

**Inuvik to Tuktoyaktuk Highway  
Wildlife Effects Monitoring Program (WEMP):  
*Initial Design and Cost Estimates of Proposed Wildlife Studies*  
DISCUSSION DRAFT**

**DEPARTMENT OF TRANSPORTATION  
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES  
GOVERNMENT OF THE NORTHWEST TERRITORIES**

## Acronyms

COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DDT	an insecticide with the chemical name dichlorodiphenyltrichloroethane
DLP	Defense-of-Life-and-Property
EIS	Environmental Impact Statement
ENR	Department of Environment and Natural Resources
GNWT	Government of the Northwest Territories
GPS	Global Positioning System
ISR	Inuvialuit Settlement Region
km	kilometer
VC	Valued Component of the ecosystem
WEMP	Wildlife Effects Monitoring Program
WPP	Wildlife Protection Plan
RSA	Regional Study Area
RSFs	Resource Selection Functions
TK	Traditional Knowledge
ZOI	Zone of Influence

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## 1. Introduction

The Government of the Northwest Territories (GNWT), Town of Inuvik, and Hamlet of Tuktoyaktuk have proposed the construction of a 138 kilometer (km) all season highway from north of Inuvik to the Source 177 site near Tuktoyaktuk. The road will take approximately four years to build. Within the GNWT, this project is led by the Department of Transportation (DOT) but the Department of Environment and Natural Resources (ENR) has been providing technical expertise related to how potential highway impacts on wildlife can be monitored and mitigated. A number of concerns have been raised during the review of the Environmental Impact Statement (EIS) that relate to the impact of the proposed highway on the distribution and abundance of barren-ground caribou (*Rangifer tarandus*), barren-ground grizzly bears (*Ursus arctos*), wolverine (*Gulo gulo*), and wolves (*Canis lupus*). These species are considered important to harvesters or trappers, and/or they are species at risk or special concern. Specifically, there are concerns that the highway will lead to the loss and disturbance of wildlife habitat (e.g., den sites) and increased wildlife mortality due to increased harvest pressure and traffic-related mortality.

There is some baseline wildlife information available in and around the area of the proposed highway. Most of the information that does exist is from collared caribou in the Cape Bathurst and Tuktoyaktuk Peninsula herds, but these collaring programs were designed for previous population surveys and not for the collection of the type of detailed information that is necessary to evaluate highway impacts on winter caribou habitat selection and movement. Similarly, there is some information on grizzly bear distribution in the Regional Study Area (RSA), but not at a fine enough scale to accurately determine the impact of the highway on bears. Other wildlife information in this area is sparse as there were few wildlife concerns prior to the proposal of the all season highway.

The Inuvik to Tuktoyaktuk Highway Wildlife Effects Monitoring Program (WEMP) is designed to evaluate the effect of the proposed highway on the movement, habitat selection, and direct mortality of barren-ground caribou and barren-ground grizzly bears. The WEMP describes additional wildlife effects monitoring for wolverine and wolf. The program will be targeted to the Regional Study Area (RSA) described in the EIS, which is a 15 km wide buffer running along the proposed highway corridor and existing Source 177 access road. Wildlife monitoring is proposed to occur prior to construction, during highway construction, and five years after the highway has been opened for use. This will allow for a clearer understanding of wildlife movement, habitat selection and mortality before, during, and after the highway has been constructed. As a result, the impact of the highway on wildlife can be assessed and any mitigation actions can be tested and revised, if necessary.

Key elements of the proposed program are new and specific to the effects of the highway. Some elements of the program fit into existing ENR strategies<sup>1,2</sup> but it is expected additional resources for this work will be part of the development package for the construction of the road. The WEMP is expected to be used in combination with the Wildlife Protection Plan (WPP) for construction and use of the highway after construction.

## 2. Objectives

The WEMP includes proposed monitoring of caribou and grizzly bear wildlife effects, primarily through collaring. The WEMP also includes proposed monitoring of wolverine and wolves through methods other than collaring. The primary objectives of all monitoring activities will be to:

- Determine how selected wildlife species move, use, and select habitat within the RSA prior to highway construction (i.e., establish a pre-disturbance baseline of information from which to determine the potential impacts of the Highway).
- Test the prediction made in the EIS that the road will have limited impacts on wildlife by monitoring wildlife distribution, movements and/or habitat use and selection in and around the highway before, during and up to five years after construction. More specifically, the WEMP will:
  - Monitor and measure changes in distribution, movement and/or habitat use and selection along the highway as borrow site activities and highway right-of-way construction progresses (e.g., determine if there is a Zone of Influence or ZOI along the highway; this may be evident if wildlife use the area around the highway less than expected by chance or move across the highway less than expected by chance).
  - Monitor and measure changes in distribution, movement and/or habitat use and selection along the highway once the highway is completed (e.g., determine if the ZOI is smaller once construction is over).
- Determine if the highway will lead to additional mortalities for selected wildlife species within the RSA (and if these mortalities are significant at the population level).
- Use the information from this program to mitigate and manage highway impacts where possible (e.g., using an adaptive management approach, test the effect of reducing highway speed on the ZOI for caribou).

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<sup>1</sup> Caribou Forever – Our Heritage, Our Responsibility: A Barren-ground Caribou Management Strategy for the Northwest Territories 2011 – 2015.

<sup>2</sup> Western NWT Biophysical Study

- Use the information from this program to inform best practices associated with future highway developments in the NWT (i.e., the proposed Mackenzie Valley Highway). The wildlife information collected during this program will also be used to inform cumulative effects assessment and management within the Inuvik Region and the NWT as a whole.

**Note:** *This is the draft WEMP and it will be adapted and revised as needed (i.e., pending consultations with co-management partners, new information, and identification of resources that allow for inclusion of additional species).*

### **3. Components of a species-based wildlife effects monitoring program**

#### **3.i. Barren-ground caribou**

##### Rationale:

Caribou are an important big game species in the Inuvialuit Settlement Region (ISR). Radio-collar information indicates that caribou from the Cape Bathurst and Tuktoyaktuk Peninsula herds use the area where the highway corridor is proposed. Caribou from the Bluenose-West herd have also used the proposed corridor when their numbers were high. Based on studies conducted on barren-ground caribou in other parts of Canada<sup>3</sup>, it is expected that caribou will initially avoid the highway during construction and after the highway opens until they become habituated to the new disturbances. After habituation to the highway, caribou are expected to cross it regularly as long as traffic volume remains low and additional linear structures are not built adjacent to the road. There may remain an area of reduced use along the highway corridor.

The response of caribou to the highway will be based primarily on the analysis of caribou radio-collar movements and habitat use and selection before, during, and five years after highway construction. This type of analysis has been carried out for boreal woodland caribou in Alberta and the NWT and will show if caribou are less likely to cross the highway and if caribou use areas around the highway less than expected.

ENR deployed a number of GPS collars on caribou in the Cape Bathurst and Tuktoyaktuk Peninsula herds in March 2012. Collars were deployed to start the

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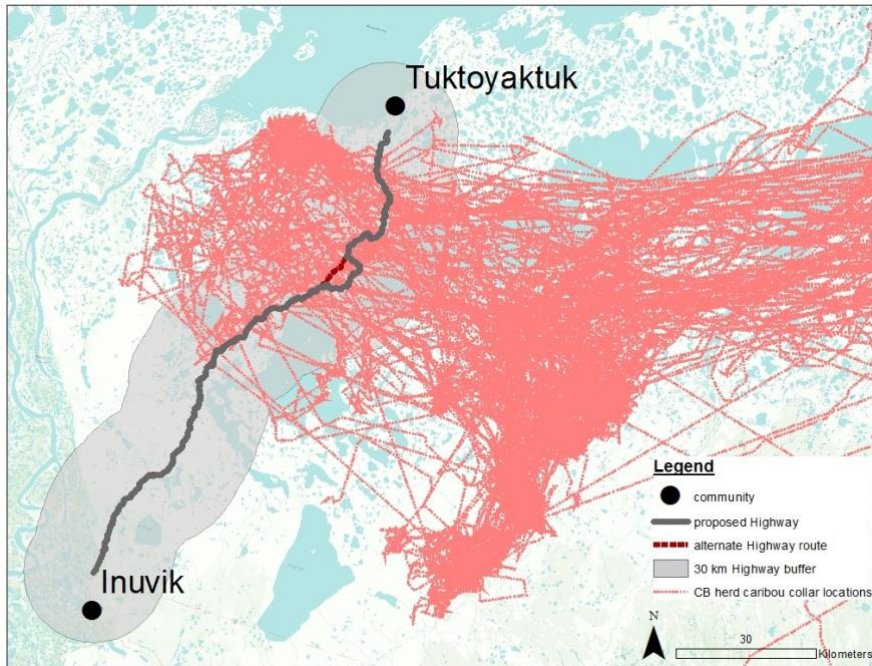
<sup>3</sup> Literature reviewed by Wolfe et al. (2000) showed that "... infrequently travelled transportation corridors resulted in low numbers of road-kills, did not deter road crossing by caribou, and had no observable effect on traditional migration routes, annual distribution, or energetic costs (Klein 1971; Johnson and Todd 1977; Johnson 1985; Russell and Martell 1985). Traditional migrations have continued across constructed railways or roads in Newfoundland (Bergerud 1971), Yukon (Surrendi and DeBock 1976; Russell and Martell 1984), British Columbia (Johnson and Todd 1977) and Alaska (Skoog 1968), but have ceased after construction of a railway and a highway between summer and winter ranges in Norway (Nellemann et al. 2000)."

baseline collection of information for the WEMP and as part of the preparation for the July 2012 post-calving ground surveys for both herds. Collars are used to locate herds during the surveys, which are used to estimate herd size for the Cape Bathurst and Tuktoyaktuk Peninsula herds. Analysis of collar location data that has previously been collected in the area indicates that caribou use the area containing the proposed road corridor (Figures 1 and 2). Use takes place mainly between October and April.

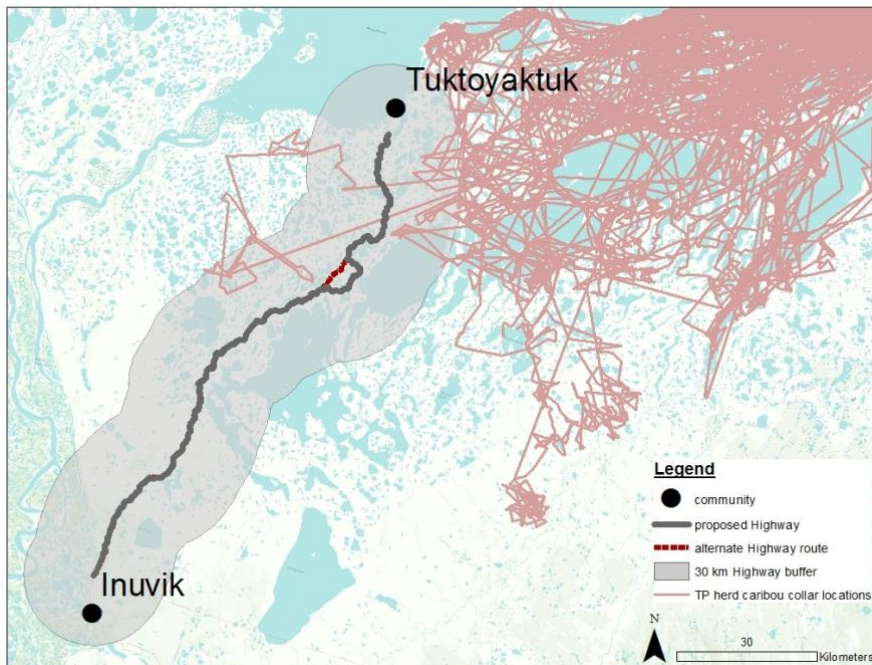
Location information will also be combined with harvest data, incidental mortality data (vehicle collisions, etc.), and traffic volume information within the RSA to get a better understanding of the impact of the highway on direct mortality. This information will be used to determine if any actions, such as signage or harvest management along the highway, are necessary.

Potential for future increased caribou hunting from the road:

In other portions of the NWT, roads have provided harvesters with easier access to caribou herds and are considered to have contributed significantly to accelerating declines of herds at low numbers (e.g., the Bathurst herd). Although harvest of the Cape Bathurst herd has been suspended since 2007, there is concern that the ITH will increase hunter access to the herd once harvest is re-opened. When this occurs, the impact of the ITH on harvest of caribou will need to be monitored and managed (e.g., via harvest management actions that include check stations, public education programs, etc.).



**FIGURE 1:** ENR's barren-ground caribou collar data from the Cape Bathurst (CB) herd between 2005 – 2010 within the area of the proposed Inuvik to Tuktoyaktuk Highway. Collar data shown is from all seasons (year-round).



**FIGURE 2:** ENR's barren-ground caribou collar data from the Tuktoyaktuk Peninsula (TP) herd between 2005 – 2010 within the area of the proposed Inuvik to Tuktoyaktuk Highway. Collar data shown is from all seasons (year-round).



### Predictions to be tested:

Radio-collar data will be used to determine caribou movement and habitat use and selection before highway construction. Mortality from harvest and other sources will continue to be tracked prior to highway construction. This information will form the baseline conditions from which it will be determined:

- If there is an area of reduced use near the highway during and after construction, and if so, what the size of this area is (i.e., the ZOI).
- If caribou cross the highway at a higher rate of travel than they would cross over un-disturbed areas.
- If caribou are less likely to cross the highway.
- What the overall impact of the highway is on direct mortality within the RSA.
- If mitigations and management actions meant to limit impacts on caribou are effective.

### Methods:

A total of forty-six GPS/satellite collars were placed on caribou from the Cape Bathurst and Tuktoyaktuk Peninsula herds in March 2012. These collars provide three locations daily. Ten of the deployed collars were equipped with a geofence, allowing more data to be collected if the caribou move into the area of the proposed road (one location every hour). Additional collars will be deployed in March 2013, and as necessary additional collars will be purchased and deployed in March 2014, March 2017, and March 2020 in order to maintain thirty collars/herd for both herds.

Collar location data collected in the RSA will be analysed using movement rate analysis and habitat selection analysis (Resource Selection Functions or RSFs). Collar tracks and locations from caribou that were within or near the highway corridor before construction will be compared to tracks and locations during, and up to five years after, construction.

### Proposed Schedule/Budget for 2012/13 and beyond:

The following table provides cost estimates and approximate timing of field work and analysis of data necessary to monitor the effects of the highway corridor on caribou. Currently, ENR has funds for 2012/13 and for the data acquisition costs for 2013/14.

<b>Fiscal Year</b>	<b>Cost</b>	<b>Details<sup>4</sup></b>
2012/13	\$150K	Data acquisition, collar deployment, and data analysis
2013/14	\$120K	Collar pick up, data acquisition, analysis, and preliminary report
2014/15	\$230K	Collar pick up, purchase and deployment; and data acquisition and analysis
2015/16	\$70K	Collar pick up, data acquisition, analysis, and preliminary report
2016/17	\$70K	Collar pick up, data acquisition, and analysis
2017/18	\$230K	Collar pick up, purchase and deployment; and data acquisition, analysis, and preliminary report
2018/19	\$70K	Collar pick up, data acquisition, and analysis
2019/20	\$70	Collar pick up, data acquisition, and analysis
2020/21	\$100K	Collar pick up, data acquisition, final analysis, and report of results

### **3.ii. Barren-ground grizzly bear**

#### **Rationale:**

Grizzly bears were assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2012 as a species of Special Concern in Canada. Low recruitment and reproductive rates<sup>5</sup>, as well as concern over the vulnerability of grizzly bear populations and their range to increasing human presence, provide further rationale for including barren-ground grizzly bears in the ITH WEMP.

Grizzly bears occur throughout the RSA (**FIGURE 3**), with the northern half of the proposed highway corridor occurring within grizzly bear denning areas identified in community conservation plans. Construction occurring during winter months provides the greatest potential for disturbance to denning bears, particularly females with cubs. Summer construction will happen outside of the normal denning period. Normal highway use post-construction is anticipated to create a loss of functional habitat close

<sup>4</sup> Based on a three-year life expectancy for GPS/satellite collars.

<sup>5</sup> Northern barren-ground grizzly bears have been shown to have low recruitment rates compared to other terrestrial mammals. Mean age of female bears' first reproductive episode is 8.1 years of age; and litter sizes are small (averaging two cubs per litter), with a reproductive interval averaging three years between litters (McLoughlin et al. 2003). A study looking at grizzly bears in the NWT and Nunavut showed an average 74% survival rate for the first year of life (McLoughlin and Messier 2003).

to the highway (i.e., a ZOI). It is also expected that grizzly bears will select den sites away from the highway.

The physical presence of the highway, along with traffic travelling on it, may be a physical barrier to movement until bears become habituated to its presence. During construction of the highway, direct mortality of grizzly bears through the destruction of nuisance bears is a potential concern, although the implementation of the WPP created for the Inuvik to Tuktoyaktuk highway is predicted to reduce the potential for defence-of-life-and-property (DLP) kills.

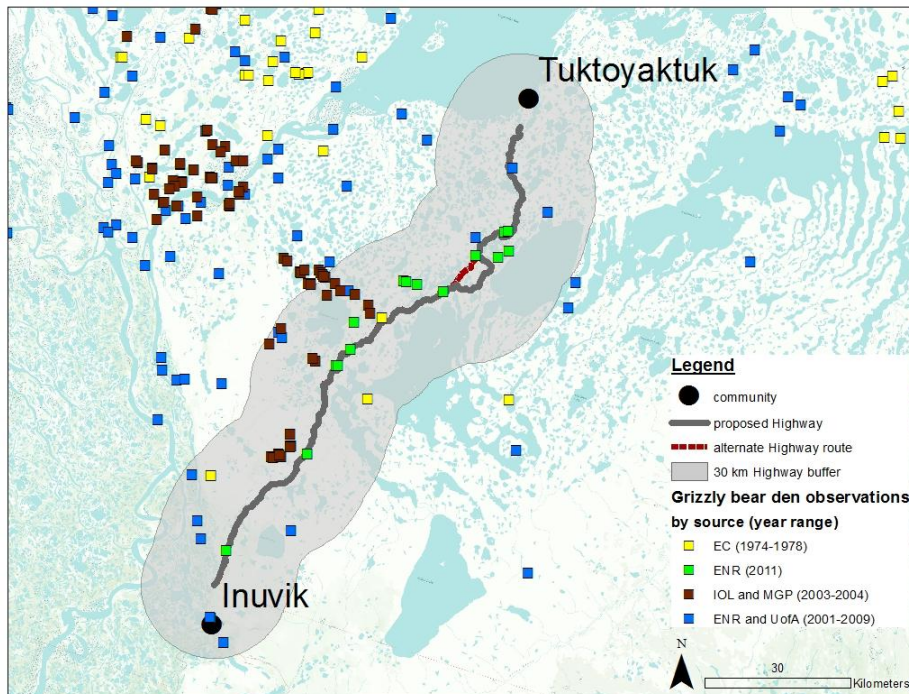
Grizzly bears will be monitored via GPS collars deployed before, during, and for up to five years after highway construction to determine the impacts of the highway on grizzly bear movement and habitat selection. Specific impacts of highway construction on denning behaviour will be determined via aerial den surveys of the RSA before and during highway construction. This information will be used to avoid denning bears during winter work. It will also provide location information for bears residing in the area for spring capture work.

To get a better understanding of the impact of the highway on direct mortality in the RSA, DLP kills, harvest data, and other incidental mortality data (vehicle collisions, etc.) will be tracked before, during, and up to five years after highway construction. This information will be used to determine if any actions, such as harvest management along the highway, is necessary. This is part of the current ongoing monitoring program of ENR.

#### Predictions to be tested:

Radio-collar data will be used to determine bear movement and habitat selection (including location of den sites) before highway construction. Mortality from harvest and other factors will to be tracked prior to highway construction. This information will form the baseline conditions from which it will be determined:

- If there is an area of reduced use near the highway during and after construction, and if so, what the size of this area is (i.e., the ZOI).
- If there is a change in bear denning frequency within or near the road corridor during and after construction when the road is in use.
- If bears cross the highway at a higher rate of travel than they would cross over un-disturbed areas.
- If bears are less likely to cross the highway.
- What the overall impact of the highway is on direct mortality within the RSA.
- If mitigations and management actions meant to limit impacts on bears are effective.



**FIGURE 3:** Observed grizzly bear denning sites within the area of the proposed Inuvik to Tuktoyaktuk Highway and the time period within which the den was observed. Sources for data are Environment Canada (EC); Environment and Natural Resources, GNWT (ENR); Imperial Oil (IOL); Mackenzie Gas Pipeline project (MGP); and the University of Alberta (UofA).

### Methods:

A total of fifteen GPS/satellite collars will be deployed on grizzly bears in or near the RSA in May 2013. These collars will be programmed to provide six locations a day in the active period and one location daily during hibernation. Depending on the performance of the caribou collars, grizzly collars may be equipped with a geofence that allows more data to be collected if the bears move into the area of the proposed highway (one location every hour). Additional collars will be deployed to keep the number of bears collared around fifteen, likely in May 2015, May 2017, and May 2019.

Collar location data for any bears found near the road corridor will be analysed using movement rate analysis and habitat selection analysis (RSFs). Collar tracks and locations from bears that were within or near the road corridor before construction will be compared to tracks and locations during and up to five years after construction.

As ENR records for the area go back to the late 1980s, harvest locations post construction will be compared to historic grizzly bear harvest data. Levels of DLP kills and other types of mortality pre, during, and post construction will be monitored.

### Proposed Schedule/Budget for 2012/13 and beyond:

The following table provides cost estimates and approximate timing of field work and analysis of data necessary to monitor the effects of the highway corridor on bears. Currently, ENR has funds for 2012/13 and for the data acquisition costs for 2013/14.

<b>Fiscal Year</b>	<b>Cost</b>	<b>Details</b>
12/13	\$80K	Purchase GPS collars, fall denning survey, and preliminary data analysis
13/14	\$109K	Spring deployment, collar pick up, fall denning survey, and data acquisition/analysis
14/15	\$105K	Collar pick up and purchase/refurbishment; fall denning survey; and data acquisition/analysis
15/16	\$114K	Spring deployment, collar pick up, fall denning survey, and data acquisition/analysis
16/17	\$105K	Collar pick up and purchase/refurbishment; fall denning survey; and data acquisition/analysis
17/18	\$114K	Collar deployment, collar pick up, data acquisition/analysis
18/19	\$105K	Collar pick up and purchase/refurbishment; and data acquisition
19/20	\$114K	Collar deployment, data acquisition
20/21	\$53K	Data acquisition, and data analysis
21/22	\$40K	Final data analysis, and report

### **3.iii. Wolverine**

#### Rationale:

Wolverines are an important furbearer species in the ISR and Traditional Knowledge (TK) and harvest data confirm that wolverines utilize the RSA. COSEWIC has assessed the status of the western population of wolverine in Canada as *Special Concern*. In the NWT, wolverines are ranked as *Sensitive* by the NWT General Status Ranking Program and are slated for assessment by the NWT Species at Risk Committee in 2013. The inclusion of wolverine in the WEMP is based on this status, their low tolerance to human disturbance, and concern over how the proposed highway may result in increased mortality of the species.

During and after construction, wolverines may use the area within the RSA less than expected as a result of noise from construction activity, camps, and vehicle traffic. Alternatively, wolverines may be attracted to camps, cabins, or construction activity if waste and odours are not properly managed. The WEMP will establish the ZOI on

wolverines, if it exists, by comparing distribution and movements within the RSA before highway construction to the distribution and movements during and five years after construction. Attraction versus avoidance will be assessed by determining how wolverine distribution and movements in the RSA changes with road construction and use.

Wolverines attracted to camps, cabins, or construction activities associated with the highway may be removed from the local population as problem wildlife. After the highway is opened, additional mortalities may occur if wolverines that are attracted to any ungulate kill sites near roads are themselves hunted or trapped (ungulate kill sites would occur if future harvesting of caribou or other species occurs along the highway or because of animals killed by vehicles). Direct wolverine mortality associated with vehicle collisions is expected to be a rare event.

Wolverines will be monitored via a hair snagging program that allows for DNA sampling within the RSA (see Mulders *et al.* 2007 for more information). This program will be used to determine wolverine distribution and movements before, during, and up to five years after highway construction. To get a better understanding of the impact of the highway on direct mortality in the RSA, harvest data and other incidental mortality data (vehicle collisions, etc.) will be tracked before, during, and five years after highway construction. This information will be used to determine if any actions, such as harvest management along the highway, are necessary.

#### Predictions to be tested:

DNA data will be used to determine wolverine distribution and movement before highway construction. Mortality from harvest and other factors will be tracked prior to highway construction. This information will form the baseline conditions from which it will be determined:

- If there is an area of reduced or enhanced use near the highway during and after construction, and if so, what the size of this area is (i.e., the ZOI).
- What the overall impact of the highway is on direct mortality and wolverine distribution within the RSA.
- If mitigations and management actions meant to limit impacts on wolverines are effective.

#### Methods:

DNA hair snagging will be used to determine if there is a ZOI around the Highway during and after construction, and if the Highway contributes to wolverine mortality and changes in population trends within the RSA. The **preliminary** study design, subject to refinements based on power analysis by a statistician, is proposed to involve

establishing a grid over the middle 50 km portion of the RSA. The central portion of the study area was chosen to maximize the number of years of baseline data that could be collected before construction takes place, given that construction is scheduled to begin at either end of the highway for the first two seasons of construction. Monitoring stations consisting of single wooden posts covered in barbed wire and supplied with bait will be placed within each of the grid cells. Hair samples will be collected over two sessions spaced ten days apart in early April, beginning in 2013. Following the protocols established for monitoring of wolverines at the diamond mines in the North Slave Region, collections will take place annually before and during construction and biannually during the operations phase (to be verified statistically; see Mulders *et al.* 2007 for more information). Collected samples would be sent out for DNA analysis and results evaluated after each phase of the project.

Existing sources of data will be analysed to identify changing patterns of wolverine harvest relative to the highway during the pre-construction, construction, and up to five years after construction phase. ENR's wolverine carcass collection program has been collecting data on sex, age, and harvest since 2004/2005 and is an ongoing program that can be used to track this information into the operation phase of the project. Further baseline information can be provided by the Inuvialuit Harvest Study which recorded location and numbers of wolverine harvested in the ISR from 1988 to 1999.

Proposed Schedule/Budget for 2012/13 and beyond:

The following table provides costs and approximate timing of field work and analysis of data necessary to determine the effects of the Highway corridor on wolverines.

<b>Fiscal Year</b>	<b>Cost</b>	<b>Details</b>
2013-14	\$79K	Statistical analysis (\$5,000), post set up and sampling (\$300/post), and DNA analysis
2014-15	\$48K	Sampling posts and DNA analysis
2015-16	\$48K	Sampling posts and DNA analysis
2017-18	\$48K	Sampling posts and DNA analysis
2019-20	\$48K	Sampling posts and DNA analysis; final analysis and write up
2020-21	\$10K	Contract for final analysis and write-up, including analysis of harvest data

### 3.iv. Wolves

#### Rationale:

Wolves are an important furbearer species in the ISR and traditional knowledge and harvest data confirm that wolves utilize the RSA and proposed road corridor. Wolves are ranked as *Stable* by the NWT General Status Ranking Program and typically display high resilience to harvest and other pressures. However, their importance as harvest species in the ISR, concerns over the impact of disturbance on den use and productivity, and the relatively low cost of monitoring wolves provide a rationale for their inclusion in the monitoring program.

The highway may result in reduced use of denning habitats within the RSA because of disturbance, resulting in lowered productivity. Attraction of wolves to gut piles of other species harvested near the highway might predispose them to increased levels of mortality due to additional hunting and trapping pressure. While wolf mortality associated with vehicle collisions is expected to be a rare event, increased access is likely to increase wolf harvesting levels.

Aerial surveys of known and potential den locations will provide baseline data from which to determine the impacts of highway construction and operation on den occupancy and productivity. To get a better understanding of the impact of the highway on direct mortality in the RSA, harvest data and other incidental mortality data (vehicle collisions, etc.) will be tracked before, during, and up to five years after construction. This information will be used to determine if any actions, such as harvest management along the highway, is necessary.

#### Predictions to be tested:

- If there is an area of reduced den use near the highway during and after construction, and if so, what the size of this area is (i.e., the ZOI).
- If highway construction and operation impacts den site occupancy and productivity within the RSA.
- What the overall impact of the highway is on direct mortality of wolves within the RSA.
- If mitigations and management actions meant to limit impacts on wolves are effective.

#### Methods:

***Den occupancy relative to highway:*** In early June 2013, ENR and DOT will conduct surveys of eskers and suitable denning habitat within the RSA to locate active wolf dens. Located dens will be surveyed twice more, once in late June/early July to check



on site occupancy and assess detection probabilities and again in late August to assess pup recruitment at dens or rendezvous sites. Surveys will be conducted before, during, and five years after construction. It will be necessary to find enough dens in the RSA pre-construction to be able to statistically measure an effect during construction. If this is not possible, this aspect of the WEMP will be dropped.

***Patterns of wolf harvest.*** Existing sources of data will be analysed to identify changing patterns of wolf harvest relative to the highway in the RSA during the pre-construction, construction and post-construction phases. ENR's wolf carcass collection program has been collecting data on sex, age and harvest since 2006/2007 and is an ongoing program that can be used to track this information into the operation phase of the project. Further baseline can be provided by the Inuvialuit Harvest Study which recorded location and numbers of wolves harvested in the ISR from 1988 to 1999.

Proposed Schedule/Budget for 2012/13 and beyond:

The following table provides costs and approximate timing of field work and analysis of data necessary to determine the effects of the highway corridor on wolves.

Fiscal Year	Cost	Details
Annually	\$30K	Use of small fixed-wing aircraft; data analysis and annual reports
2020-2021	\$10K	Contract for final analysis and write-up, including final analysis of harvest data

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