upon completion of Phase 2 of the project which would allow for the transport of vehicles and equipment during the summer months, and thereby increase the potential for transport of invasive species into the study area. It is recommended that an invasive species management plan be developed prior to project construction to determine appropriate best management practices with respect to the prevention of invasive species establishment and invasive species control. The invasive species management plan should be developed in consultation with applicable stakeholders to ensure proposed mitigation efforts comply with existing regulations which may potentially limit the application of specific invasive species control measures (e.g. use of herbicides in National Parks).

The use of seed mixes for re-vegetation of disturbance areas may also introduce invasive species. Given this risk, CZN's approach (as defined in EA0809-002) for re-vegetation of disturbed areas will rely primarily on encroachment of native species from surrounding vegetation communities.

Given the low anticipated traffic volumes anticipated for the all season road and the application of additional mitigation strategies (which should include an invasive species management plan) the extent, magnitude, duration and frequency of potential effects from invasive species introduction are considered low and reversible.

Overall, the significance of effects from invasive plants is expected to be low. No residual effects are anticipated assuming the appropriate application of mitigation strategies.

7.2.9 Effects to Soil, Hydrological and Permafrost Regimes

The study area is characterized by a variety of vegetation cover types ranging from alpine tundra areas with little to no soil development, to lowland areas dominated by wetland communities and organic soils (Beak 1981). Based on the review of the winter access road DAR (CZN 2010), the study area also contains areas with 'ice-rich ground' or discontinuous permafrost. Road construction in these environments presents challenges, both from the perspective of maintaining a viable, safe road surface and from the perspective of maintaining biological integrity in potentially sensitive environments.

Challenges associated with road engineering in permafrost areas are well documented, and generally result from removal of insulating vegetation (active thaw layer) overlying permafrost soils and disruption of the thermal equilibrium (Ferrians et al. 1970). Once vegetation is removed, the active thaw layer increases and collects greater quantities of moisture leading to greater heaving of the ground during the winter and a greater incidence of sediment flow, landslides and subsidence during the summer. All of these resulting consequences can have detrimental effects to the stability of road surfaces.

Thawing of permafrost can potentially result in direct and indirect negative effects to terrestrial and aquatic vegetation communities (ENR 2014i). Thawing of permafrost resulting in slumping and landslides can physically alter the landscape, and can potentially alter drainage patterns, moisture regimes, and nutrient regimes resulting in changes to community composition. Sediment releases caused by thawing permafrost can also alter suspended sediment levels in waterbodies, altering chemical and nutrient concentrations which may also result in changes to aquatic vegetation community composition.

Road construction can negatively affect physical and chemical properties of soil including changes to structure, porosity, permeability, organic matter content and chemical conditions; resulting from soil disturbance, compaction and mixing of soil layers (Johnston and Johnston 2004).

Road construction in wetland areas also has the potential to alter hydrology and cause changes to such communities. Jeglum (1975) and Hillman (1987) reported increases in tree growth and the development of a drier treed bog on one side of a road following construction in an open peatland. Similar studies conducted by Lieffers and Rothwell (1987) and Lieffers (1988) found that water drawdown on peatland soils increased growth of shrubs and hardwoods. Prevost et al. (1999) observed that changes in water levels, nutrient levels, and pH generally results in changes to species composition and species growth rates.

The use of existing disturbance areas (winter access road) for construction of a proportion of the all season access road will reduce potential project related effects to soil resources in the study area and avoid wetland areas to the greatest extent feasible. As part of the DAR prepared for the approved winter road access, CZN has committed to constructing road infrastructure in accordance with standard industry best practice, including guidelines described in the *Northern Land Use Guidelines: Access Roads and Trails* (INAC 2008). All best management practices, including the salvage of topsoil, erosion control measures, and the maintenance of the existing hydrological regimes (using appropriately placed culverts or other methods) should be determined prior to construction.

Assuming adherence to standard industry best practices during construction, the extent, duration and frequency of potential project related effects to soils, hydrology and permafrost regimes are considered low and reversible.

Overall, the significance of effects are expected to be low. No residual effects are anticipated assuming the appropriate application of mitigation strategies.

7.2.10 Mitigation and Best Management Practices

7.2.10.1 General Best Management Practices

Currently authorized changes in the alignment of the winter access road are related to the avoidance of karst features west of Mosquito Lake, avoidance of wetlands between Fishtrap Creek and Grainger Pass, and extensive areas of muskeg between Granger Pass and the Liard Highway. The latter two realignments are favoured by residents of Nahanni Butte. Other realignment changes are to avoid bisecting karst features (poljes) and sharp bends (CZN DAR 2010; Golder 2010).

General best management practices (BMPs) related to mitigating further potential effects on vegetation (including ecosystems and rare plants) along the current winter road corridor and future access road include:

- Confine all season road development activities to the approved winter road corridor to the greatest extent feasible;
- Preparation of an Emergency Response Plan for spill containment and management along the access road;
- Fuel storage facilities that meet industry standards for tank construction, location and spill containment;
- Staff training with respect to fire prevention protocols and emergency response procedures;
- Construction in accordance with best standard industry practices in relation to soil disturbance, hydrology maintenance and construction in permafrost areas;
- Hydrocarbon and chemicals that are hauled along the access road or stored at the TTF meet industry standard containers with appropriate spill containment and management measures in place;
- Refuelling of trucks and equipment away from any stream, lake, wetland or other water body, per industry standards;
- Diligent application of the GNWT (1998) dust suppression guidelines at the TTF and along portions of the road as appropriate; and
- Development and implementation of an invasive species management plan to ideally prevent, or if necessary, control the establishment of invasive species in off-site vegetation communities adjacent to the roadway.

7.2.10.2 Re-vegetation During Reclamation

It is anticipated that re-vegetation of borrow sources and other disturbances associated with the development of the all season access road will occur primarily through encroachment of native species from surrounding vegetation communities.

7.2.10.3 Vegetation Control

During operation of the all season access road, it is anticipated that vegetation control may be required to control shrub and tree growth within the road ROW to maintain safe driving conditions. Additional vegetation control may be required in the event that invasive species are identified within proximity to the proposed development.

Control of tree and shrub growth within the proposed ROW should be conducted using mechanical methods (such as a brush mower). The use of herbicides and/or other chemical means of vegetation control are not recommended.

If required, control of invasive species should be conducted in accordance with an invasive species management plan that should be developed prior to project construction. The plan should detail appropriate best management practices with respect to invasive species control. The invasive species management plan should be developed in consultation with applicable stakeholders to ensure proposed mitigation efforts comply with existing regulations which may potentially limit the application of specific invasive species control measures (e.g., use of herbicides in National Parks).

8.0 CUMULATIVE EFFECTS

A cumulative effects assessment was performed on residual wildlife effects from the proposed all season access road (construction, operation, and closure) and airstrip interacting with residual effects predicted from other existing and future human-related projects and activities in the immediate vicinity or broader geographic region (i.e., Northern Mountain Caribou herd annual range).

8.1 Residual Effects of the All Season Access Road

With the application of the proposed mitigation measures, there are three residual effects identified for the proposed all season access road and airstrip, including:

- Positive residual effects on subsistence harvest and harvesting areas of Moose and Dall's Sheep;
- Adverse residual effects to Moose harvest pressure; and
- Adverse residual effects to Grizzly Bear movements in NNPR.

8.2 Existing Projects Considered in the Cumulative Effects Assessment

The potential cumulative effects of the Prairie Creek Mine and associated Project infrastructure, including the entire winter access road, were most recently discussed in the CZN DAR (2010). The Project had been referred to the Mackenzie Valley Environmental Review Board (MVEIRB) for environmental assessment (EA0809-002) and on December 8, 2011 the MVEIRB issued their Report of EA (REA).The MVEIRB concluded that the proposed development, as described in the REA and including CZN's commitments, is not likely to have any significant adverse impacts on the environment or to be a cause for significant public concern.

Golder had been retained by CZN to undertake the cumulative effects assessment (CEA) for the Project, which was provided as Appendix 17 to the DAR (Golder 2010). This previous CEA for wildlife was performed in the context of residual effects from the Prairie Creek Mine and associated winter access road operation, and how the potential residual effects could be additive to residual effects from other resource development projects in the immediate vicinity or broader geographic region (i.e., southern Mackenzie Mountains).

In accordance with the previous EA0809-002 environmental assessment process, three mining projects were identified for consideration in the CEA (Figure 4): the Howard's Pass district (Selwyn Project), the existing Cantung Mine and, the Mactung development proposal in the MacMillan Pass area. Increased road access related to these three mining projects was also to be considered in that CEA.

For purposes of the current all season road CEA, it is highly relevant to revisit the CZN DAR (2010) and Golder (2010) CEA, as a basis for consideration of any possible changes to predicted cumulative effects resulting from converting the existing winter access road, to an all season road, most likely in two phases.

Given the spatial separation between the Prairie Creek Mine and winter access road, and the three mine projects in the Mackenzie Mountains to the north, the potential for the identified residual effects from the Prairie Creek Mine and winter access road to result in a cumulative effect on the species discussed was determined to be unlikely (CZN DAR 2010).

Over the larger geographic region, there are a small number of human developments and activities that may interact to cumulatively affect wildlife in NNPR:

- Highway 7 (a gravel road considered to be a low traffic highway by the Department of Transportation) and the Nahanni Butte access. The average annual daily traffic volumes on Highway 7 collected from 2002 – 2011 ranged from 30-50 vehicles, with peak summer (June, July, August) daily traffic volumes reaching 40-70 vehicles (DOT 2012); and
- Active and inactive mines, their access roads, and airstrips including:
  - The Selwyn Project includes a 22 km approved access road (the Howard's Pass Access Road) at the headwaters of Flat River that is located inside the expanded NNPR boundary. This access road has been granted a 30 year licence of occupation. This mine and access road is located within the annual ranges of the Nahanni Complex and Finlayson caribou herds. The Prairie Creek Mine and access road are located at the extreme limit of the Nahanni Complex herds' winter range.
  - The Cantung mine includes a low traffic gravel road constructed in the early 1960's (referred to as the Nahanni Range Road). This road is located in the upper reaches of the Coal and La Biche river watersheds, immediately outside the expanded NNPR border. This road is managed by controlled gated access, with an apparent high level of success (Anderson et al. 2002). The Coal River Northern Mountain Caribou herd (part of the Nahanni Complex) occupies this area in the spring, summer, and fall, and crosses this road on their annual migrations (Weaver 2008). The Prairie Creek Mine and access road are located outside their defined annual range; however, a few caribou may occur near the all season access road in the winter.
  - The existing DAR (CZN 2010) considered the Mactung Mine, 339 km to the northwest, too far from the Prairie Creek Mine and its access road and was not likely to act cumulatively with the Prairie Creek Mine and activities. Species with large home ranges, such as Grizzly Bears and Northern Mountain caribou, were assessed. Management measures, including a Bear Management Plan for the Prairie Creek Mine and its access road, can go a long way to reduce the risk of cumulative impacts to regional grizzly populations. Similarly, the Mactung mining project predicts that there will be no effects on the overall health and migration of the Redstone caribou population. The Redstone herd may also occur in the area of the Prairie Creek mine; however, it is thought to be subdivided into two subherds, with only the Moose Horn River subherd potentially occupying the area of the Prairie Creek Mine, but does not encompass the Mactung project area.

– Prairie Creek Mine is at KP 0 of the proposed all season access road. Three residual effects were identified for the Prairie Mine and winter access road, these included (Golder 2010):

1) Potential for air traffic effects to Dall's sheep lambing activity in the spring (May-June) on the slopes above the airstrip and on Folded Mountain.

2) Potential for mortality of Dall's Sheep, Woodland Caribou (no distinction between Northern Mountain and Boreal woodland caribou), Moose, and Wood Bison from operation of the access road (November to mid-April) when populations are present in proximity to the access road alignment.

3) Potential for movements of Woodland Caribou and Grizzly Bear to be affected by sensory disturbance related to Mine site activity and human presence.

Overall in the wildlife cumulative effects assessment for the Prairie Creek Mine and the winter access road, Golder (2010) predicted the Selwyn, Cantung, and Mactung projects (proposed and active) were too far from the Prairie Creek Mine and its access road to likely interact adversely. The Prairie Creek Mine site is 186 km air distance from the existing Cantung mine site, 242 km from the Selwyn Project, and 339 km from the propose Mactung Mine development area (Golder 2010).

8.2.1.1 Foreseeable Future Projects Considered in the Cumulative Effects Assessment

There has been low industrial interest in the local area, which has been driven by land withdrawals over the past decade as the Dehcho Land Claim Process has been on-going (Senes 2011). Reportedly very few industrial interests were within or close to the Sambaa K'e candidate protected area given its remote location, climate, and small population base which limit economic growth potential (Senes 2011). Similar limits to industrial interest are anticipated in the region of the NNPR.

Over the foreseeable future, there are a few anthropogenic activities that may interact to cumulatively effect wildlife, these include:

- Exclusion of non-resident harvesting in the Nahanni Butte and South Nahanni outfitting zones inside the expanded NNPR boundary; and
- Protection from anthropogenic development through the Draft Interim Dehcho Land Use Plan conservation zones and other parks in the region.

Besides human developments, there are other conservation programs occurring over the larger geographic region that have the potential to moderate adverse effects from these human developments. Connecting to the NNPR, large corridors surrounding major rivers (e.g., the Mackenzie, Root rivers to the north) are defined as conservation zones in the Draft Interim Dehcho Land Use Plan, as well as large areas further away encompassing Sibbeston Lake to the North Nahanni River and Arrowhead Hills (NWT PAS 2014). Trout Lake (Sambaa K'e), approximately 100 km southeast of NNPR, is a proposed National Wildlife Area (NWT Protected Areas Strategy candidate protected area). Inherent in the values of conservation zones and national parks/wildlife areas, any new industrial developments will be prohibited. Therefore, little additional land use developments are anticipated in the immediate future surrounding NNPR to adversely interact with residual effects potentially occurring as a result from the proposed all season access road.

8.2.1.2 Cumulative Effects of All Season Access Road

Moose, Dall's Sheep, and Grizzly Bear adverse effects potentially persist as a result of the proposed all season access road and airstrip after mitigation is applied. In contrast, positive affects remain for members of the Naha Dehe Dene Band by providing additional access to Moose and Dall's Sheep harvesting areas.

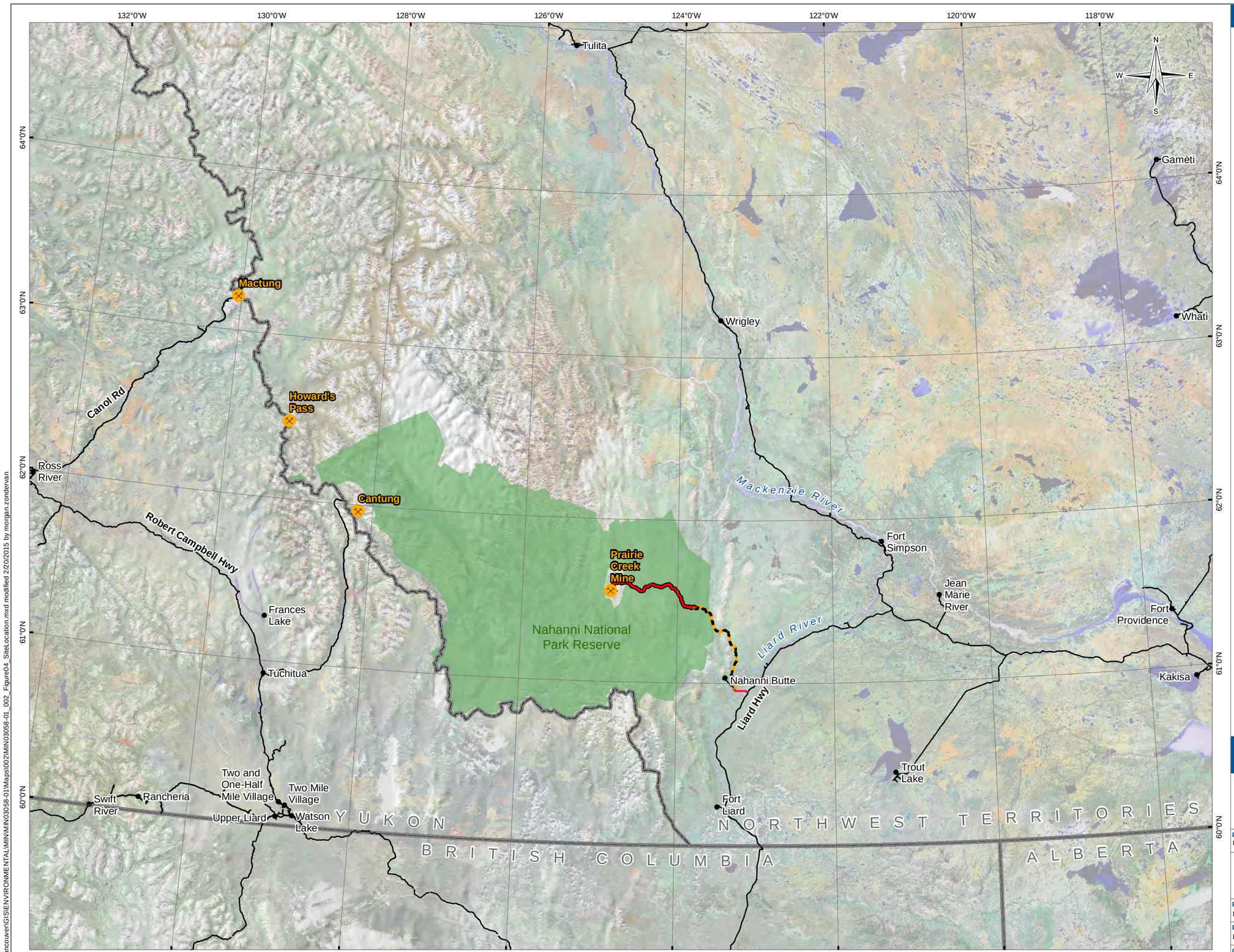
Residual wildlife effects from the proposed all season access road has the potential to interact adversely primarily with the Prairie Creek Mine and its airstrip. These could affect Grizzly Bear and Dall's Sheep.

The proposed all season access road effects assessment includes associated effects during winter operations, and therefore, essentially negates the predicted winter operation effects.

Moose: The environmental assessment for the Prairie Creek Mine and winter road predicted a low likelihood of vehicle collisions with moose along the Prairie Creek winter access road, but was not expected to be a cumulative effect for regional moose populations in the NWT (Golder 2010). The proposed all season access road reduces traffic volumes from the approved winter road levels and, therefore, essentially negates this potential cumulative effect. However, the cumulative harvest pressure anticipated because of the proposed all season access road may act cumulatively with Moose-vehicle mortality assumed to occur along Highway 7. Strict access control measures are required to monitor and manage non-Project related travel and hunting pressure along the all season access road.

Dall's Sheep: The environmental assessment for the Prairie Creek Mine and winter road predicted it was unlikely that cumulative effects on Dall's sheep habitat or populations would occur with full operation of the Prairie Creek Mine and its winter access road with other mines across the region (Golder 2010). However, potential residual effects in harvest pressure as a result of the proposed all season access road may act cumulatively with the predicted residual effects to Dall's Sheep lambing activity in the spring (May to June) near the airstrip and Folded Mountain. However, this is counter-balanced by the end of outfitter hunting for sheep in the NNPR by 2019. Strict access control measures and flight management (during lambing season) into the Prairie Creek Mine are required to monitor and manage non-Project related travel, hunting pressure, and disturbances to lambing areas near the Mine site and Phase 1 of the all season access road.

Grizzly Bear: The environmental assessment for the Prairie Creek Mine and winter road predicted a low but manageable risk to the regional Grizzly Bear population associated with bear-human encounters and mortality (Golder 2010). Golder (2010) suggested this risk to regional grizzly populations could be managed with a Bear Management Plan for the Prairie Creek Mine. Potential residual effects to Grizzly Bear movements through NNPR were predicted from the proposed all season access road. However, since traffic volumes and speed limits remain low, and the few resident bears using the Prairie Creek corridor are low, no further mitigation is considered necessary beyond the Bear Management Plan.



LEGEND

- Community
- Exploration Activity Location
- Provincial Boundary
- National Park
- Existing Road

Proposed All Season Road

- Phase 1
- Phase 2
- Existing Road

NOTES
Base data source:
ESRI Base Data and Maps
Road alignment provided by AllNorth (Jan 22, 2015)

STATUS
ISSUED FOR USE

PRAIRIE CREEK ALL SEASON ROAD DEVELOPER'S ASSESSMENT REPORT

Regional Location Map

PROJECTION UTM Zone 10		**DATUM** NAD83		**CLIENT** CANADIAN ZINC CORPORATION
Scale: 1:2,500,000 — 50 25 0 50 Kilometres				TETRA TECH EBA
FILE NO. MIN03058-01_002_Figure04_SiteLocation.mxd				
PROJECT NO. ENVMIN03058-01.002	**DWN** MEZ	**CKD** SL	**APVD** RH	**REV** 0
OFFICE Tt EBA-VANC	**DATE** February 20, 2015			**Figure 3**

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9.0 FOLLOW-UP AND MONITORING

Golder (2012) prepared a Draft Wildlife Mitigation and Monitoring Plan (WMMP) for the Prairie Creek Mine and winter access road operation that outlines approaches to reduce potential human-wildlife conflicts and to measure the effectiveness of the mitigation measures implemented. This plan was developed to be dynamic to allow further evaluation through engagement with appropriate stakeholders and development based on the principles of adaptive management.

The draft WMMP considers:

- On-site education consisting of detailed site orientation session for all site personnel and visitors regarding general wildlife education and site-specific wildlife policies and rules, including bear awareness and response programs, wildlife-human conflict management, waste management, and prevention and treatment of problem wildlife;
- Regular surveillance by a wildlife monitor to ensure appropriate policies are being followed (e.g., waste management plan);
- Management of toxic substances, waste, and employee safety on the Mine site;
- Management of sensory disturbances at the mine, airstrip, and access road;
- Dall's Sheep and caribou monitoring program to ensure Project-related effects are minimized;
- Traffic management including but not limited to checking and deterring wildlife from the airstrip prior to take-off and landing, vehicle speed limits, yielding the right-of-way to wildlife, appropriate signage to warn drivers of wildlife "caution zones" (including moveable signs), reporting system of wildlife on the road, and wildlife sweeps prior to avalanche control and management;
- Access road control including signage at the south-eastern terminus of the access road to deter non-mine related use (including ATVs and snowmobiles), manning a check-point and screening station, and reporting of public use of the access road and evidence of land use (e.g., hunting, firewood harvesting);
- Wildlife monitoring by qualified wildlife monitors to conduct ground surveillance at Mine start up and production periods at the Mine and along the access road, responding to and reporting on wildlife incidents and bear encounters, and reporting wildlife-Project interactions (including the wildlife observation logs);
- Ground-based caribou monitoring (caribou numbers, frequency and location of occurrence, and response to aircrafts), during year-round Mine operations and winter access road use by qualified wildlife monitor surveillance at the Mine and airstrip and through reported observation logs by winter road users and pilots at the airstrip;
- Aerial and ground-based reconnaissance surveys to determine Dall's Sheep sensitive lambing areas within 5 km of the Mine site, airstrip, and airstrip approach and their distribution, movements, and behaviour during the parturition period in relation to the Mine and airstrip;
- Incident management and regulatory contacts;
- Data analysis and reporting; and
- Adaptive management triggers, responses, and reporting including a zero mortality threshold and reporting directives for caribou, Wood Bison, Grizzly Bear, Wolverine, Peregrine Falcon, Short-eared Owl, Horned

Grebe, Rusty Blackbird, Olive-sided Flycatcher, and Common Nighthawk directly affected by Project-related activities.

The scope of the existing draft WMMP should be updated to include all season monitoring and species potentially affected by the all season access road and airstrip use. Additional considerations for the draft WMMP includes incorporating:

- Including mortality thresholds for additional species at risk (e.g., Trumpeter Swan, Collared Pika), Moose, and Dall's Sheep;
- Monitoring, evaluating, and reporting harvest pressure, particularly along the Nahanni Range portions of the outfitter zone that is located outside the NNPR boundary;
- Educating and promoting First Nations voluntary reporting of harvests from along the all season access road; and
- Incorporating additional mitigation measures outlined in this document to minimize non-winter period potential effects (e.g., water pumping from Beaver and Trumpeter Swan ponds) and all potential species at risk.

10.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
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Personal Communications

Steve Gooderham, Regional Forester, ENR. November 24, 2014 via email.

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

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3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by Tetra Tech EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.