

MACKENZIE VALLEY HIGHWAY PROJECT

DEVELOPER'S ASSESSMENT REPORT

Mandate commitment of the 19th Legislative Assembly

October 2023

VOLUME 5

Management Plans

Government of
Northwest Territories

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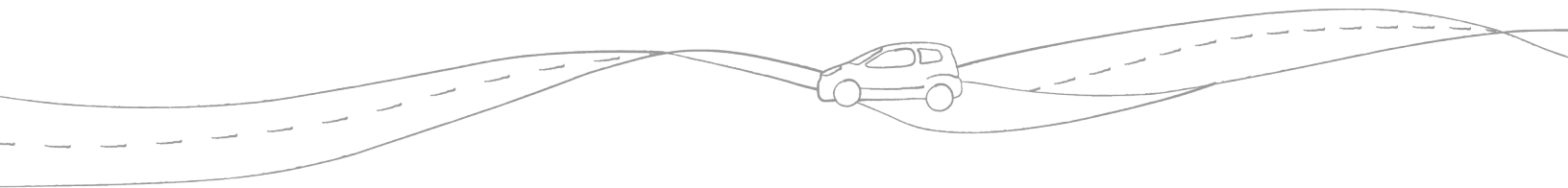
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MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT EMERGENCY RESPONSE PLAN FRAMEWORK

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		Draft for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

ERP	Emergency Response Plan
GNWT	Government of the Northwest Territories
GNWT-ECC	Government of the Northwest Territories – Department of Environment and Climate Change
GNWT-INF	Government of the Northwest Territories – Department of Infrastructure
km	kilometre
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	<i>Mackenzie Valley Resource Management Act</i>
MVWR	Mackenzie Valley Winter Road
NWT	Northwest Territories
the Project	Mackenzie Valley Highway Project
ROW	right-of-way
SLUP	Sahtu Land Use Plan
SLWB	Sahtu Land and Water Board
SCP	Spill Contingency Plan

1 Introduction

This Emergency Response Plan (ERP) has been developed to support the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is located in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells and includes the development of quarry and borrow sources (Figure 1.1). The ERP was developed in accordance with applicable guidelines and best practices in Northwest Territories and is one of several plans developed for the construction, operations, and maintenance of the Project. **This ERP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. Future revisions of the ERP will be submitted to regulatory authorities as may be required.**

The primary goal of this ERP is to direct a prompt, efficient, and coordinated response should an emergency event occur at the project site. The goal of the plan is also to mitigate potential harm along the project alignment and to present project personnel with the appropriate action response should an emergency event occur. Under this ERP, emergency readiness takes into consideration the most likely accidents or malfunctions based on project activities. Emergency events related to this Project include spills, transportation accidents, fire, and explosion. Emergency events will be described within four key pillars: emergency preparedness, mitigation measures, response actions, and recovery.

This ERP accompanies and compliments the Project Spill Contingency Plan (SCP). Major spill-related emergencies will be handled by the emergency response team. A similar approach to communications, training, and messaging around spill contingency aligns with the overall Project ERP principles. For additional detail related to spill events, please refer to the SCP.

The first version of this plan was developed based on best practice, professional judgement, and emergency management guidance, where applicable. The ERP and future revisions will be submitted to regulatory authorities, as may be required. Following approval of the environmental assessment, the ERP will become effective upon commencement of project construction.

This ERP will be reviewed and updated with feedback from the environmental assessment process. Revisions will also be performed, as needed, to adapt and incorporate any changes related to project-based factors; pertinent project-specific changes during construction (e.g., site conditions and design modifications); and GNWT Department of Infrastructure (GNWT-INF) and Contractor practices, experiences, and policies; and will include results from ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties in the Sahtu Region, the Dehcho Region, and all applicable regulatory agencies.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
- Community
- Northwest Territories Highway
- Winter Road
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary

0 40 80 Kilometres
 (At original document size of 8.5x11)
 1:4,500,000



Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

1.1

Title

Project Overview

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2020

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

1.1 Purpose and Approach

The ERP provides methods, strategies, and recovery efforts aimed at preventing or mitigating negative impacts due to emergency events that could arise from activities related to the construction of the Project. This plan also describes a response approach, with an emphasis on state of readiness, which will enable prompt and effective response and recovery for possible emergency events.

The purpose of this plan is to establish and implement direction for managing potential project emergency events during the construction phase of the Project. This plan identifies key information for project personnel such as emergency event descriptions, response organization, response procedures, communication protocols, and training. The ERP describes how the Project will:

- Uphold relevant authorization terms and conditions, relevant standards, control plans, and procedures for training, communications, investigation, and corrective actions
- Meet commitments made during the environmental assessment or subsequent regulatory review processes
- Meet the conditions of regulatory authorizations, as applicable

1.2 Project Contacts

In the event of an emergency or inquiries about emergencies, emergency management, and/or this plan, key contacts include:

Primary GNWT-INF Dehcho contact:

[Insert Name]
Regional superintendent, Dehcho Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary GNWT-INF Sahtu contact:

[Insert Name]
Regional superintendent, Sahtu Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary [Contractor] contact:

[Insert Name]
[Title]
[Company name]
[mailing address]
[Phone]
[Fax]
[Email]

1.3 Roles and Responsibilities

The Contractor is responsible for implementing the ERP and complying with all permits and licences issued to the GNWT. Response roles and responsibilities are outlined in Table 1.1.

Table 1.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this ERP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate emergency response measures • Continue implementing the ERP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Is the lead in command for emergency response and is the lead for the Emergency Response Team • Call for emergency services when needed • Verify that this ERP will be available on site at all times • Verify that an Emergency Response Team will be established for each shift • Report and document emergency information to regulatory or emergency authorities and the Inspector • Verify that personnel will be trained and competent in the ERP's application • Verify that the measures in the ERP will be adequately applied • Verify that the emergency response equipment, supplies, and inventory will be maintained • Coordinate mitigative and remedial measures where required • Conduct regular worksite inspections • Coordinate additional equipment and/or workforce (if necessary) for emergency event management • Liaise with the GNWT Lands Inspector, the GNWT Water Resources Officer, or other authorities
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation measures, and worksite inspection or emergency response activities • Report emergencies to the GNWT project contacts and the Contract Supervisor • Oversee completion of the Project • Support the Contractor Supervisor, as required
GNWT INF	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with the GNWT Lands Inspector, the GNWT Water Resources Officer, government agencies, and the public, and Indigenous Governments, Indigenous Organizations, and other affected parties (as required) • Confirm all emergency reports, clean up, and recovery are completed as required by authorities

Entity	Responsibility
Site Based Emergency Response Personnel	
First Responders	<ul style="list-style-type: none"> • Verify their own safety and then the safety of others when responding to an emergency event • Notify first responders of the emergency using the ERP communication protocol • Respond to the event using their training and the contents of this plan • Provide care to injured people until the Project Medic or Emergency Response Team arrives
Project Medic	<ul style="list-style-type: none"> • Treat injured or ill people in remote settings • Initiate and coordinate medical evacuation • Maintain documentation and records related to the injuries, condition, and treatment • Possess knowledge of industrial site hazards and injury
Environmental Coordinator	<ul style="list-style-type: none"> • Support the work of the Contractor Supervisor and Contract Project Manager to respond, monitor, clean up, or provide follow up action related to an environmental emergency • Maintain records and detailed information related to environmental impacts (i.e., spill report information)
Emergency Response Team	<ul style="list-style-type: none"> • Verify their own safety and then the safety of others when responding to an emergency event • Control and secure the emergency scene • Coordinate and perform emergency response procedures • Provide medical first aid and support the Project Medic • Assign resources during emergency response • Address the emergency from producing further damage

1.4 Distribution List

The ERP has been distributed to the following key project contacts and regulators:

- Project Contactor and Personnel: Contractor Supervisor, Contractor Project Manager, Contractor Camp Manager, Contractor Lead Hands
- Inspector, GNWT Lands
- Water Resources Officer, GNWT Environment and Climate Change (GNWT-ECC)
- Water Management and Monitoring Division (GNWT-ECC)
- GNWT Public Relations (ECC, INF, Lands)
- Environmental Protection, Environment Canada
- Area Manager, Fisheries and Oceans Canada
- Environmental Protection and Waste Management Division, GNWT
- Mackenzie Valley Land and Water Board

- Sahtu Land and Water Board
- Norman Wells Renewable Resources Council
- Tulita Renewable Resources Council
- Tulita District Land Corporation
- Applicable GNWT-INF Employees

Key regulatory and emergency contacts in the event of an emergency event include:

Regulatory Agency	Contact
Workers' Safety and Compensation Commission – 24 Hour Incident Reporting Line	1-800-661-0792
GNWT-ECC (Inspector)	[TBC]
GNWT-ECC (Water Resource officer)	[TBC]
Sahtu Land and Water Board	(867) 598-2413
Mackenzie Valley Land and Water Board	(867) 669-0506
Fisheries and Oceans Canada	1-866-290-3731
Environment and Climate Change Canada	(780) 951-8600
Emergency Services	Contact
Report a Wildland fire	(877) 698-3473 or (877) NWT-FIRE
24-hour NWT Spill Report Line	(867) 920-8130
Wildlife Emergencies (Sahtu)	(867) 587-2422
Wildlife Emergencies (Dehcho)	(867) 695-7433
RCMP – Fort Simpson	(867) 695-1111
RCMP – Norman Wells	(867) 587-1111
Ambulance, Fire, Police	911
Medevac	(867)-669-4115

1.5 Legislation, Guidelines and Policy

This plan has been developed in consideration of the applicable legislation and guidelines, including:

- *[List any applicable here]*

1.6 Training

All project personnel will receive training on the purpose and procedures provided in this ERP.

2 Project Description and Activities

The Project occurs in the Dehcho and Sahtu regions under the regulatory authorities of the Mackenzie Valley Land and Water Board (MVLWB) and the Sahtu Land and Water Board (SLWB) given power and effect by the *Mackenzie Valley Resource Management Act*. Development of the Project will deliver 321 km of all-season road access in the areas of Norman Wells, Tulita, and Wrigley, to the east of the Mackenzie River (Deh Cho). The area is currently serviced by the Mackenzie Valley Winter Road (MVWR). Construction of the Project will create approximately 281 km of new all-season gravel highway embankment and intermittent pullouts.

The Project is located within two distinct physiographic regions: the Mackenzie Plain and the Franklin Mountains. North of Tulita, the Highway is found within the Taiga Plains Ecozone. South of Tulita, the Highway lies within the Taiga Cordillera Ecozone. The area supports numerous wildlife, fish, and bird species.

The Project interacts with several communities with traditional land use areas. Community members participate in hunting, trapping, fishing, berry picking, and other land-based activities. In addition to traditional land uses, the Sahtu Land Use Plan (SLUPB, 2023) also identifies several zones in the vicinity of Project such as conservation zones and special management zones, where traditional, cultural, or heritage sites are found.

The Project includes the following activities to which this plan applies:

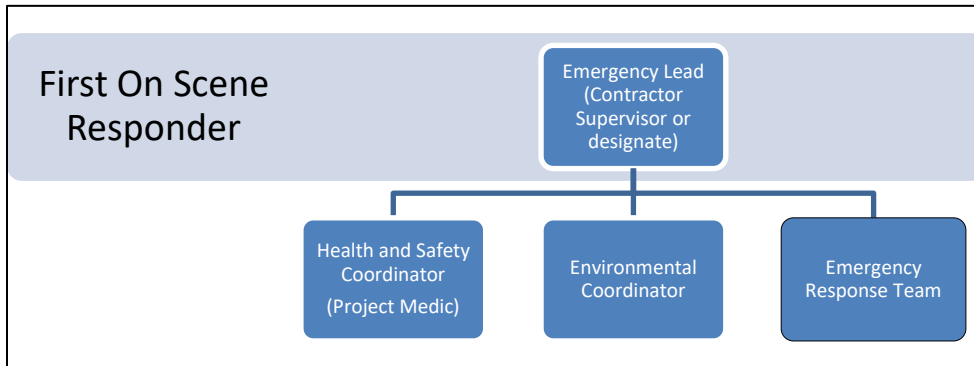
- Mobilizing and demobilizing construction equipment to and from work sites
- Site preparation:
 - Clearing, stripping, and grubbing vegetation and organic material from the alignment right-of-way (ROW), quarry access roads, and within proposed work areas
 - Construction of a winter travel lane(s)
- Highway and access road construction:
 - Placing geotextile
 - Hauling and end-dumping embankment rock fill
 - Placing and compacting granular sub-base and base course
 - Snow clearing and grading
- Construction of watercourse crossing and drainage structures
 - Temporary crossings
 - Excavation of watercourse base for culvert installation
 - Excavation of watercourse bank for apron and rip rap installation
 - Placement and backfill of culverts
 - Apron and rip rap installation

- Beaver dam and/or beaver lodge removal
 - Culvert clearing and maintenance
- Quarry operations during construction and operations and maintenance
 - Drilling
 - Excavation
 - Blasting
 - Crushing and stockpiling
 - Water management
- Temporary workspaces and laydowns
 - Site clearing and grading
 - Site use and maintenance
 - Reclamation
- Camp accommodations and associated facilities
 - Camp operations
- Highway maintenance
 - Snow clearing, grading, repair
 - ROW mowing/brushing
 - Culvert and bridge maintenance and repair

3 Emergency Response Team

An Emergency Response Team will be established during project construction to respond to and manage emergency events. Emergency response often requires multiple people with roles and training to adequately address an emergency. The suggested specific emergency response roles for this framework are identified in Figure 3.1.

Figure 3.1 Emergency Response Team Hierarchy



All emergency response situations will be triggered by the first on scene responder. The role requires the responder to identify the emergency, call in the emergency using the communication protocols in Section 6, and provide first response actions until help arrives or for as long it is safe to do so. The Contractor Supervisor will then initiate and command the emergency response efforts by following the procedures in Section 5.

The emergency response team will include a coordinator for health and safety (the medic) and an environmental coordinator. Together, the team will provide oversight, advice, and support, respective of their responsibility roles (as required). The Emergency Response Team is composed of trained site personnel who are trained in the ERP and will assist in carrying out emergency response procedures to control or address the event.

When emergencies are announced via the site-wide announcement described in Section 6, those on the Emergency Response Team will suspend their work, report to the emergency scene, assemble resources, and provide emergency response, as described in Section 5. Further details for communication protocols are described in Section 6.

4 Emergency Event Descriptions

4.1 What is an Emergency?

An emergency is defined as an unplanned incident requiring remedial response to stop damage and prevent further damage to property, people, or the environment. For the context of the ERP, potential incidents were derived from analysis of potential accidents and malfunctions related to the Project and its activities. The ERP framework provides specific procedures for these incidents, as outlined in Table 4.1.

Table 4.1 Potential Emergency Events at the Project Site

Potential Emergency Events	General Description
Spill of fuel or hazardous materials (contaminants) during project construction	<ul style="list-style-type: none"> • Accidental discharge of hazardous material (e.g., diesel fuel, sewage) during storage, handling, or dispensing, resulting in the release of contaminants to the aquatic or terrestrial environment • Vehicle accident or mechanical malfunction involving construction equipment or transport trucks resulting in the release of hazardous materials such as hydraulic fluid, fuel, sewage, or oil to the aquatic or terrestrial environment
Explosion or fire	<ul style="list-style-type: none"> • A fire or explosion within Project infrastructure (e.g., camp or maintenance yard) resulting in the release of contaminants to the atmospheric, aquatic, or terrestrial environment • A fire or explosion within Project infrastructure causing injury to people
Transportation, storage, manufacture, and use of explosives	<ul style="list-style-type: none"> • Accidental discharge of bulk explosive supplies (ammonium nitrate) during transportation or storage resulting in the release of contaminants to the aquatic or terrestrial environment • Accidental detonation of explosives causing injury to people
Transportation accidents	<ul style="list-style-type: none"> • Traffic accident (vehicle collision or rollover) during transport of Project supplies and workers from community centers or camp accommodations to construction sites causing injury to people • Traffic accident (vehicle collision) involving Project equipment and public user of the MVWR causing injury to people

5 Event Response Protocols

The potential emergency events can be summarized as spills, explosions, fire, and transportation accidents. Incidents involving the use of explosives by the Project are recognized as either a spill or an explosion event. The following framework for procedures is provided for emergency responses and follow-up recovery.

5.1 Spill of Fuel or Hazardous Materials

Initial notification and response will be done in accordance with the SCP. For a full description of the event response information for a spill of fuel or hazardous materials, further details are found in the SCP.

The following procedures are provided as a framework for initial emergency spill response for land and water-based events:

5.1.1 Spills on Land

1. Identify the source
2. If possible and safe, contain the spill at the source
3. Check valves and seals. Stop using valves if leaking
4. Transfer fuels out of leaking containers
5. Place impermeable material and absorbent material below the leak to limit seepage

Land spills can be contained and cleaned up by:

- a. Creating a soil berm downslope of leaking material. In winter a snow berm and impermeable liner may be used.
- b. Placing impermeable material at the foot of and over top of the berm to allow pooling of leaked material
- c. Using appropriate absorbent material to soak up the fuel. It may also be used to transfer fuel into drums or pails for re-use of the pads. Larger quantities of fuel may be pumped into empty drums
- d. Using a light covering of absorbent material to remove films of petroleum products
- e. In winter, moving contaminated snow or ice into drums or on impermeable material
- f. Transporting material to an approved disposal/recovery site

Spot Spills can be contained and cleaned up by:

- a. Cleaning up small spot spills (those below reportable quantities) immediately
- b. Excavating affected soil into an empty drum or lined container, while limiting destruction of the root zone
- c. Suspending activities in the immediate vicinity until the Site Foreman grants permission to resume
- d. Flagging locations where spot spills have occurred and documenting the location GPS coordinates recorded by the person in charge of the spill. Flags will be removed once reporting is complete.
- e. Disposing of heavily contaminated soil and vegetation, and/or removed contaminated materials at an approved waste facility

Snow spills can be contained and cleaned up by:

- a. Constructing a trench or ditch to channel and control the flow of spilled product
- b. Compacting any snow lying along the outside perimeter of the control ditch
- c. Constructing a snow dike or dam
- d. Using impermeable lining material to create an impervious barrier
- e. Locating the topographic lowest point of the spill area and creating snow channels to direct unabsorbed material away from water courses
- f. Collecting the spilled material for disposal

5.1.2 Spills on Water

1. Block spill entry into water using booms and absorbent pads, trenches, or other barriers (e.g., bridge drain plugs)
2. If spilled material enters an open water body, booms, skimmers, and sorbent pads will be deployed, if feasible, to contain and recover the spill material.
3. Remove minor spills with sorbent pads
4. Major spill in water will require pumping and disposal of contaminated water and other actions as determined in discussion with regulatory authorities.
5. Contaminated areas, including downstream shorelines (non-frozen conditions), will be cleaned up in consultation with spill response specialists and the appropriate government agencies.
6. If spilled materials enter a frozen water body through or under the ice to flowing or standing water, auguring will be conducted to determine the extent of the spill plume. If feasible, a vacuum truck will be brought to the site to skim off the contaminants. As well, the appropriate regulatory agencies will be contacted, and a post-break-up monitoring and reclamation plan will be implemented to determine the extent of the impacts of the spill on the water body and its banks.

Ice spills can be contained and cleaned up by:

- a. Containing the spill using the methods mentioned above for snow
- b. Preventing spilled material from penetrating ice and entering water
- c. Removing any contaminated material quickly
- d. Using an auger to locate material that has seeped under ice, as containment is challenging if material gets under the ice
- e. Cutting slots with chain saws and remove blocks
- f. Using a suction hose if available to clean up spill

[Drafting Note: to be developed by the GNWT-INF and/or contractor.]

5.2 Transportation Accidents

[Drafting Note: to be developed by the GNWT-INF and/or contractor.]

5.3 Fire

[Drafting Note: to be developed by the GNWT-INF and/or contractor.]

5.4 Explosion

[Drafting Note: to be developed by the GNWT-INF and/or contractor.]

5.5 Other

The ERP may outline additional emergency events such as medical emergencies or animal threats.

[Drafting Note: to be developed by the GNWT-INF and/or contractor.]

6 Emergency Communication Protocol

Delivering effective communication is an essential part of emergency response. The following section provides a framework for a standard emergency communication approach. Standardized communication is recommended for clear message transmission and formality during a serious situation when bystanders or the Emergency Response Team may be called upon.

When a site worker is first to encounter or experience an emergency event, they will call in the emergency via two-way radio or telephone. The following protocol is described as an example for how site personnel will communicate emergencies to initiate help. The communication protocol may be updated based on the Contractor's experience and/or preference.

6.1 When Is Emergency Communication Necessary?

Site-wide emergency announcements are intended for major emergencies where there is an ongoing threat or situation that requires immediate emergency response. It is also intended to verify that workers in the vicinity of the emergency are aware so that they can help or get to safety. All site staff are equipped with a communication device (phone, radio) to communicate when an emergency occurs.

Examples of when to announce a site-wide emergency notification include:

- Where immediate medical attention is required for a worker, where the individual cannot independently (or with support) go to the medic or first aid station
- Where there is a fire or explosion of any kind – whether it is easily controlled or not
- Where there is a reportable spill of a contaminant that is ongoing and cannot be stopped by the person who is first on scene – non reportable spills, or spills that are not ongoing, do not require an emergency call
- Any other situation that requires immediate response to prevent further harm to people or the environment

6.2 How to Report a Site Emergency

To report an emergency as first on scene:

- Turn radio to channel [X] for emergency reporting
- Transmit the message: 'Code 1 Emergency.' Repeat three times
- Wait for response
- Provide your name, nature of emergency, location – protect privacy details such as the name of someone who is injured

- Answer any questions asked and follow directions for immediate emergency response actions
- Remain on the channel until help arrives

If an emergency escalates, or if there is reason to suspect that the event could impact many people at the project area, a site-wide notification will be announced by the Contractor Supervisor. The following protocol is described as an example and the communication protocol may be updated based on the Contractor's experience and/or preference.

To report a site-wide emergency notification, the Contractor Supervisor will:

- Turn radio to channel [X] for emergency reporting
- Transmit the message: 'Attention, Attention, Attention – this is an emergency response announcement. There is a situation involving [brief explanation and location]. Please standdown and remain in your equipment or vehicles until further notice. Do not enter the emergency area. Standby for further information.'

Site staff will not make inquiries over the radio and all non-essential radio use will be limited until all clear is given.

- The Contractor Supervisor will further communication and next steps as the situation is brought to control.

7 Training

All site staff will be trained with the emergency response requirements based on their role and responsibilities on the site. All site staff will also be trained on hazards, most likely incidents anticipated by the Project, and protective measures. The following training description is an example and the communication protocol may be updated based on the Contractor's experience and/or preference. Training may require:

- First aid
- Knowledge of safe work practices
- Emergency response communication protocol
- Actions for first on scene responders
- General response actions for event control
- Clean-up and recovery

The Emergency Response Team will be trained in tactical response procedures, including for fighting fires (equipment, buildings, wildlife), administering advanced first aid, medical evacuations, and spill response clean up and handling of hazardous chemicals.

[Drafting Note: section to be further developed by the GNWT-INF and/or contractor.]

8 References

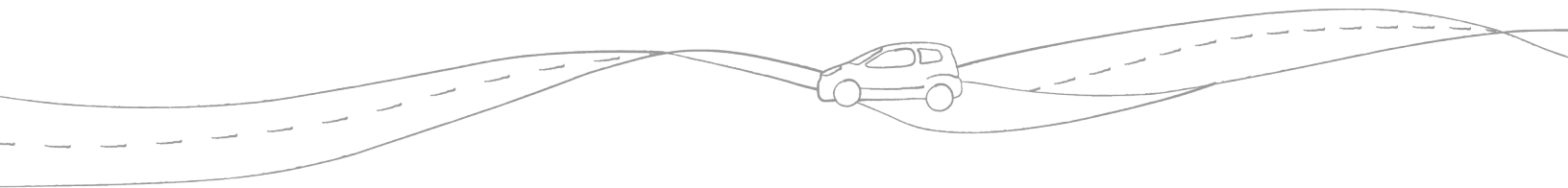
SLUPB (Sahtú Land Use Planning Board). 2023. Sahtú Land Use Plan. Government of Northwest Territories. Fort Good Hope. Ratified but not available as of July 19, 2023; see <https://sahtulanduseplan.org/plan>.

Appendix A – Material Location Map

[Placeholder]

Appendix B – NWT Spill Report Form

[Placeholder]



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT EROSION AND SEDIMENTATION CONTROL PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

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Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0	n/a	DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

>	more than
ATV	all-terrain vehicle
BMP	best management practice
CCME	Canadian Council of Ministers of the Environment
cm	centimetre
DFO	Fisheries and Oceans Canada
ESCP	Erosion and Sedimentation Control Plan
GNWT	Government of the Northwest Territories
INF	Department of Infrastructure, Government of the Northwest Territories
km	kilometre
km/h	kilometre per hour
m	metre
NTU	Nephelometric Turbidity Unit
the Project	Mackenzie Valley Highway
ROW	right-of-way

1 Introduction

1.1 Purpose

This Erosion and Sedimentation Control Plan (ESCP) describes the mitigation measures to reduce erosion and sedimentation effects from activities related to the construction, and operations and maintenance of the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita and 28 kilometres (km) southeast of Norman Wells and includes the development of quarry and borrow sources (Figure 1.1). The ESCP was developed in accordance with applicable guidelines and best practices in Northwest Territories and is one of several plans developed for the construction, and operations and maintenance phases of the Project. The Quarry Development Plan and the Permafrost Protection Plan intersect with the content found in this plan. This ESCP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the GNWT. **This ESCP is draft, as it has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board and is not for application to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.**

The ESCP will be reviewed annually during the construction of the Project to capture lessons learned from the previous year's construction and monitoring activities. Once constructed, the Project will become part of the GNWT's operational highway network. The ESCP will be reviewed every five years or as required to provide the best guidance in preventing erosion and sedimentation of watercourses and waterbodies.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
- Community
- Northwest Territories Highway
- Winter Road
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary

0 40 80 Kilometres
 (At original document size of 8.5x11)
 1:4,500,000



Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

1.1

Title

Project Overview

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2020

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

1.2 Project Overview

The Project includes the following activities to which this plan applies:

- Mobilizing and demobilizing construction equipment to and from work sites
- Site preparation:
 - Clearing, stripping, and grubbing vegetation and organic material from the alignment right-of-way (ROW) and within proposed work areas
 - Construction of a winter travel lane(s)
- Road construction and maintenance:
 - Placing geotextile
 - Hauling and end-dumping embankment rock fill
 - Placing and compacting granular sub-base and base course
 - Snow clearing and grading
- Construction of watercourse crossing and drainage structures:
 - Temporary crossings
 - Excavation of watercourse base for culvert installation
 - Excavation of watercourse bank for apron and rip rap installation
 - Placement and backfill of culverts
 - Apron and rip rap installation
 - Beaver dam and/or beaver lodge removal
 - Culvert clearing and maintenance
- Quarry operations:
 - Drilling
 - Excavation
 - Blasting
 - Crushing and stockpiling
 - Water management
- Temporary workspaces and laydowns:
 - Siting
 - Site clearing and grading
 - Site use and maintenance
 - Reclamation
- Camp accommodations and associated facilities
 - Camp operations

1.3 Relevant Guidance

This ESCP has been developed in consideration of applicable legislation, guidelines, and best practices as they may apply to the project activities, including:

- The Fisheries and Oceans Canada's (DFO's) codes of practice (DFO, 2022) and interim codes of practice (DFO, 2019), including:
 - Code of practice: Culvert maintenance
 - Code of practice: Clear span bridges
 - Code of practice: Ice bridges and snow fills
 - Code of practice: Temporary fords
 - Code of practice: Beaver dam breaching and removal
 - Interim code of practice: Temporary cofferdams and diversion channels
- DFO's Measures to protect fish and fish habitat, including:
 - Measures to maintain riparian vegetation
 - Ensuring proper sediment control
 - Avoiding work in water where possible
- Northern Land Use Guidelines: Camp and Support Facilities (GNWT, 2015a)
- Northern Land Use Guidelines: Pits and Quarries (GNWT, 2015b)
- Northern Land Use Guidelines: Roads and Trails (GNWT, 2015c)
- Erosion and Sediment Control Manual (GNWT, 2013)

1.4 Previous Experience

The GNWT's Erosion and Sediment Control Manual (GNWT, 2013) provides a comprehensive compilation of guidelines and standard procedures for selecting, designing, and implementing erosion and sedimentation control measures for transportation infrastructure projects in the Northwest Territories. The GNWT has applied its experience implementing erosion and sedimentation control measures for the following recent highway construction projects:

- Inuvik to Tuktoyaktuk Highway
- Tẖcẖq̱ All Season Road
- Canyon Creek Road
- Prohibition Creek Access Road

1.5 Roles and Responsibilities

The Contractor is responsible for implementing the ESCP. Roles and responsibilities are outlined in Table 1.1.

Table 1.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this ESCP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Continue implementing the ESCP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this ESCP is available on site at all times • Verify that personnel are trained and competent in the ESCP's application • Verify that the measures in the ESCP are adequately applied • Conduct regular worksite inspections • Coordinate additional equipment and/or workforce (if necessary) • Liaise with GNWT Lands Inspector, GNWT Water Resources Officer and Engineer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and inspection activities • Report to GNWT • Oversee completion of the Project • Support the Contractor Supervisor as required
Government of the Northwest Territories Department of Infrastructure (INF)	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with government agencies and public and Indigenous Governments and Indigenous Organizations (as required) • Confirm all reports are completed, as required, by authorizations
Engineer and/or GNWT's Designated Representative	<ul style="list-style-type: none"> • Support contractor and GNWT by providing technical guidance on the implementation of this ESCP • Make recommendations for modification to mitigation measures based on site reviews • Verify that the ESCP is being followed

1.6 Training

The GNWT, its contractors, and other authorized personnel working for, or on behalf of the GNWT, will be trained and competent in the purpose and methods included in this plan.

2 Potential Effects and Mitigation Measures

Mitigation measures aim to prevent erosion and reduce the effects of sedimentation. Erosion is the wearing away of soil or rock by water, wind, or ice, whereas sedimentation is the deposition of this eroded material into water. Erosion control aims to prevent material from being eroded, and sedimentation control aims to limit the transport and deposition of this eroded material, thereby reducing effects on the environment. See Table 2.1 to Table 2.5 for activities that may lead to erosion and sedimentation and their specific mitigation measures.

2.1 Best Management Practices

The GNWT Erosion and Sediment Control Manual (GNWT, 2013) is to be used for further guidance on selecting, installing, and monitoring the best method/installation for sedimentation control. Appendix C of the GNWT Erosion and Sediment Control Manual includes 30 best management practices (BMPs) for erosion and sediment control.

In all cases:

- Mitigation BMPs must not contravene permit conditions or other regulatory requirements, such as DFO codes of practice.
- Installations, as indicated in design drawings and specifications, take precedence over BMPs unless otherwise approved by the Engineer based on observed site conditions (see Section 3 of this plan).
- The location of mitigation installations is to be recorded to facilitate inspection.

2.2 Mitigation Measures to be Applied

Table 2.1 to Table 2.6 identify measures required to be implemented to mitigate the potential effects of erosion and sedimentation that may be caused by each general project activity of the Project.

Table 2.1 Mitigation Measures for Equipment Mobilization to and from Work Sites

Activity: Equipment Mobilization to and from Work Sites	
Potential Effect	Mitigation Measures
Vehicle use causes ponding and rutting	<ul style="list-style-type: none"> • Travel of vehicles will be confined to existing roads, constructed embankments, and winter roads as much as possible to avoid disturbing vegetated areas. • Travel on steep slopes will be avoided, where possible. • Off-road travel will be limited to frozen conditions (approximately December 15 to April 1), where possible. • During spring, summer, and fall, suitable ground equipment will be used to prevent effect on sensitive terrain. • Off-road travel on highly saturated soil will be avoided, where possible. • A minimum of 10 centimetres (cm) of packed snow will be maintained on all off-road travel surfaces.
Vehicle travel creates dust	<ul style="list-style-type: none"> • Vehicle speeds will be limited to 50 kilometres per hour (km/h) on unfinished surfaces. • Dust suppression will be conducted as necessary to reduce dust and sediment from entering watercourses or waterbodies.
Vehicle travel causes erosion of stream banks	<ul style="list-style-type: none"> • Equipment will be operated in a manner that limits disturbance to lake, river, or stream banks.

Table 2.2 Mitigation Measures for Site Preparation

Activity: Site Preparation (Clearing of Workspaces and Right-of-Way and Construction of a Winter Travel Lane)	
Potential Effect	Mitigation Measures
Vegetation clearing exposes soil to erosion	<ul style="list-style-type: none"> • Clearing will be completed when the ground is frozen. • Clearing will not be conducted during high rainfall or runoff events. • Removal of vegetation will be limited to the width of the ROW. • Where possible, windrowed material will be mulched and spread over cleared areas within the ROW. • Organic material and topsoil will be retained.
Equipment use causes ponding and rutting	<ul style="list-style-type: none"> • Clearing will be completed by hand, where required, to prevent damage to the ground. • Clearing will not be conducted during high rainfall or runoff events. • Construction activities will be conducted during dry or frozen conditions, or use rig mats to reduce soil compaction, rutting, and erosion.
Erosion causes sediment to enter watercourse	<ul style="list-style-type: none"> • Travel of vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas. • Travel on steep slopes will be avoided, where possible. • Erosion and sedimentation control measures (per GNWT, 2013) will be in place prior to construction activities and before the spring melt/freshet. • Silt fencing will be used downgradient of the works where required. • Poned water will be directed away from watercourses.
Excess sediment enters watercourse	<ul style="list-style-type: none"> • Install effective erosion and sediment control measures (such as silt fencing) before starting work to prevent sediment from entering the waterbody • Regularly inspect and maintain erosion and sediment control measures • Repair erosion and sediment control measures and structures if damage occurs • Remove non-biodegradable erosion and sediment control materials once the site is stabilized
Vehicle use on winter travel lane causes erosion or rutting	<ul style="list-style-type: none"> • A winter travel lane will be constructed in previously cleared areas only. • Construction of a winter travel lane will occur during frozen conditions. • A minimum of 10 cm of packed snow will be maintained on all off-road travel surfaces. • Use of the winter travel lane will cease by April 1 or as directed by the Inspector or specified in the land use permit.

Activity: Site Preparation (Clearing of Workspaces and Right-of-Way and Construction of a Winter Travel Lane)	
Potential Effect	Mitigation Measures
Temporary crossings release sediment into water degrading water quality	<ul style="list-style-type: none"> • Temporary crossings will be constructed perpendicular to the watercourse. • Temporary crossings will be constructed of clean snow fill. • Snow fill crossings will be v-notched prior to the spring melt/freshet before April 1 each year. • Logs or woody debris will be removed from the watercourse and banks. • Temporary bridges, if required, will not be placed below the ordinary high water mark. • No fording of watercourses is permitted, except to install a temporary work bridge.

Table 2.3 Mitigation Measures for Road Construction and Maintenance

Activity: Road Construction	
Potential Effect	Mitigation Measures
Vehicle use causes erosion or rutting	<ul style="list-style-type: none"> • Construction of embankment will occur primarily during winter (December 15 to April 1), during frozen conditions. If work is to be completed under non-frozen conditions, equipment will be equipped with mushroom shoes. • Equipment will be operated on existing roads, constructed embankments, or designated winter roads only. • A minimum of 10 cm of packed snow will be maintained on all off-road travel surfaces. • Construction will cease during high rainfall or runoff events.
The use of machinery in or near water causes sediment to enter watercourses	<ul style="list-style-type: none"> • Machinery on-site will be in a clean condition. • Machinery will not be left in the watercourse. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted at least 100 metres (m) from the high water mark and in a manner to prevent any deleterious substances from entering the water. • All-terrain vehicles (ATVs) and mobile equipment will avoid steep banks at crossings. • Erosion and sedimentation control measures will be implemented (per GNWT, 2013).
Excavation releases sediment into watercourses	<ul style="list-style-type: none"> • A fill-only construction approach will be used, except at specific locations of road cuts. • Where cutting of the subgrade is required per design (for example, at road cuts), erosion and sedimentation control measures will be implemented (per GNWT, 2013).
Newly placed embankment or base material is eroded	<ul style="list-style-type: none"> • Erosion control products and methods will be used to limit erosion of fine-grained soils (per GNWT, 2013).
Snow clearing causes sediment to enter watercourses	<ul style="list-style-type: none"> • Direct cleared snow away from watercourses and drainages • Implement runoff control to avoid entry to waterbodies, including: <ul style="list-style-type: none"> – Install drainage per design specifications – Divert water from entering watercourse – Control flow velocity

Table 2.4 Mitigation Measures for Construction of Watercourse Crossings and Drainage Structures

Activity: Construction of Watercourse Crossings and Drainage Structures	
Potential Effect	Mitigation Measures
Embankment causes ponding of water and erosion	<ul style="list-style-type: none"> • Drainage culverts will be installed according to specifications to facilitate water movement and maintain drainage patterns. • Modification to the location or number of drainage culverts will be determined in consultation with the Engineer as based on observed site conditions.
Excavation of bed and bank material releases sediment into water degrading water quality	<ul style="list-style-type: none"> • Sediment control measures will be in place prior to construction activities and before the spring melt/freshet. • Construction activities will be conducted during no or low flow periods, where possible. • Grading of stream banks at approaches shall be limited where possible. • Banks will be restored to original condition or as design specifies. • Excavated spoil material will be disposed of at least 30 m from the watercourse. • Material stockpiles will be kept a minimum of 30 m from a watercourse or waterbody with the appropriate erosion control mitigation measures in place (per GNWT, 2013) to prevent sediment from entering a watercourse or waterbody.
The use of machinery in or near water degrades water quality	<ul style="list-style-type: none"> • Machinery on-site will be in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds. • Work in the active stream channel will be avoided. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m away from the high water mark of waterbodies and in a manner to prevent any deleterious substances from entering the water. • ATVs and mobile equipment will avoid steep banks at crossings. • Silt fencing will be installed where required to control possible sediment releases. • The spill contingency plan for the Project will be followed to prevent and reduce the effect of a spill entering a watercourse.
Clearing of vegetation exposes soil to erosion	<ul style="list-style-type: none"> • Riparian vegetation will be maintained whenever possible. • Where vegetation must be cut but is not removed, the cut will be made > 10 cm above the ground to retain the root structure. • Erosion and sedimentation control measures will be maintained until disturbed areas are revegetated or until such areas have been permanently stabilized by other effective measures. • Clearing will be completed by hand, where required, to prevent damage to the ground such as rutting, compaction and erosion.

Activity: Construction of Watercourse Crossings and Drainage Structures	
Potential Effect	Mitigation Measures
Placement of material in and near water degrades water quality	<ul style="list-style-type: none"> • Riprap will be free of silt and other debris.
Temporary crossings and fords release sediment into water degrading water quality	<ul style="list-style-type: none"> • Temporary crossings will be constructed perpendicular to the watercourse. • Temporary crossings will be constructed of clean snow fill. • Snow fill crossings will be v-notched prior to the spring melt/freshet before April 1 each year. • Temporary bridges, if required, will not be placed below the ordinary high water mark. • No fording of watercourses is permitted, except to install a temporary work bridge. If fording is required: <ul style="list-style-type: none"> – Plan in-water works to respect fish timing windows – Use methods to reduce soil compaction and erosion of banks – Conduct fords during periods of low flow – Do not skid or drag material across the ford
Breaching or removal of beaver dams causes erosion and degrades water quality	<ul style="list-style-type: none"> • Beaver dam removal will be done in accordance with the code of practice: Beaver dam breaching and removal (DFO, 2022) and conditions of a GNWT General Wildlife Permit. • Riparian vegetation will be maintained whenever possible. • Access will be along existing trails and perpendicular to the watercourse, where possible. • Erosion and sedimentation control measures will be maintained until disturbed areas are revegetated or until such areas have been permanently stabilized by other effective measures. • When dewatering beaver impoundments: <ul style="list-style-type: none"> – Remove the dam gradually, beginning with a small breach, and work in stages to control flows, prevent sediment from being released downstream, and prevent fish stranding – Verify that the width of the breach opening of the beaver dam does not exceed the width of the original stream channel – As the water levels drop in the upstream pond, increase the size of the opening to drain the pond to the desired water level

Table 2.5 Mitigation Measures for Quarry Operations

Activity: Quarry Operations	
Potential Effect	Mitigation Measures
Quarried material, debris and dust enter water degrading water quality	<ul style="list-style-type: none"> • Quarry operations will be located a minimum of 100 m from the ordinary high water mark of any waterbody. • Blast mats will be used when blasting in sensitive environments, as identified in the Wildlife Management and Monitoring Plan. • Blast rock will not enter a waterbody or watercourse. • Runoff water will be directed into vegetated areas away from natural drainages. • Positive drainage will be maintained within the quarry floor.
The use of machinery in or near water degrades water quality	<ul style="list-style-type: none"> • Machinery on-site will be in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds. • Machinery will not be left in the watercourse. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high water mark of waterbodies and in a manner to prevent any deleterious substances from entering the water. • ATVs and mobile equipment will avoid steep banks at crossings. • Erosion control measures will be implemented.
Sediment enters watercourse or waterbody degrading water quality	<ul style="list-style-type: none"> • Material stockpiles will be kept a minimum of 30 m from a watercourse or waterbody with the appropriate erosion control mitigation in place (per GNWT, 2013) to prevent sediment from entering a watercourse or waterbody.

Table 2.6 Mitigation Measures for Temporary Workspaces and Laydowns

Activity: Temporary Workspaces and Laydowns	
Potential Effect	Mitigation Measures
Erosion of soil from temporary workspaces or laydowns causes changes to water quality	<ul style="list-style-type: none"> • Equipment laydown and staging areas will be located at least 100 m from the ordinary high water mark of any waterbody. • Clearing will be completed when the ground is frozen. • Organic material and topsoil will be retained. • Site drainage will be directed away from natural drainages. • A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads.
Vegetation clearing exposes sediment to erosion	<ul style="list-style-type: none"> • Where possible, windrowed material will be mulched and spread over cleared areas within the footprint.
The use of machinery in or near water degrades water quality	<ul style="list-style-type: none"> • Machinery on-site will be in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds. • Work in the active stream channel will be avoided. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m away from the high water mark of waterbodies and in a manner to prevent any deleterious substances from entering the water. • ATVs and mobile equipment will avoid steep banks at crossings. • Silt fencing will be installed where required to control possible sediment releases. • The spill contingency plan for the Project will be followed to prevent and reduce the effect of a spill entering a watercourse.

Table 2.7 Mitigation Measures for Camps and Associated Facilities

Activity: Construction and Operation of Camps and Associated Facilities	
Potential Effect	Mitigation Measures
Erosion of soil from camp pad locations causes changes to water quality	<ul style="list-style-type: none"> • Camps will be located at least 100 m from the ordinary high water mark of any waterbody. • Clearing will be completed when the ground is frozen. • Organic material and topsoil will be retained. • Site drainage will be directed away from natural drainages. • A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads. • Travel of vehicles will be confined to existing roads, constructed embankments, and winter roads as much as possible to avoid disturbing vegetated areas.
Snow clearing causes sediment to enter watercourses	<ul style="list-style-type: none"> • Direct cleared snow away from watercourses and drainages

3 Monitoring, Inspection and Response

3.1 Monitoring During Culvert Installation

Monitoring of water quality is required during culvert installation when:

- Water is present in the watercourse, and
- The watercourse is potentially fish-bearing

Turbidity monitoring is a method of sediment monitoring to be conducted only during the removal of sediment control structures, when pulses of sediment release are most likely to occur.

Visual monitoring is to be used at other times to monitor performance of sediment control measures. If sediment is seen to be released while sediment control is in place, work is to be halted until sediment mitigation is corrected.

During winter construction, smaller watercourses are expected to be frozen to the bottom with no flowing water and therefore no water quality monitoring is required.

3.1.1 Turbidity Monitoring Method

Turbidity monitoring includes the establishment of four transects: one at 25 m upstream of the construction site (baseline), and three transects downstream (50 m, 100 m, 200 m). An additional transect at 300 m would be established if turbidity levels are not decreasing by the 200 m transect. At each transect turbidity will be measured at three stations; 25%, 50% and 75% of the channel width. Three measurements using a turbidity meter will be taken at each station at approximately 30% water depth to avoid potential floating material (e.g., organic material) on the surface of the water affecting the turbidity measurement. The three measurements are to be averaged to provide a turbidity level for each station. Turbidity monitoring would occur once every three hours just prior to, during, and after removal of sediment control, until turbidity levels reach baseline levels (upstream transect). Monitoring requirements for culvert installation are summarized in Table 3.1.

Table 3.1 Monitoring During Culvert Installation

Watercourse Location KM			
Watercourse Location UTM			
Monitoring Location	Measurement Location	Parameters to be Monitored	Frequency
25 m upstream of installation; 50 m, 100 m, and 200 m downstream of installation; 300 m downstream if needed ¹	25%, 50%, and 75% of channel width and at 30% water depth at each monitoring location	Turbidity ² , reported as average of the three measurements at each monitoring location	Once every 3 hours immediately prior to, during and after removal of sedimentation control mitigation measures
Notes:			
¹ An additional transect at 300 m would be established if turbidity levels are not decreasing by the 200 m transect.			
² Measured as Nephelometric Turbidity Units (NTU).			

3.1.2 Turbidity Criteria and Response

Per Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life, Total Particulate Matter (CCME, 2002), **if downstream turbidity levels exceed eight (8) Nephelometric Turbidity Units (NTUs) above baseline levels**, removal of the sediment control barriers will cease and additional site-specific mitigation measures will be employed to allow the continuation of the removal of the sediment control structures.

3.2 Inspection

Daily

Work areas are to be inspected daily during construction to:

- Observe the effectiveness of erosion and sedimentation control measures
- Identify damage or degradation of erosion and sedimentation control measures
- Observe for scouring at new culvert installations
- Observe excavations throughout summer and fall for signs of degradation of permafrost

Prior to Freshet

Work areas are to be inspected prior to the onset of spring melt (freshet) to:

- Verify that erosion and sedimentation control measures are in place
- Confirm that snow crossings are v-notched
- Confirm that drainage culverts and drainage pathways are not blocked

3.3 Response

The response is to be based on the outcome of inspections conducted on the effectiveness and condition of erosion and sedimentation control measures. Responses may include:

- Repair or replace damaged installations
- Add or substitute measures, as approved by the Inspector or Engineer, to improve effectiveness

3.4 Documentation

All inspections and responses are to be documented by contractor supervisor and shared with the GNWT.

4 References

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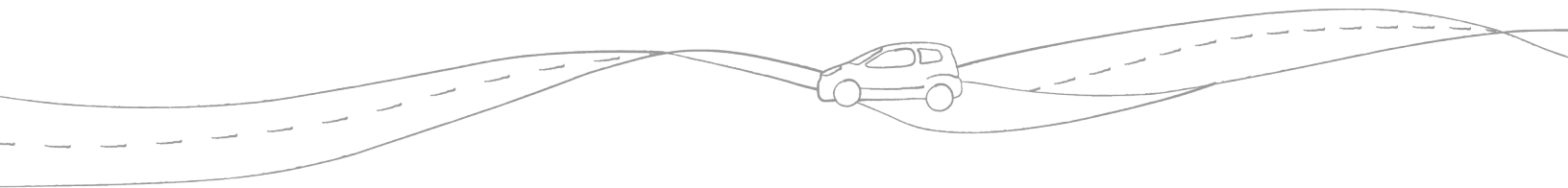
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MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT FISH AND FISH HABITAT PROTECTION PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

>	more than
ANFO	Ammonia nitrate/fuel oil explosive
ARD/ML	Acid rock drainage/metal leaching
BMP	best management practice
cm	centimetre
DFO	Fisheries and Oceans Canada
ExMP	Explosives Management Plan
FFHPP	Fish and Fish Habitat Protection Plan
GNWT	Government of the Northwest Territories
INF	Department of Infrastructure, Government of the Northwest Territories
km	kilometre
KPa	kilopascals
m	metre
the Project	Mackenzie Valley Highway Project
ROW	right-of-way
s	second

1 Introduction

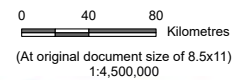
1.1 Purpose

This Fish and Fish Habitat Protection Plan (FFHPP) describes the mitigation measures to be applied to reduce potential effects on fish and fish habitat from activities related to the construction and operations and maintenance of the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells, and includes the development of quarry and borrow sources (Figure 1.1). The FFHPP was developed in accordance with applicable guidelines and best practices in the Northwest Territories and is one of several plans developed for the construction and operations and maintenance phases of the Project. The Erosion and Sedimentation Control Plan, Quarry Development Plan, and the Permafrost Protection Plan intersect with the content found in this plan. This FFHPP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the GNWT and any supplementary advice issued by Fisheries and Oceans Canada (DFO). **This FFHPP is draft, as it has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board, and is not for application to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.**

The FFHPP will be reviewed annually during the construction of the Project to capture lessons learned from the previous year's construction and monitoring activities. Once constructed, the Project will become part of the GNWT's operational highway network. During operations and maintenance, the FFHPP will be reviewed every five years or as required to provide the best guidance in protecting fish and fish habitat.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
- Community
- Northwest Territories Highway
- Winter Road
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 1.1

Title

Project Overview

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2020

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

1.2 Project Overview

The Project includes the following activities to which this plan applies:

- Mobilizing and demobilizing construction equipment to and from work sites
- Site preparation:
 - Clearing, stripping, and grubbing vegetation and organic material from the alignment right-of-way (ROW) and within proposed work areas
 - Construction of a winter travel lane(s)
- Road construction and maintenance:
 - Placing geotextile
 - Hauling and end-dumping embankment rock fill
 - Placing and compacting granular sub-base and base course
 - Snow clearing and grading
- Construction of watercourse crossing and drainage structures:
 - Temporary crossings
 - Excavation of watercourse base for culvert installation
 - Excavation of watercourse bank for apron and rip rap installation
 - Placement and backfill of culverts
 - Apron and rip rap installation
 - Beaver dam and/or beaver lodge removal
 - Culvert clearing and maintenance
- Quarry operations:
 - Drilling
 - Excavation
 - Blasting
 - Crushing and stockpiling
 - Water management
- Temporary workspaces and laydowns:
 - Siting
 - Site clearing and grading
 - Site use and maintenance
 - Reclamation
- Camp accommodations and associated facilities:
 - Camp operations

1.3 Timing Windows

The Project is located within Zone 2 for the identification of the Northwest Territories restricted activity timing windows for the protection of fish and fish habitat (DFO, 2013a). Restricted activity timing windows are determined based on species presence and spawning habitat potential within waterbodies. The following restricted activity timing windows apply to watercourses crossed by the Project:

- **April 1 to July 15:** Most watercourses crossed by the Project provide habitat potential for spring- and summer-spawning fish.
- **December 1 to July 15:** Twelve Mile Creek and Four Mile Creek (Sahtu Region) support spring-spawning species and burbot, which spawn in winter.
- **August 15 to July 15:** Prohibition Creek supports spring-, summer-, and fall-spawning fish species.

1.4 Relevant Guidance

This FFHPP has been developed in consideration of applicable legislation, guidelines, and best practices as they may apply to the project activities, including:

- DFO's codes of practice (DFO, 2022) and interim codes of practice (DFO, 2019), including:
 - Code of practice: Culvert maintenance
 - Code of practice: Clear span bridges
 - Code of practice: Ice bridges and snow fills
 - Code of practice: Temporary fords
 - Code of practice: Beaver dam breaching and removal
 - Interim code of practice: Temporary cofferdams and diversion channels
 - Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater
- DFO's Measures to protect fish and fish habitat, including:
 - Measures to maintain riparian vegetation
 - Ensuring proper sediment control
 - Avoiding work in water, where possible
- Northern Land Use Guidelines: Camp and Support Facilities (GNWT, 2015a)
- Northern Land Use Guidelines: Pits and Quarries (GNWT, 2015b)
- Northern Land Use Guidelines: Roads and Trails (GNWT, 2015c)
- Erosion and Sediment Control Manual (GNWT, 2013)

1.5 Previous Experience

The GNWT has applied its experience implementing fish and fish habitat protection measures for the following recent highway construction projects:

- Inuvik to Tuktoyaktuk Highway
- Tłı̄chǫ Highway

1.6 Roles and Responsibilities

The Contractor is responsible for implementing the FFHPP. Roles and responsibilities are outlined in Table 1.1.

Table 1.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this FFHPP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Continue implementing the FFHPP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this FFHPP is available on site at all times • Verify that personnel are trained and competent in the FFHPP's application • Verify that the measures in the FFHPP are adequately applied • Conduct regular worksite inspections • Coordinate additional equipment and/or workforce (if necessary) • Liaise with GNWT Lands Inspector, GNWT Water Resources Officer and Engineer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and inspection activities • Report to GNWT • Oversee completion of the Project • Support the Contractor Supervisor, as required
Government of the Northwest Territories, Department of Infrastructure (INF)	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with government agencies, public and Indigenous Governments, and Indigenous Organizations (as required) • Confirm all reports are completed as required by authorizations

Entity	Responsibility
Engineer and/or GNWT's Designated Representative	<ul style="list-style-type: none">• Support contractor and GNWT by providing technical guidance on the implementation of this FFHPP• Make recommendations for modification to mitigation measures based on site reviews• Verify that the FFHPP is being followed

1.7 Training

The GNWT, its contractors, and other authorized personnel working for, or on behalf of the GNWT will be trained and competent in the purpose and methods included in this plan.

2 Potential Effects and Mitigation Measures

Mitigation measures aim to prevent and reduce project effects on fish and fish habitat. Fish, as defined in the federal *Fisheries Act* (Section 2.1), “includes shellfish, crustaceans and fish including the eggs, sperm, larvae, spat and juvenile stages of fish, shellfish and crustaceans.” Fish habitat, as defined in the federal *Fisheries Act* (Section 2.1), “means water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life history processes, including spawning grounds and nursery, rearing, food supply, and migration areas.” Riparian areas are considered fish habitat as they indirectly support fish life history processes. Riparian areas extend 30 metres (m) outward from the high-water mark of each watercourse. See Table 2.1 to Table 2.6 for activities that may affect fish and fish habitat, and their specific mitigation measures.

2.1 Best Management Practices

The FFHPP was prepared in consideration of regulatory requirements, DFO codes of practice and northern land use guidelines, and best management practices (BMPs).

In all cases:

- Mitigation BMPs must not contravene permit conditions or other regulatory requirements, such as DFO codes of practice
- Installations, as indicated in design drawings and specifications, take precedence over BMPs unless otherwise approved by the Engineer based on observed site conditions (see Section 3 of this plan)
- The location of mitigation installation is to be recorded to facilitate inspection

2.2 Mitigation Measures to be Applied

Table 2.1 to Table 2.6 identify mitigation measures required to be implemented to mitigate the potential effects on fish and fish habitat that may be caused by each general project activity. The FFHPP must be used together with the Erosion and Sedimentation Control Plan for the Project.

Table 2.1 Mitigation Measures for Equipment Mobilization to and from Work Sites

Activity: Equipment Mobilization to and from Work Sites	
Potential Effect	Mitigation Measures
Vehicle use causes alteration of riparian area	<ul style="list-style-type: none"> • Travel of vehicles will be confined to existing roads, constructed embankments, and winter roads as much as possible to avoid disturbing vegetated areas. • Off-road travel will be limited to frozen conditions (approximately December 15 to April 1), where possible. • During spring, summer, and fall, suitable ground equipment will be used to prevent effects on sensitive terrain. • Off-road travel on highly saturated soil will be avoided, where possible. • A minimum of 10 centimetres (cm) of packed snow will be maintained on all off-road travel surfaces.
Vehicle travel causes alteration of lake or stream banks	<ul style="list-style-type: none"> • Equipment will be operated in a manner that limits disturbance to lake, river, or stream banks. • Banks will be restored to original condition or as design specifies.

Table 2.2 Mitigation Measures for Site Preparation

Activity: Site Preparation (Clearing of Workspaces and Right-of-Way and Construction of a Winter Travel Lane)	
Potential Effect	Mitigation Measures
Vegetation clearing resulting in loss or alteration of riparian area	<ul style="list-style-type: none"> • The Project will use previously disturbed areas for project infrastructure and workspaces, to the extent practical. • Riparian vegetation will be maintained whenever possible. • A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads. • Removal of vegetation will be limited to the width of the ROW. • Clearing will be completed by hand, where required, to prevent damage to the ground. • Where vegetation must be cut but is not removed, the cut will be made > 10 cm above the ground to retain the root structure.
Temporary crossings and fords may alter fish habitat, restrict water flow, or cause injury to fish	<ul style="list-style-type: none"> • Temporary crossings for ice bridges and snow fills, fords, and clear span bridges will abide by DFO's codes of practice (DFO, 2022). • Temporary crossings will be constructed perpendicular to the watercourse. • Temporary crossings will be constructed of clean snow fill or ice. • Snow fill crossings will be v-notched prior to the spring melt/freshet before April 1 each year. • Temporary bridges, if required, will not be placed below the ordinary high water mark. • No fording of watercourses is permitted except to install a temporary work bridge. If fording is required: <ul style="list-style-type: none"> – Plan in-water works to respect fish timing windows – Use methods to reduce soil compaction and erosion of banks – Conduct fords during periods of low flow – Do not skid or drag material across the ford

Table 2.3 Mitigation Measures for Road Construction and Maintenance

Activity: Road Construction	
Potential Effect	Mitigation Measures
The use of machinery in or near water may cause the release of deleterious substances into a waterbody	<ul style="list-style-type: none"> • The Erosion and Sedimentation Control Plan will be developed and implemented. • The Spill Contingency Plan will be developed and implemented. • All site personnel will receive Spill Contingency Plan training and will have awareness of spill prevention. • Fuel will be stored in containers with secondary containment capable of containing 110% of the largest container. • Fuel handling and refueling will be in accordance with Operating Procedure. • Areas and containers used to store project wastes will be constructed, operated, and maintained in a manner to prevent waste from discharging to the surrounding environment. • Machinery onsite will be in a clean condition. • Work in the active stream channel will be avoided. • Machinery will not be left in the watercourse. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted at least 100 m from the high water mark and in a manner to prevent any deleterious substances from entering the water. • Hydraulic fluids for machinery used for in-stream work (i.e., below the ordinary high water mark) will be biodegradable in case of accidental loss of fluid . • Erosion and sedimentation control measures will be implemented (per GNWT, 2013).
Waste storage and transportation can lead to deleterious substances entering a waterbody	<ul style="list-style-type: none"> • All waste will be handled, stored, and disposed of in accordance with the Waste Management Plan.
Embankment causes ponding of water and affect natural drainage patterns	<ul style="list-style-type: none"> • Drainage culverts will be constructed along the roadway to facilitate water movement and maintain drainage patterns. • Modification to the location or number of drainage culverts will be determined in consultation with the Engineer as based on observed site conditions.

Activity: Road Construction	
Potential Effect	Mitigation Measures
Debris in culverts creates a barrier to fish passage or stranding of fish	<ul style="list-style-type: none"> • Culvert maintenance will abide by DFO's code of practice for culvert maintenance (DFO, 2022). • The removal of accumulated material (i.e., branches, stumps, other woody materials, garbage, ice, buildup) must be conducted outside the restricted activity timing window for fish (DFO, 2013a), unless there is immediate blockage of water or fish movement, at which time removal can occur. • The removal of accumulated material (i.e., branches, stumps, other woody materials, garbage) will be limited to the area within the culvert, immediately upstream of the culvert, and to that which is necessary to maintain culvert function and fish passage. • Accumulated material and debris will be removed slowly to allow clean water to pass, prevent downstream flooding, and reduce the amount of sediment-laden water going downstream. Gradual dewatering will also reduce the potential for stranding fish in upstream areas. • Measures to prevent sedimentation and provide erosion control will follow the Erosion and Sedimentation Control Plan.
Placement of rip rap may interfere with fish passage	<ul style="list-style-type: none"> • Rip rap will be placed so as not to interfere with fish passage or constrict channel width.
Bridge maintenance can lead to habitat alteration or harm to fish	<ul style="list-style-type: none"> • The removal of debris from under and around bridges will occur outside of the restricted activity timing window for protection of fish (DFO, 2013a) unless the debris accumulation is an immediate threat to the integrity of the piers and abutments. • Ice buildup removal can be conducted at any time of year. • The removal of material will be limited to that which is necessary to protect piers and abutments. • Debris will be removed by hand or with machinery operating from shore. • Measures to prevent sedimentation and provide erosion control can be found in the Erosion and Sediment Control Plan.

Table 2.4 Mitigation Measures for Construction of Watercourse Crossings and Drainage Structures

Activity: Construction of Watercourse Crossings and Drainage Structures	
Potential Effect	Mitigation Measures
Culverts could create a barrier to fish passage or cause stranding of fish	<ul style="list-style-type: none"> • Culverts will be designed and constructed to maintain water flow and fish passage. • In-water construction activities will be conducted during no or low flow periods, where possible, and with erosion control mitigation in place. • Water flow and fish passage will be maintained during construction. • Culvert maintenance will abide by DFO's code of practice for culvert maintenance (DFO, 2022). • Temporary isolation will occur for the placement of rip rap and culverts and will follow the interim Code of Practice: Temporary cofferdams and diversion channels (DFO, 2020).
Excavation of bed and bank resulting in loss or alteration of fish habitat	<ul style="list-style-type: none"> • Sediment control measures, as identified in the Erosion and Sedimentation Control Manual, will be in place prior to construction activities and before the spring melt/freshet. • Instream work will be limited. • Construction activities will be conducted during no or low flow periods, where possible. • Grading of stream banks at approaches shall be limited, where possible. • Banks will be restored to original condition or as design specifies.
Isolations in watercourses may impede water flow and cause stranding of fish	<ul style="list-style-type: none"> • Temporary isolation will occur for the placement of rip rap and culverts and will follow the interim code of practice: Temporary cofferdams and diversion channels (DFO, 2020). • Water flow will be maintained. • A fish rescue will be conducted in isolated areas prior to dewatering and fish captured placed immediately downstream of the isolated area in the same watercourse. • Water withdrawal will be in accordance with DFO measures to protect fish and fish habitat and the Code of Practice: End-of-pipe Fish Protection Screens for Small Water Intakes in Freshwater (Interim) (DFO, 2020).
Vegetation clearing resulting in the alteration or loss of riparian area	<ul style="list-style-type: none"> • Riparian vegetation will be maintained whenever possible. • Where vegetation must be cut but is not removed, the cut will be made > 10 cm above the ground to retain the root structure. • Erosion and sedimentation control measures will be maintained until disturbed areas are revegetated or until such areas have been permanently stabilized by other effective measures. • Clearing will be completed by hand, where required, to prevent damage to the ground.

Activity: Construction of Watercourse Crossings and Drainage Structures	
Potential Effect	Mitigation Measures
Placement of material in and near water degrades water quality	<ul style="list-style-type: none"> • Rip rap will be free of acid rock drainage/metal leaching (ARD/ML) material. • Rip rap will be free of silt and other debris.
Temporary crossings and fords may alter fish habitat or restrict water flow	<ul style="list-style-type: none"> • Temporary crossings for ice bridges and snow fills, fords, and clear span bridges will abide by DFO's codes of practice (DFO, 2022). • Temporary crossings will be constructed perpendicular to the watercourse. • Temporary crossings will be constructed of clean snow fill or ice. • Snow fill crossings will be v-notched prior to the spring melt/freshet before April 1 each year. • Temporary bridges, if required, will not be placed below the ordinary high water mark. • No fording of watercourses is permitted except to install a temporary work bridge. If fording is required: <ul style="list-style-type: none"> – Plan in-water works to respect fish timing windows – Use methods to reduce soil compaction and erosion of banks – Conduct fords during periods of low flow – Do not skid or drag material across the ford
Breaching or removal of beaver dams causing scouring of watercourse bed and loss of riparia area	<ul style="list-style-type: none"> • Beaver dam removal will be done in accordance with the Code of Practice: Beaver dam breaching and removal (DFO, 2022) and conditions of a GNWT General Wildlife Permit. • Riparian vegetation will be maintained whenever possible. • Access will be along existing trails and perpendicular to the watercourse, where possible. • Erosion and sedimentation control measures will be maintained until disturbed areas are revegetated or until such areas have been permanently stabilized by other effective measures. • When dewatering beaver impoundments: <ul style="list-style-type: none"> – Remove the dam gradually, beginning with a small breach, and work in stages to control flows, prevent sediment from being released downstream, and prevent fish stranding – Verify that the width of the breach opening of the beaver dam does not exceed the width of the original stream channel – As the water levels drop in the upstream pond, increase the size of the opening to drain the pond to the desired water level

Table 2.5 Mitigation Measures for Quarry Operations

Activity: Quarry Operations	
Potential Effect	Mitigation Measures
Quarried material, debris and dust enter water degrading water quality and alteration of fish habitat	<ul style="list-style-type: none"> • Quarry operations will be located a minimum of 100 m from the ordinary high water mark of any waterbody. • Blast mats will be used when blasting in sensitive environments, as identified in the Wildlife Management and Monitoring Plan. • Blast rock will not enter a waterbody or watercourse. • Runoff water will be directed into vegetated areas away from natural drainages. • Positive drainage will be maintained within the quarry floor.
Use of explosives near waterbodies	<ul style="list-style-type: none"> • An Explosives Management Plan (ExMP) will be developed and will include control measures to prevent or reduce the mobilization of nitrogen compounds to the aquatic environment. • Blasting will not occur within 100 m of fish-bearing waterbodies such that instantaneous pressure will be no more than 50 kilopascals (KPa) where fish maybe present and particle velocity will be less than 13 millimeters/second within or near a spawning bed where eggs or larval fish may be present. • Storage of explosives will be controlled and runoff from storage areas will be contained. • To the extent possible, blasting activities will be completed during winter to avoid freshet runoff. • Blast holes will be kept free of water, where possible, to avoid the incomplete combustion of ammonia nitrate/fuel oil explosives (ANFO). • Explosives will be sealed and kept dry to prevent the incomplete combustion of ANFO. • The handling and transport of explosives will be carried out by the supplier and blasting contractor under a licence to conduct such work and according to the requirements of the <i>Explosives Act</i>, <i>Transport of Dangerous Good Act</i>, and <i>National Fire Code of Canada</i>.

Table 2.6 Mitigation Measures for Camps, Temporary Workspaces and Laydowns

Activity: Temporary Work Spaces and Laydowns	
Potential Effect	Mitigation Measures
Materials stored at temporary workspaces may enter a watercourse, altering fish habitat or degrading water quality	<ul style="list-style-type: none"> • Equipment laydown and staging areas will be located at least 100 m from the ordinary high water mark of any waterbody. • A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads. • Site drainage will be directed away from natural drainages. • Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted at least 100 m from the high water mark and in a manner to prevent any deleterious substances from entering the water. • The Spill Contingency Plan will be developed and implemented. • The Erosion and Sedimentation Control Plan will be developed and implemented. • The Waste Management Plan will be developed and implemented.
Water withdrawal causing the entrainment or impingement of fish, and reduced water volumes affecting fish habitat and fish health	<ul style="list-style-type: none"> • Water withdrawal will be in accordance with DFO measures to protect fish and fish habitat and the Code of Practice: End-of-pipe Fish Protection Screens for Small Water Intakes in Freshwater (Interim) (DFO, 2020). • Winter water withdrawal will only occur at approved locations and follow guidance from the DFO Framework to Support Flow Requirements to Support Fisheries in Canada (DFO, 2013b) and the Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (DFO, 2010).

3 Inspection and Response

3.1 Inspection

Daily

Work areas are to be inspected daily during construction to:

- Observe the effectiveness of fish and fish habitat protection measures
- Identify damage or degradation of erosion and sedimentation control measures
- Observe for scouring at new culvert installations
- Observe excavations throughout summer and fall for signs of degradation of permafrost

Prior to Freshet

Work areas are to be inspected prior to the onset of spring melt (freshet) to:

- Verify that erosion and sedimentation control measures are in place
- Confirm that snow crossings are v-notched
- Confirm that drainage culverts and drainage pathways are not blocked

3.2 Response

The response is to be based on the outcome of inspections conducted on the effectiveness and condition of erosion and sedimentation control measures. Responses may include:

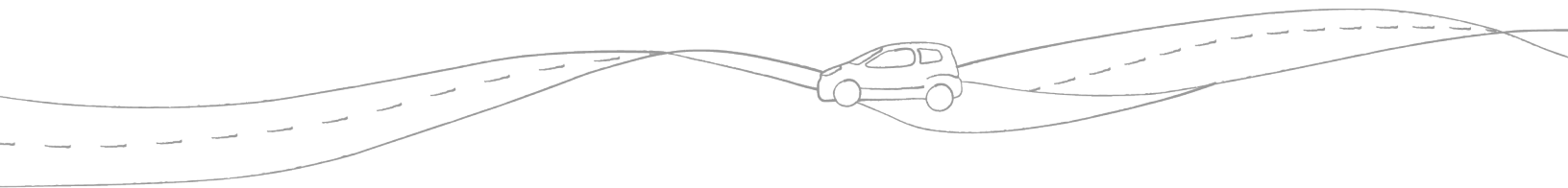
- Repair or replace damaged installations
- Add or substitute measures as approved by the Inspector or Engineer to improve effectiveness

3.3 Documentation

All inspections and responses are to be documented by contractor supervisor and shared with the GNWT.

4 References

- DFO (Fisheries and Oceans Canada). 2010. DFO Protocol for Winter Water Withdrawal from Ice Covered Water Bodies in the Northwest Territories and Nunavut
- DFO. 2013a. Northwest Territories Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. Available at: <https://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/nwt-eng.html>. Accessed February 2023.
- DFO. 2013b. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Canadian Science Advisory Secretariat Report 2013/017.
- DFO. 2019. Interim Codes of Practice. Available at: <https://www.dfo-mpo.gc.ca/pnw-ppe/practice-pratique-eng.html>. Accessed February 2023.
- DFO. 2022. Standards and Codes of Practice. Available at: <https://www.dfo-mpo.gc.ca/pnw-ppe/practice-pratique-eng.html>. Accessed February 2023.



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT HERITAGE AND SITES PROTECTION PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		Draft for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

AIA	Archaeological Impact Assessment
AOA	Archaeological Overview Assessment
CR	Conformity Requirements
DAR	Developer's Assessment Report
ECE	Ministry of Education, Culture and Employment
GNWT	Government of the Northwest Territories
HSPP	Heritage and Sites Protection Plan
km	kilometre
LSA	Local Study Area
MVLUR	Mackenzie Valley Land Use Regulations
MVRMA	<i>Mackenzie Valley Resource Management Act</i>
MVWR	Mackenzie Valley Winter Road
PDA	Project Development Area
the Project	Mackenzie Valley Highway Project
PWNHC	Prince of Wales Northern Heritage Centre
ROW	right-of-way
RSA	Regional Study Area
SLUP	Sahtu Land Use Plan
TDR	Technical Data Report
TLRU	traditional land and resource use

1 Introduction

1.1 Purpose and Objectives

This Heritage and Sites Protection Plan (HSPP) describes the mitigation measures to protect heritage resources from activities related to the construction and operations and maintenance of the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells and includes the development of quarry and borrow sources (Figure 1.1). Under the *Mackenzie Valley Resource Management Act* (MVRMA), heritage resources are defined as archaeological or historical sites; burial sites; artifacts; other objects of historical, cultural, or religious significance; and historical or cultural records.

Precontact archaeological, historical, and traditional land use sites represent discrete episodes of past activities. They are non-renewable and can be removed or altered by project development, including both the direct primary effects of project construction as well as indirect secondary effects, such as increased access and associated activities that are not project-related. Precontact and historical archaeological resources are tangible expressions of past land use activities. The archaeological interpretation of the resources depends on site contents such as artifacts, buildings, or trails, but also on the spatial relationship of site contents to one another and to the landscape. They are constantly at risk of disturbance and disappearance through both natural processes over time and human use and development of the land. They are therefore fragile, ephemeral, and the product of unique processes and conditions of preservation. Once they have been disturbed, they cannot be replaced, recreated, or restored. Archaeological resources are finite in quantity.

The purpose and objectives of this management plan are to provide guidance relative to the continued management of heritage resources within the Project Development Area (PDA) and to limit the potential of inadvertent effects on known, recorded heritage resources and unknown resources which may be encountered during project activities. **This HSPP is draft, as it has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board and is not currently intended to support applications to regulatory agencies.**



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0 40 80 Kilometres
 (At original document size of 8.5x11)
 1:4,500,000



Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV/B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

1.1

Title

Project Overview

Notes
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1.2 Regulatory and Policy Setting

The GNWT Guidelines for Developers for the Protection of Archaeological Sites in the Northwest Territories summarizes the relevant legislation and regulations.

Heritage Resources are protected and regulated under the Northwest Territories Archaeological Sites Regulations pursuant to the *Archaeological Sites Act* (S.N.W.T. 2014, c.9), which applies to all lands and waters other than those within the administration and control of His Majesty in right of Canada. The Regulations state that:

“4. No person shall search for archaeological sites or archaeological artifacts, or survey an archaeological site, without a Class 2 or Class 2 permit.

5. No person shall excavate, alter or otherwise disturb an archaeological site, or remove an archaeological artifact from an archaeological site without a Class 2 permit.”

Additional legislative protection is provided through the MVRMA, regulated through the Mackenzie Valley Land Use Regulations (MVLUR) and the *Historical Resources Act* (territorial). Under Part 5 of the Act, any “impact on the environment” includes any effect on the social and cultural environment or on heritage resources. Two sections of the MVLUR are relevant to archaeological sites:

“6 (a). Unless expressly authorized by a permit or in writing by an inspector, no permittee shall conduct a land use operation within 30 m of a known monument or a known or suspected historical, archaeological site or burial ground; and

12. Where, in the course of a land-use operation, a suspected historical or archaeological site or burial ground is discovered, (a) the permittee shall immediately suspend operations on the site or burial ground and notify the Board or an inspector; and (b) the Board or inspector shall notify any affected First Nation and the department of the Government of the Northwest Territories responsible therefor of the location of the site or burial ground and consult them regarding the nature of the materials, structures or artifacts and any further actions to be taken.”

The Sahtu Land Use Plan (SLUP) (SLUPB, 2023) contains provisions regarding archaeological sites. These are presented as General Conformity (CR) #4 – Archaeological Sites and Burial Sites and state that:

“1) Land use activities must not be located within 500 m of known or suspected burial sites, or within 150 m of known or suspected archaeological sites, unless measures are developed in cooperation with the Prince of Wales Northern Heritage Centre (PWNHC), affected communities, or, in the case of burial sites, with affected families where possible, to fully mitigate all impacts to the site.

2) In areas where there is a high risk of impact to known or suspected archaeological sites, as determined by the PWNHC, an archaeological impact assessment must be conducted prior to commencement of the land use activity.”

1.3 Engagement and Consultation

Consultation and engagement have been initiated and will continue to occur throughout the life of the Project relative to completion of an Archaeological Impact Assessment (AIA) for the Project. The GNWT has engaged and consulted with affected Indigenous Governments, Indigenous Organizations, and other affected parties including community members, landowners, and regulators. Indigenous Governments, Indigenous Organizations, and other affected parties, such as renewable resources councils, shared information and expressed concerns relative to heritage resources. Through the project-specific engagement program, engagement participants stated that there are burial sites, trails, historic cabins and campsites, and historical sites, as well as spiritual and sacred sites, within the Regional Study Area (RSA). Participants expressed concern that these sites will be disturbed by the Project; many of these areas are still in use. Engagement participants requested that an archaeological monitoring plan be put in place for the Project.

Engagement opportunities to foster and support site protection are:

- Inviting communities to guide selection of field assessment target areas
- Including Indigenous community members on field crews
- Sharing effects assessment results to communities through an in-person presentation, to request guidance for site interpretation and appropriate mitigation
- Incorporating input and guidance shared by Indigenous communities into the final permit report(s) resulting from and summarizing the results of field-based AIA(s)
- Discussing appropriate mitigative approaches with communities relative to individual sites identified and/or revisited during the AIA(s)
- Incorporating input and guidance into protection of sites that are yet undiscovered and may be encountered as chance finds:
 - During Project activities
 - Following Project construction, due to increased access

2 Proposed Protection Plan

2.1 Project Description

As described in Chapter 5, Section 5.4.1, of the Developer's Assessment Report (DAR), the Project will take approximately 10 years to construct, over a timeframe of up to 20 years. The schedule used for this assessment is conceptual and reflects a phased approach to construction, such that the Project is not likely to be constructed as a single, continuous project. The conceptual schedule assumes the highway will be constructed in three segments:

- From the community of Wrigley to the Dehcho/Sahtu regions border (102 km)
- From the community of Tulita south to the Dehcho/Sahtu regions border (134 km)
- From the community of Tulita north to the Prohibition Creek Access Road (45 km)

The actual schedule for construction of each segment will be determined based on secured funding and regulatory approvals. The operations and maintenance phase of the Project will likely commence in a similarly staged approach once construction of a particular segment has been completed. The operations and maintenance phase is not considered to have an end date as the Project will not be decommissioned.

The Project includes the following physical works and activities:

- Clearing of intermittent sections of new right-of-way (ROW) and widening of the existing Mackenzie Valley Winter Road (MVWR) ROW
- Construction of approximately 281 km of new all-season gravel highway embankment (102 km in the Dehcho Region, 179 km in the Sahtu Region) and intermittent pullouts
- Construction of approximately 85 culverts as watercourse crossing structures
- Construction and operation of approximately six temporary borrow sources and quarries and associated all-season access roads
- Construction and operation of approximately nine permanent borrow sources and quarries and associated all-season access roads
- Water withdrawal and water use for road construction, and maintenance
- Construction and operation of temporary support infrastructure and workspaces, including camps, maintenance yards, laydown and staging areas, and fuel storage areas
- Staging, supply, and resupply of equipment, materials, fuel, and personnel
- Construction and operation of permanent maintenance yards
- Closure and reclamation of temporary borrow sources, quarries, and workspaces
- Demobilization of equipment and materials
- Closure and reclamation of portions of the MVWR ROW not used for the Project

- Operations and maintenance activities, including snow clearing, grading, dust control, and culvert maintenance
- Use of the highway by the general public

2.2 Project Effects on Heritage Resources

Heritage Resources are non-renewable resources that are immovable and spatially defined. Activities that result in surface and/or subsurface disturbance have the potential to affect known and/or potential heritage resources through the loss of site contents and/or site contexts. These effects will occur primarily during the construction phase from the initial vegetation clearing activities and throughout the construction. They are not limited or defined by season of activity. As the highway will be used by the general public, increased access to these areas may contribute to effects on Heritage Resources after project construction (e.g., increased trails, camps).

2.3 Existing Conditions

The Mackenzie Valley corridor has been subject to archaeological desktop studies (archaeological overview assessments [AOAs]) as well as field assessments (AIAs) since the early 1970s. Each of these studies has addressed slightly different footprints related primarily to proposed roadway expansions, the Mackenzie Gas Project and, more recently, the Mackenzie Valley Fibre Link. These AIAs have resulted in the identification of archaeological sites and other heritage resources and have contributed to the evaluation of archaeological site potential. Recent AOAs (Krahulic, 2020; Peach, 2021) have incorporated the results of these AIAs to identify data gaps between the Project and previous field assessments and in the evaluation of resource potential within these unassessed areas.

A total of 133 sites are currently on record with the Culture and Heritage Division within the RSA. Sites can range in size from a point (e.g., one isolated artifact) to a large campsite, village, trading post, or trail. This range in site size and in the differing accuracy of locational data due to decades of site records means that the likelihood of spatial overlap between a resource and the Project is approximate. As a result, potential project effects on known heritage resources must be considered with caution.

Of the 133 sites within the RSA, 50 of these lie within the Local Study Area (LSA; see Appendix 27A) and 13 fall within the PDA. Until a final footprint/PDA has been defined, the likelihood of effect to the majority of these recorded sites is unknown. It is assumed that these sites would be revisited during an AIA, the locational information updated, and the relationship between the Project and the sites established. Recommendations for site protection and/or mitigation will be presented within the AIA report for consideration by the territorial regulators.

Of these 133 sites within the RSA, 63 may reflect traditional land and resource use (TLRU) based on the available site descriptions. Five of these sites are recorded as consisting of or including graves/burials.

Areas of particular site density are at the confluences of Mackenzie River and Ochre River, White Sand Creek, Dam Creek, Blackwater River, Step Creek, Saline River, Little Smith Creek, Big Smith Creek, and Great Bear River.

A total of 33 areas of high archaeological site potential have been identified within the 2020 AOA footprint (Krahulic, 2020). Nine areas of high archaeological site potential have been identified within the 2021 AOA footprint for borrows, quarries, and associated access within the PDA. Additionally, previously unknown sites may be recorded in these areas of high archaeological site potential during the AIA field assessment. Previously unknown sites may be encountered during project construction.

2.4 Protection Plan Components

The mitigation of project effects on heritage resources is a staged process, essentially occurring during the pre-construction, construction, and operations and maintenance phases.

2.4.1 Pre-Construction Phase

The first step within this phase is the submission of the Heritage Resources Technical Data Report (TDR) and DAR to the Culture and Heritage Division of the Ministry of Education, Culture and Employment (ECE). It is expected that the territorial regulators for heritage resources will review the project information and issue requirements intended to initiate the staged process of mitigating project effects. These requirements are expected to include completion of:

- An AOA to identify assessment gaps relative to a final footprint/PDA
- An AIA to assess areas of high potential that are ‘assessment gaps’ and to evaluate known sites within the PDA

Completion of the AIA will likely result in the identification of previously unrecorded heritage resources, as well as an updated evaluation of known sites, including updates to locational information and site status (e.g., intact, disturbed). The relationship between the PDA and these resources will be established during the AIA and each resource will be evaluated.

Additional requirements may be issued by the territorial regulators for heritage resources identified during the AIA completion. These requirements may include the following pre-construction mitigative approaches:

- Avoidance of sites through Project redesign and/or fencing/marketing for protection against inadvertent effects during construction
- Archaeological mitigative excavation
- Controlled surface collection of cultural materials
- Historic structure recording
- Oral history and/or archival/documentary research

The preferred mitigative approach is avoidance of effect, preferably through project redesign/revision of footprint, as this protects these non-renewable heritage resources.

Similar requirements of 'known and suspected sites' as identified by Indigenous Governments, Indigenous Organizations, and other affected parties during Consultation and engagement and/or through TLRU studies will also serve to mitigate project effects. Results of engagement and TLRU studies will be incorporated into the early processes noted above, including incorporation of information into the identification of high potential areas in the AOA, review of the AIA Class 2 Archaeologist Permit application, inclusion of Indigenous Governments and Indigenous Organizations in the AIA field crews, and presentation of AIA results to Indigenous Governments and Indigenous Organizations to develop site evaluations, interpretations, and mitigative approaches. In the later processes, Indigenous Governments, Indigenous Organizations, and select other affected parties, such as renewable resources councils, will review the Class 2 Archaeologist Permit for mitigative approaches (such as archaeological excavation, surface collections, historic structure recording, and oral history/documentary research) and will be requested to be members of field crews.

2.4.2 Construction Phase

Final permit reports for the initial AIA and subsequent mitigative activities will include recommendations to the territorial regulators regarding each heritage resource recorded during the field program(s). These site-specific recommendations may be for:

- No further work relative to the Project
- Continued avoidance of effect through project redesign and/or fencing/markings during construction
- Monitoring during construction for specific sites and/or high potential or sensitive areas

It is suggested that heritage resources protection activities conducted during the construction phase be conducted by a joint team of archaeologists and Indigenous Governments and Indigenous Organizations.

Changes in project construction activities during the construction phase may include changes in footprint (e.g., expansion of borrow/quarry boundaries, relocations of watercourse crossings, access road alignments) and/or season of activity (e.g., access roads originally considered for winter use only are used in alternate seasons without the substantial snow cover/ frozen ground conditions that could serve to protect heritage resources). In these situations, the revised plans and spatial data will be provided to the archaeological team for review and evaluation, combining input from Indigenous Governments and Indigenous Organizations. The team will review the plans relative to the likelihood of effects to known heritage resources or to areas of high archaeological site potential. The project archaeological team will forward these evaluative conclusions and recommendations to the Project Manager for consideration. If avoidance of effects is not possible through modification of the footprint or limitation of activities, the project archaeological team will forward the plans, spatial data, evaluative conclusions, and recommendations to the territorial regulators with ECE at PWNHC for consideration by the Territorial Assessment Archaeologist, who

may then issue requirements for additional archaeological mitigative options that are either site- and/or footprint-specific.

Archaeological sites are often limited in size, with sparse and ephemeral physical evidence of past human activities and presence. An AIA focuses on areas of perceived and modeled high archaeological site potential, as identified within a preceding desktop AOA. An AIA, by definition, samples a small percentage of the overall project footprint. As a result, there is a high likelihood that AIA efforts will not identify all archaeological sites within the Project; chance finds of archaeological and other cultural materials are likely to occur during project activities.

Final protection measures during the construction phase are:

- Consideration of a monitoring program for specific sites and/or high potential and/or sensitive areas.
- Development and application of a chance find protocol for cultural materials, features, and sites during project construction
- Development of a workers' education program to further the objectives of the chance find protocol

Should heritage resources be encountered during the construction phase of the Project, all ground disturbance activities within 50 m should be halted. The site inspector and/or environmental monitor should be contacted. If a member of the project archaeological team is on site, they should be contacted. If not on site, photographs and spatial data should be provided to the project archaeological team for further evaluation. The project archaeological team and/or Project Manager will inform the territorial heritage regulators at ECE as well as the Indigenous Governments and Indigenous Organizations. Chance finds may result in additional requirements issued by the territorial regulators and/or action requests from Indigenous Governments and Indigenous Organizations.

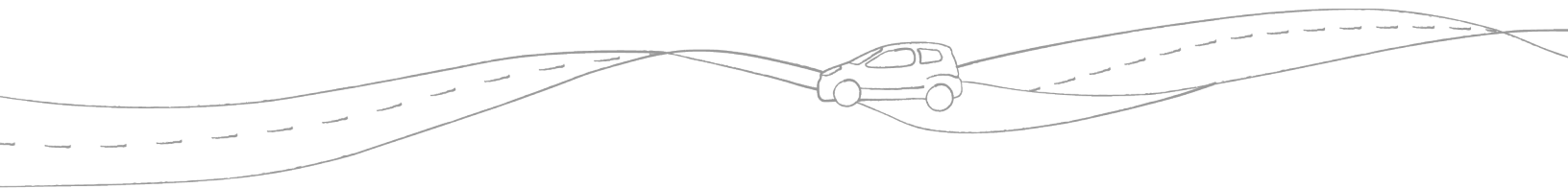
2.4.3 Operations and Maintenance Phase

Following completion of project construction, chance find occurrences are possible during the operations and maintenance phase. Continuation of the chance find protocol described above is recommended, as well as continued renewal of the workers' education program.

For heritage resources that are in proximity to the Project, and which were avoided through project redesign and/or fencing/marking during construction, development of a post-construction monitoring program may be developed in coordination with the territorial heritage regulators and Indigenous Governments, Indigenous Organizations, and select other affected parties, such as renewable resources councils. This type of monitoring program would allow for site-specific status updates for sites at potential risk of effect either due to ongoing operations and/or increased access to previously remote areas. The period (e.g., 5 years following completion of construction) and intervals (e.g., annually) for this type of monitoring program also would be developed in coordination with the territorial heritage regulators and Indigenous Governments and Indigenous Organizations, and renewable resources councils.

3 References

- DLUPC (Dehcho Land Use Planning Committee). 2006. NDÉH TS'EDÎCHÁ: Dehcho Ndéh T'áh Ats'et'î K'eh Eghálats'ênda RESPECT FOR THE LAND: The Dehcho Land Use Plan. Final draft plan, May 2006.
- Krahulic, T. 2020. Archaeological Overview Assessment, GNWT INF, Mackenzie Valley Highway. Consultant's report on file, Prince of Wales Northern Heritage Centre. Yellowknife, NT.
- Peach, A.K. 2021. Archaeological Overview Assessment, GNWT INF, Prospect Borrow Sources – Mackenzie Valley Highway, between Wrigley and Norman Wells. Report prepared for GNWT INF, for submission to Prince of Wales Northern Heritage Centre. Yellowknife, NT.
- SLUPB (Sahtu Land Use Planning Board). 2023. Sahtu Land Use Plan. Government of Northwest Territories. Fort Good Hope. Ratified but not available as of July 19, 2023; see <https://sahtulanduseplan.org/plan>.



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT PERMAFROST PROTECTION PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
1.0	n/a	DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Appendix A -Permafrost Mitigation Measures

Abbreviations

ESCM	GNWT Transportation’s Erosion and Sediment Control Manual
ESCP	Erosion and Sediment Control Plan
GNWT	Government of the Northwest Territories
GNWT-INF	Department of Infrastructure, Government of the Northwest Territories
km	kilometre
LUP	Land Use Permit
m	metre
MVWR	Mackenzie Valley Winter Road
NLUG	Northern Land Use Guidelines
NWT or NT	Northwest Territories
PCAR	Prohibition Creek Access Road
PPP	Permafrost Protection Plan
the Project	Mackenzie Valley Highway Project
ROW	Right-of-Way
RSA	Regional Study Area
TAC	Transportation Association of Canada

1 Introduction

The primary goal of this Permafrost Protection Plan (PPP) is to prevent or mitigate project-induced permafrost degradation and to present maintenance-level mitigation measures that will reduce the effects on permafrost from the Mackenzie Valley Highway Project (the Project) to be constructed by the Government of the Northwest Territories (GNWT).

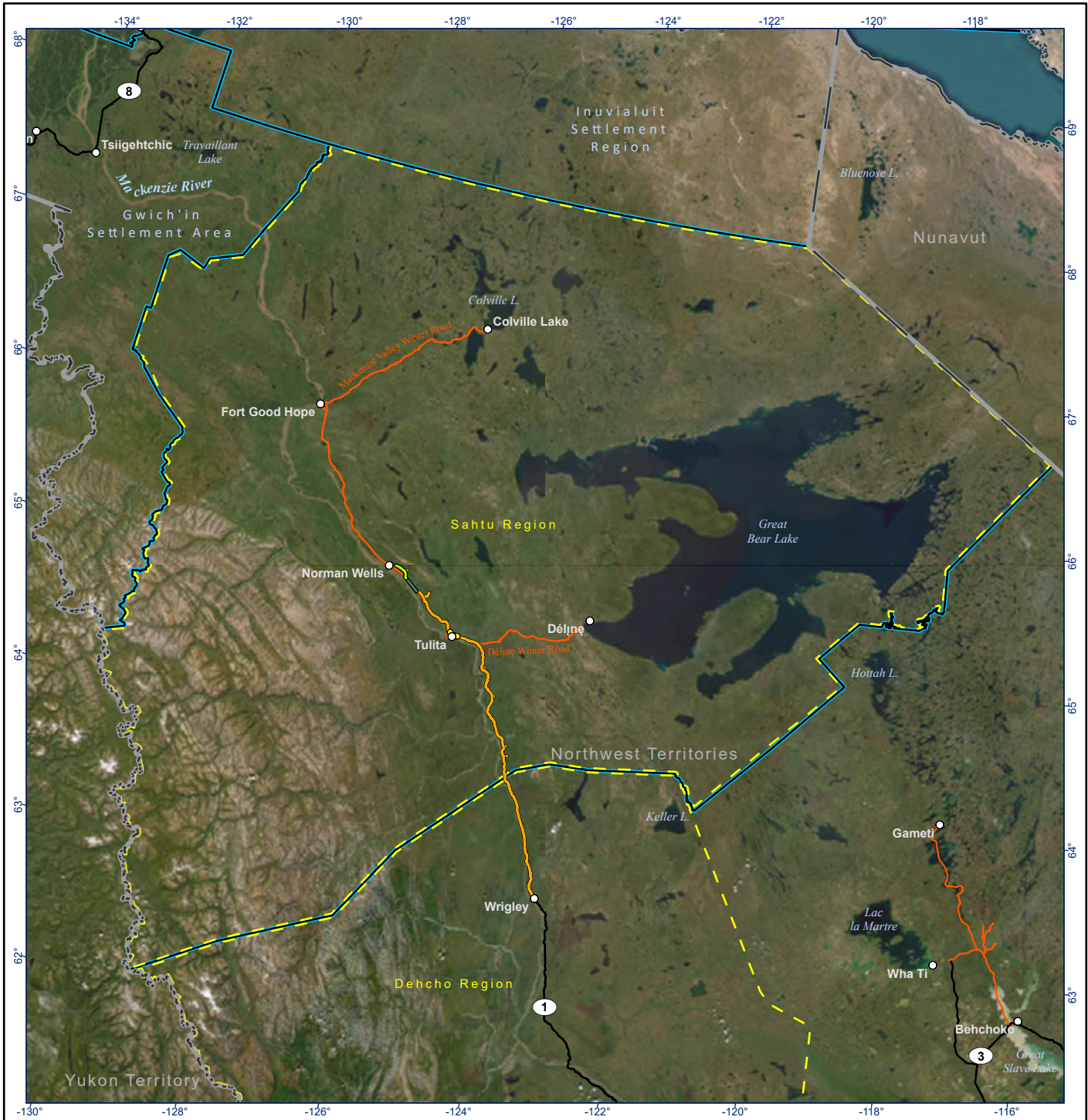
The Project is located in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells, and includes the development of quarry and borrow sources (Figure 1.1, Figure 1.2.1 through Figure 1.2.3). The PPP was developed in accordance with applicable guidelines and best practices in Northwest Territories and is one of several plans developed for the construction and operations and maintenance of the Project. This PPP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the GNWT. **This PPP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not intended to support applications to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.**

The primary goal of this PPP is to prevent or mitigate future degradation and thaw of permafrost along the project alignment and to present maintenance-level mitigation and monitoring of the permafrost regime during the construction phase of the Project. The Project spans extensive discontinuous permafrost (near Norman Wells), intermediate discontinuous permafrost (in the Mackenzie Plain), and sporadic discontinuous permafrost (near Wrigley). Permafrost may be absent along portions of the Project (K'alo-Stantec, 2022).

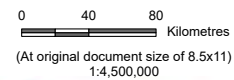
This plan accompanies and is complementary to the Project Erosion and Sedimentation Control Plan (ESCP) because permafrost degradation and erosion control are linked but separate processes. Disturbances to permafrost can result in physical erosion, but physical erosion can also result in permafrost thaw.

This document was developed to be in line with recommendations from the applicable Northern Land Use Guidelines (NLUG; GNWT, 2015a, 2015b, 2015c), the Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions by the Transportation Association of Canada (TAC, 2010), and the GNWT Erosion and Sediment Control Manual (ESCM) (GNWT, 2013).

The PPP is a living document that will be reviewed and updated as needed to adapt and incorporate any changes in environmental factors, pertinent project-specific changes during construction (e.g., site conditions and design modifications), and the GNWT-INF and Contractor practices, experiences, and policies, and will include results from ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, including regulatory agencies.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
- Community
- Northwest Territories Highway
- Winter Road
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary



Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV/B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

1.1

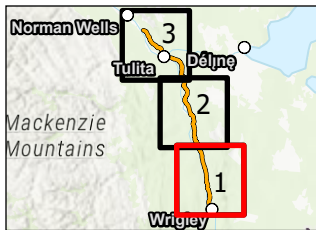
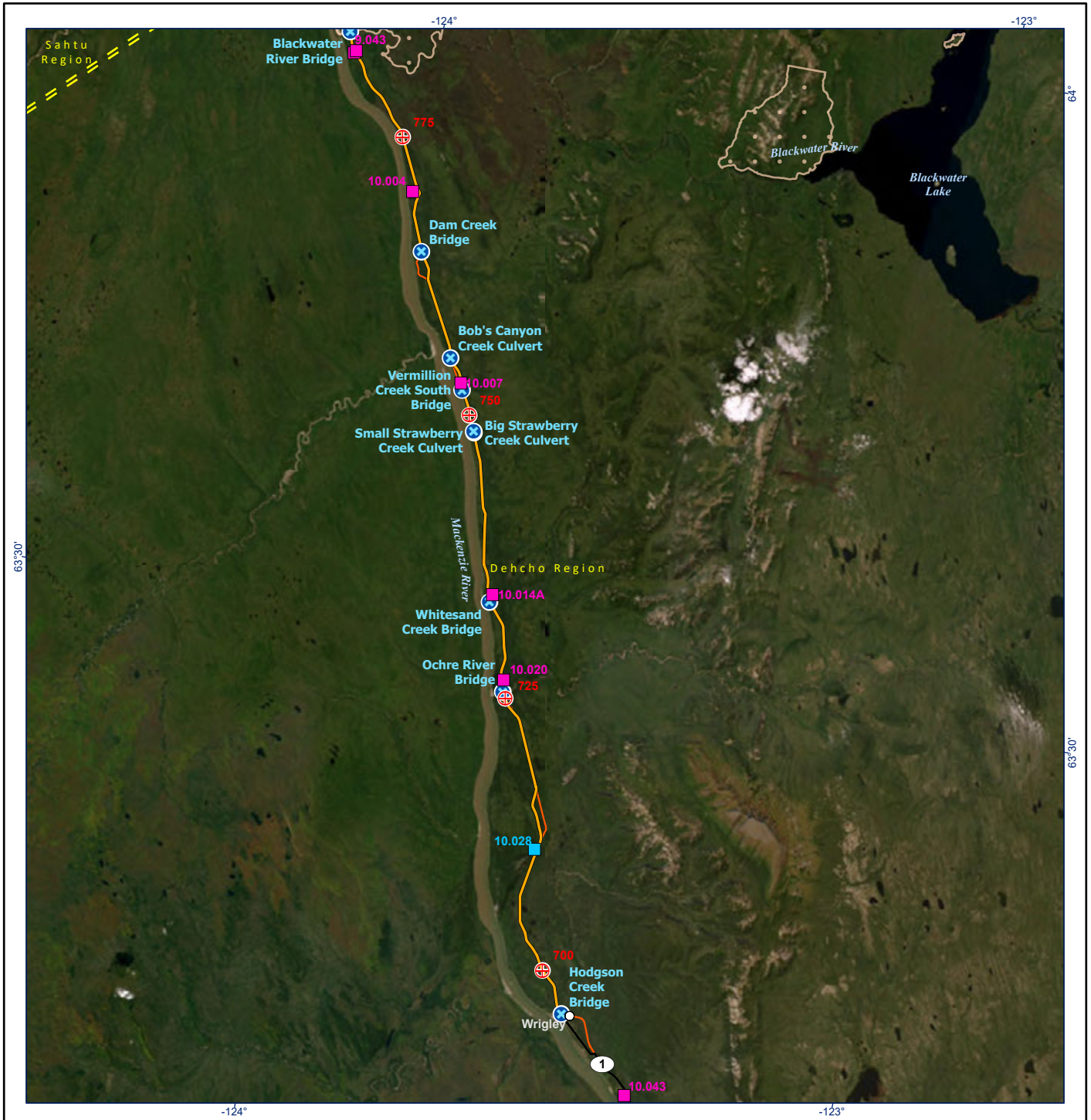
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Project Overview

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCan
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2020

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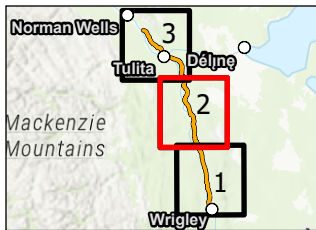
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 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2021

- Proposed Mackenzie Valley Highway Kilometre Marker (Approximate)
- Existing or Planned Bridge Crossing (Not in Scope of Project)
- Proposed Mackenzie Valley Highway Project Route
- Proposed Bear Rock Alignment Option
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge Project (Not in Scope of Project)
- Proposed Borrow Source
- Proposed Rock Quarry Source
- Proposed Borrow Access
- Proposed Rock Quarry Access
- Community
- Northwest Territories Highway
- Mackenzie Valley Winter Road (Not in Scope of Project)
- Region Boundary
- Sahtu Land

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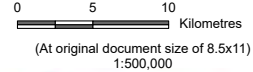
Project Location Wrigley to Norman Wells, NWT
Client/Project Government of the Northwest Territories Mackenzie Valley Highway Project
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023
 144903025-0179 REVA

Figure No. 1.2.1
Title Mackenzie Valley Highway Project - Overview
 Page 1 of 3



Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
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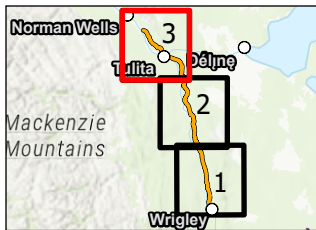
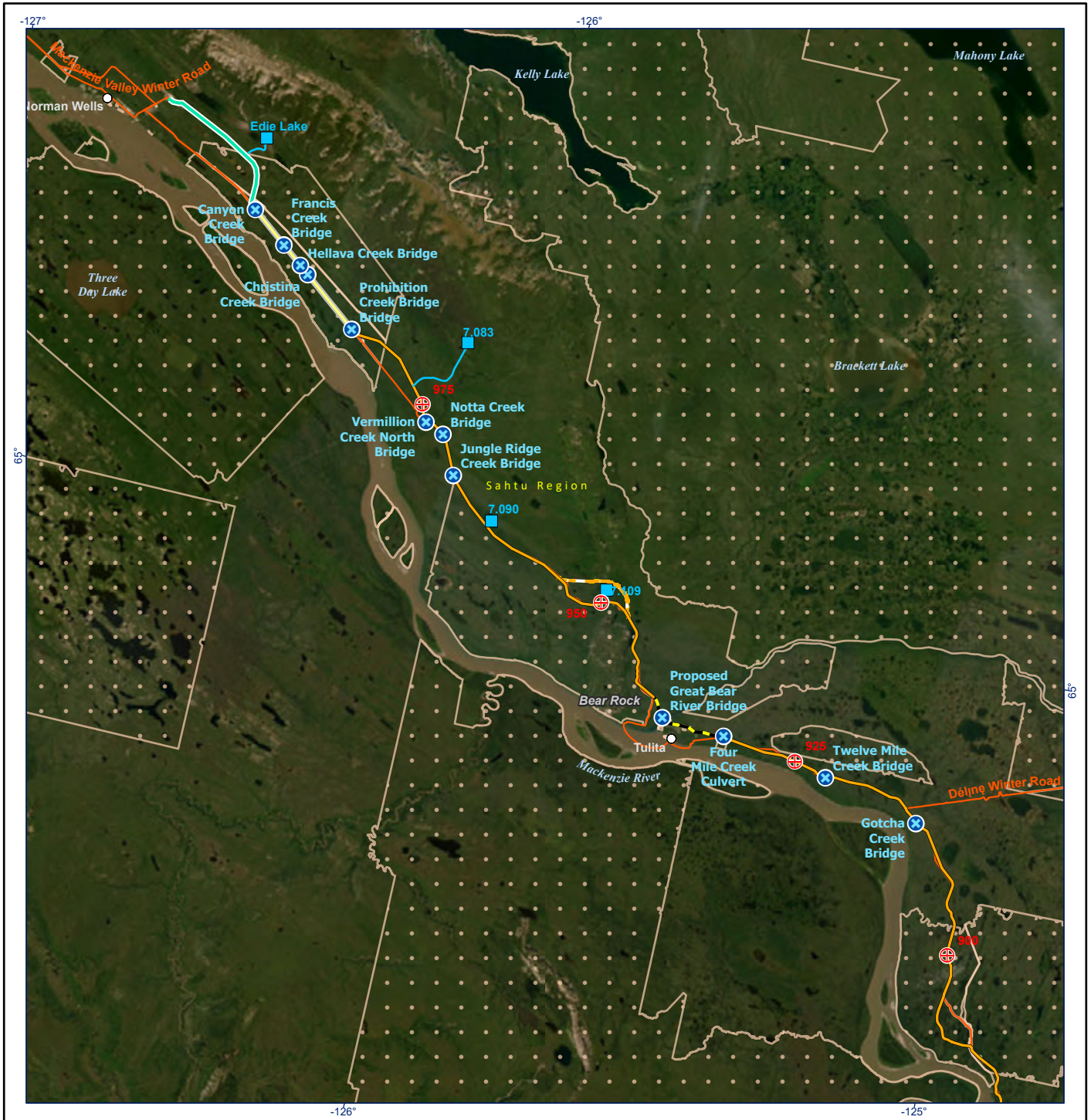


Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
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Client/Project: 144903025-0179 REVA
 Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 1.2.2
 Title

Mackenzie Valley Highway Project - Overview



Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
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Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

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Figure No.
1.2.3

Title
Mackenzie Valley Highway Project - Overview

Page 3 of 3

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2 Purpose and Approach

This PPP provides methods, strategies, and monitoring efforts aimed at preventing or mitigating negative effects on the environment due to the disturbance of permafrost from activities related to the construction, and operations and maintenance of the Project. This PPP also describes a monitoring program with an emphasis on early detection of changes in permafrost, including visual inspections, ground temperature monitoring, and climatic data reviews, which is a vital component of adaptive management.

The PPP identifies potential effects and mitigation measures using best practices adapted from the NLUG, the GNWT ESCM, Transportation Association of Canada (TAC) Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions, and professional judgement, to avoid or reduce these effects on permafrost.

The PPP describes how the Project will:

- Reduce effect on permafrost due to construction activities
- Mitigate permafrost thaw and permafrost degradation over time
- Accommodate climate change effects as they relate to permafrost
- Address long-term monitoring of permafrost regime and maintenance-level mitigation

3 Roles and Responsibilities

The Contractor is responsible for implementing the PPP and complying with all permits and licences issued to GNWT. Roles and responsibilities are outlined in Table 3.1.

Table 3.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this PPP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Quality Control during construction • Continue permafrost protection and remedial measures until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this PPP is available on site at all times • Verify that personnel are trained and competent in the PPP's application • Verify that the measures in the PPP are adequately applied • Coordinate mitigative and remedial measures in all affected areas • Conduct regular worksite inspections • Coordinate additional equipment and/or workforce (if necessary) • Liaises with Inspector and Engineer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and worksite inspection activities • Report to the GNWT • Oversee completion of the Project • Support the Contractor Supervisor, as required • Maintain contact with Contractor Supervisor to confirm final worksite inspection and sign-off are completed • Oversee completion and distribution of reporting to the GNWT
GNWT INF	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with GNWT Lands Inspector, government agencies, and public and Indigenous Governments and Indigenous Organizations (as required) • Confirm all reports are completed as required by authorizations

**Mackenzie Valley Highway
DRAFT Permafrost Protection Plan
Roles and Responsibilities**

Entity	Responsibility
Engineer and/or GNWT's Designated Representative	<ul style="list-style-type: none">• Develop design specifications related to permafrost protection• Quality Assurance during construction• Support Contractor and the GNWT by providing technical guidance on the implementation of this PPP• Make recommendations for modification to mitigative measures based on site reviews• Verify that the PPP is being followed

4 Legislation and Guidelines

This plan has been developed in consideration of the applicable legislation and guidelines, including:

- *Fisheries Act* (1985, as amended 2019) and Regulations
- *Canadian Navigable Waters Act* (1985, as amended 2019) and Regulations
- *Mackenzie Valley Resource Management Act* (1998, as amended 2019) and Regulations
- Northern Land Use Guidelines: Camp and Support Facilities (GNWT, 2015a)
- Northern Land Use Guidelines: Pits and Quarries (GNWT, 2015b)
- Northern Land Use Guidelines: Roads and Trails (GNWT, 2015c)
- Erosion and Sediment Control Manual (GNWT, 2013)
- Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions (TAC, 2010)
- National Guide to Erosion and Sediment Control on Roadways Projects (TAC, 2005)

Lessons learned from the Inuvik to Tuktoyaktuk Highway, Dempster Highway and Tłı̄chǫ Highway, where relevant, will be applied to further develop the detail of monitoring and response actions associated with permafrost protection.

5 Project Activities

The Project includes the following activities to which this plan applies:

- Mobilizing and demobilizing construction equipment to and from work sites
- Site preparation:
 - Clearing, stripping, and grubbing vegetation and organic material from the alignment right-of-way (ROW) and within proposed work areas
 - Construction of a winter travel lane(s)
- Road construction:
 - Placing geotextile
 - Hauling and end-dumping embankment rock fill
 - Placing and compacting granular sub-base and base course
 - Snow clearing and grading
 - Construction of watercourse crossing and drainage structures
 - Temporary crossings
 - Excavation of watercourse base for culvert installation
 - Excavation of watercourse bank for apron and rip rap installation
 - Placement and backfill of culverts
 - Beaver dam and/or beaver lodge removal
 - Apron and rip rap installation
- Quarry Operations:
 - Drilling
 - Excavation
 - Blasting
 - Crushing and stockpiling
 - Water management
 - Temporary workspaces and laydowns:
 - Siting
 - Site clearing and grading
 - Site use and maintenance
 - Reclamation
 - Camp accommodations and associated facilities
 - Camp operations

5.1 Timing of Construction Activities

Most of the site preparation and embankment construction activities will be conducted in the winter during frozen conditions. Winter construction reduces disturbance to the natural ground surface and permafrost soils. During the summer months, overland travel will be limited to the previously constructed embankment, existing all-season roads, and within the project footprint.

The advantages of winter construction include the following:

- The Project can be accessed using the Mackenzie Valley Winter Road (MVWR).
- Construction material can be placed directly onto frozen ground (with geotextile separation layer). This approach helps increase ground stability while protecting sensitive soils and ice-rich terrain.
- It limits potential effects on vegetation and soils adjacent to the roadway that may have occurred if working under snow-free or wet conditions.
- The installation of certain culverts may be simplified during the winter months due to decreased flows.
- It reduces the effects on wildlife.

The disadvantages of the winter construction include the following:

- Work is challenging for both personnel and equipment with extreme cold temperatures from December to February.
- Operations are conducted in periods of minimal daylight.
- Embankment construction and compaction of frozen material is more difficult.
- The same level of compaction cannot be achieved in the winter as compared to compacting unfrozen granular materials in the summer months.
- There is the potential for sensory and physical disturbance to over-wintering wildlife.

Embankment material hauling and placement and culvert installation is expected to primarily occur in winter during frozen conditions but may also be completed during the summer when moving equipment on the partially constructed embankment, and depending on site-specific terrain conditions, as approved by the GNWT.

Grading, surfacing, and compaction of the embankment base course and surface course materials is expected to occur in summer. Other site-specific activities, such as borrow material stockpiling, placement of riprap, and erosion control mitigation may occur year-round as site-specific conditions allow.

Development of quarries and borrow sources will be year-round, with operations also conducted year-round to support construction.

Final construction timing and methodology will be established during detailed design and discussion with the selected Contractor.

6 Permafrost Conditions Along the Alignment

The Project spans extensive discontinuous permafrost (near Norman Wells), intermediate discontinuous permafrost (in the Mackenzie Plain), and sporadic discontinuous permafrost (near Wrigley). Permafrost may be absent along portions of the Project (K'alo-Stantec, 2022; Heginbottom et al., 1995). A discontinuous permafrost environment is associated with warm ground temperatures and thermally sensitive permafrost conditions. The extent of localized permafrost change within the project area is difficult to predict as it is dependent on multiple variables, including surface temperature, soil properties, and the initial permafrost temperature conditions.

Permafrost can be classified into two types: ice-rich (thaw-sensitive) and ice-poor (thaw-stable). Not all permafrost is a concern to the successful construction of a road. The type of permafrost that is typically of concern is ground that is ice-rich and thaw-sensitive. Fine-grained soils that contain visible ice or are more than 100% saturated are considered thaw-sensitive. Granular soils and bedrock that do not contain excess ice are considered thaw-stable. The Project will encounter permafrost along most, but not all, of the route, and not all of the permafrost will be thaw-sensitive.

Permafrost is vulnerable to both thermal erosion of frozen ground and physical erosion of soil:

- Thermal erosion is characterized as the thawing of permafrost or seasonally frozen ground. Frozen ground containing ice will thaw and settle and the discharge water will flow over saturated soil.
- Physical erosion is characterized as the mobilization of soil particles by water flow and subsequent deposition as sediment. Vulnerability to physical erosion is similar in permafrost and non-permafrost areas.

Thermal erosion may or may not result in physical erosion, but physical erosion will increase the vulnerability to thermal erosion. To some degree, thermal erosion of permafrost following construction on permafrost terrain is inevitable due to the change in thermal regime resulting from construction. The degree of thermal erosion and permafrost thaw can be mitigated by employing appropriate measures during construction. It becomes impractical to restore permafrost once thermal erosion has occurred and the permafrost will naturally need to establish a new equilibrium.

Ground temperature data from the Geological Survey of Canada were used to assess and evaluate the presence of thaw-sensitive terrain to be incorporated into the final design to limit effects on permafrost. Data recording sites within the Regional Assessment Area (RAA), which is a 10 km buffer centred on the project alignment, access roads, and primary borrow sources, show the annual mean ground temperatures at a depth of zero annual amplitude (or deepest available measurements) to range from above zero (i.e., absence of permafrost) to approximately -2°C. Ground temperature records for the 2007–2018 period indicated that permafrost is generally warming throughout the Mackenzie Valley and for a majority of sites, permafrost is currently warmer than the baseline established during the International Polar Year (2007–2009) (Duchesne et al., 2020).

Warm permafrost (0 to -1°C) is considered to be vulnerable to thawing due to site development and over time due to climate change. Despite efforts to reduce project effects on permafrost during construction and operations, near-surface permafrost along the alignment will likely degrade in the next decades due to climate warming.

7 Potential Effects and Mitigation Measures

Appendix A, Table A.1 identifies measures required to be implemented to mitigate potential effects on permafrost from each general Project activity.

8 Climate Change Effects

After the Project is in operation, greater vigilance and effort on the part of maintenance operators will be required to limit the effects associated with climate change on the Project. This would include:

- Ongoing monitoring of ground and air temperatures and precipitation; other variables to be monitored will be identified as based on the design and additional geotechnical information
- Training staff to know how to identify issues
- Maintaining culverts so that they are operating as designed in the spring and fall
- Observing the performance of the infrastructure, including the evaluation of drainage and thaw-related problems such as icings
- Completing road inspections after heavy weather events
- Addressing performance issues such as rutting and potholes in a timely manner
- Maintaining the road and addressing settlement issues promptly

Table 8.1 outlines possible measures incorporated into the Project to mitigate effects from a changing climate.

Table 8.1 Potential Climate Change Effects and Mitigation Measures

Potential Effect	Mitigation Measures
Increase in mean seasonal temperatures, increasing Active Layer thickness, water expulsion from soils, and ground settlement	<ul style="list-style-type: none"> • Construct embankment using ‘fill approach’ with minimal disruption to the subgrade, except at specific locations where road cuts are required • Use woven geotextile fabric as insulation and to reinforce embankments, where needed, on a site-specific basis to reduce permafrost degradation and differential settlement • Incorporate approaches to limit the presence of ponded water within the ROW (e.g., appropriate culvert placement and sizing, maintain culverts free of blockages). • Use of geofabrics, geosynthetic materials, wattles, or other erosion control products in ditches covered by organics to limit erosion of the existing fine-grained soils • Stage the construction such that the placement of granular surfacing is delayed until any substantial differential settlement has occurred • Confine activities to the Project footprint to the extent possible

Potential Effect	Mitigation Measures
Increase in mean seasonal temperatures resulting in increased ponded surface water and potential erosion and drainage issues associated with permafrost thaw	<ul style="list-style-type: none"> • Identify areas within the ROW that are most vulnerable to climate change, including those areas with ice-rich permafrost • Avoid constructing in ice-rich areas, if possible, and where not possible then deploy methods to limit thermal disturbance • Refer to the ESCP for erosion and sediment control management best practices
Increase in temperature extremes causing an increase in wildfire potential, may affect insulating ground cover and increase ground temperatures	<ul style="list-style-type: none"> • Use existing disturbed areas to the extent possible
Warming temperatures globally decreasing the amount of permafrost in the local area of the Project	<ul style="list-style-type: none"> • Observe Project sites during freshet to identify and mitigate erosion concerns • Incorporate approaches to limit the presence of ponded water within the ROW (e.g., appropriate culvert placement and sizing) • Use rock quarry materials from the Edie Lake Quarry to construct the embankment rather than adjacent and low quality granular borrow materials • Use woven geotextile to reinforce embankments and reduce differential settlement • Avoid construction on steep slopes to prevent material slumping and gully erosion • Stage the construction such that the placement of granular surfacing is delayed until substantial differential settlement has occurred

9 Permafrost Monitoring

A long-term permafrost monitoring program will be developed to monitor the performance of the Project over time. The monitoring program will study the thermal regime of the infrastructure and surrounding area, and how factors such as surface ponding, revegetation, and patterns of snow accumulation affect the thermal regime.

The permafrost monitoring program describes approaches that will be taken to effectively monitor areas and describes visual and ground temperature monitoring activities that will be conducted regularly throughout the summer and fall construction seasons and during operations. These monitoring activities will assist in adaptively managing the design and construction elements aimed at protecting the ground thermal regime, and in identifying specific areas where mitigative or restorative efforts may be required.

Over the long timeframe of the Project, permafrost under and near the embankment will continue to change as a result of the Project and natural factors such as climate change. Monitoring of embankment performance will include observing the embankment for signs of cracking, sloughing, ponding water, winter icings, and vegetation changes. Where permafrost is encountered and where practical, thermal and hydrologic regimes will be monitored so that the embankment performs as designed.

The selected Contractor will implement an inspection program to quickly identify and correct any PPP hazards that are identified. During construction, inspections will be done weekly during spring runoff (freshet) as well as before and after substantial runoff events in the summer months.

9.1 Ground Temperature Monitoring

A key component for monitoring permafrost is having adequate ground temperature monitoring instrumentation installed to establish baseline ground temperatures and for long-term temperature monitoring during operation. Ground temperature instrumentation was installed in summer 2020 (Tetra Tech, 2020) and additional monitoring instrumentation may be identified during final design and potentially installed during construction of the Project.

9.2 Climatic Data Reviews

Climatic data, including mean daily air temperatures and the calculated freezing indices, will be compiled and reviewed on an annual basis. The information can assist with interpreting observed ground temperatures measured along the Project and will help to illustrate fluctuations in air and ground temperatures.

Climatic data review will focus on sensitive areas of the alignment to better assess how permafrost conditions may be altered due to climate change. Air temperatures will be sourced from current and historical weather stations. Although air temperatures do not solely influence ground temperatures, they offer help in understanding observed temperature trends. Freezing indices (the number of degree-days below 0°C) will be calculated, using this data, to show changes in seasonal temperatures from year to year. Annual climatic data reviews will be performed during operations.

10 Adaptive Management

Adaptive management of permafrost along the Project will be a systematic approach that links site observations and ground temperature monitoring with response actions to mitigate permafrost degradation. Possible changes in the permafrost regime, due to construction and climate, require triggers and planned responses to mitigate future permafrost degradation. Adaptive management will also help to evaluate the long-term success of permafrost preservation and will confirm that disturbed areas along the Project have stabilized and are performing as expected.

The response framework for permafrost degradation is an approach for responding to the results of the Permafrost Monitoring Program, as described in Section 9. The framework will require a Contractor and the GNWT Department of Infrastructure (GNWT-INF) to respond upon reaching pre-defined level of changes or effects on the permafrost regime. Action levels are, in turn, set such that adverse, long-term effects on permafrost do not occur or are limited.

Construction shutdowns may occur for reasons including inclement weather, permit or licence contraventions, or health and safety incidents. This may lead to an increased risk of potential permafrost degradation where mitigation had not yet been installed or completed.

If additional permafrost areas are found during the construction phase, the design and construction team will consider the following actions to mitigate the potential challenges:

- Maintain muskeg, peat, and organic topsoil and avoid disturbing them in permafrost areas
- Avoid cuts in areas of permafrost
- Limit removal of trees, for line of sight only
- Check the thaw stability of ice-rich permafrost areas
- Consider increasing embankment cross-section height and flatten side slopes in areas of permafrost to improve stability of the embankment
- Incorporate geosynthetic reinforcement into the embankment design to improve the stability of the embankment
- Install ground temperature cables (thermistor strings) at select locations and, in some areas, offset from the road alignment to monitor ground temperatures and check for seasonal versus perennially frozen ground
- Visually monitor embankments during construction and during highway operations so that no physical or thermal erosion, ground settlement, and embankment instability issues result from degradation of permafrost or other causes

11 Reporting

An annual report of all permafrost monitoring activities will be prepared for the period of construction. Reports will provide results of permafrost monitoring activities, indicate if any issues were identified, and describe corrective actions to address these issues. The reports will also provide updates on relevant permafrost monitoring work being carried out in the project.

An annual review of the PPP will also occur so that relevant updates can be made, and the document can be updated as new information is collected. This is consistent with the Adaptive Management framework approach.

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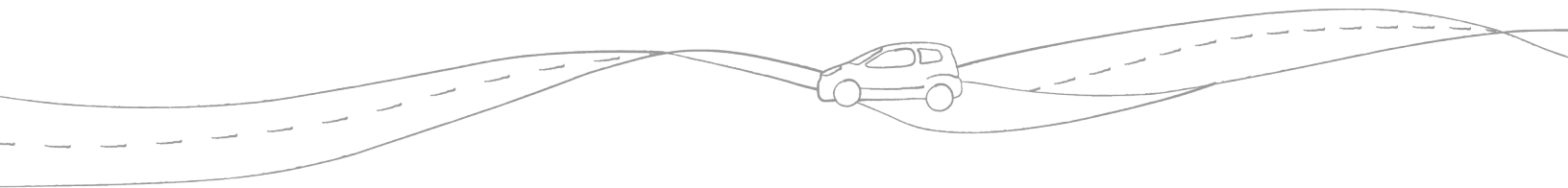
Appendix A –Permafrost Mitigation Measures

Table A.1 Potential Effects, Applicable Activities and Mitigation Measures

Potential Effect	Applicable Activities	Mitigation Measures
Vehicle use leading to potential permafrost thaw	<ul style="list-style-type: none"> • Mobilizing and demobilizing construction equipment to and from work sites • Site preparation (ROW) • Road construction • Construction of watercourse crossing and drainage structures • Quarry operations • Temporary workspaces and laydowns 	<ul style="list-style-type: none"> • Travel of vehicles will be confined to existing roads, constructed embankment, and winter roads as much as possible to avoid disturbing vegetated areas. • Travel on steep slopes will be avoided. • Off-road travel will be limited to winter (December 15 to March 31), where possible. • During spring, summer, and fall, suitable ground equipment will be used to prevent effect on sensitive terrain. • Off-road travel on highly saturated soil will be avoided, where possible. • A minimum of 10 centimetres (cm) of packed snow will be maintained on all off-road travel surfaces. • Conduct construction activities during dry or frozen conditions, or use rig mats to reduce soil compaction, rutting, and erosion
Site clearing leading to potential permafrost thaw	<ul style="list-style-type: none"> • Site preparation (ROW) • Quarry operations • Temporary workspaces and laydowns 	<ul style="list-style-type: none"> • Leave organic topsoil and in place—no removal of the organic protective layer during the construction of the road. Vegetation naturally insulates the thermal layer to limit permafrost degradation and protect the soils from erosive factors of water. • Clearing will be completed by hand, where required, to prevent damage to the ground. • During susceptible seasons (spring, summer, fall), suitable ground equipment will be used to prevent effect on sensitive terrain. • Where possible, windrowed material will be mulched and spread over cleared areas within the Project footprint to protect the soil and permafrost. • If surface organic material must be removed for construction, it will be stockpiled and re-applied after works are completed.
Potential permafrost thaw resulting from excavations	<ul style="list-style-type: none"> • Road construction • Construction of watercourse crossing and drainage structures • Quarry operations • Temporary workspaces and laydowns 	<ul style="list-style-type: none"> • If ice-rich permafrost is identified during quarry activities, suitable measures will be taken to protect permafrost and ground ice encountered during material extraction activities, as per the Project Quarry Development Plan. • Cover any permafrost soils or materials that are susceptible to physical erosion so that there is no unintended permafrost degradation • Culvert design will include requirements for bedding materials and geotextile to protect surrounding permafrost from thaw. Rip rap will be incorporated into culvert design to avoid erosion around each culvert. • Excavations and developed borrow sources will be visually monitored throughout the summer and fall to verify that there is no physical erosion resulting from the degradation of permafrost.
Potential permafrost thaw resulting from construction related activities	<ul style="list-style-type: none"> • Road construction • Construction of watercourse crossing and drainage structures 	<ul style="list-style-type: none"> • Construction of new embankment will occur primarily during winter (December 15 to April 1), during frozen conditions. If work will be completed under non-frozen conditions, equipment will be equipped with mushroom shoes to prevent effects on terrain. • Construction equipment will be operated on designated winter roads or constructed embankment. • Surface disturbance to undisturbed terrain will be limited as much as possible. Project work will be confined to the Project footprint located within the pre-existing winter road alignment. • A minimum depth of 10 cm of packed snow or ice cover will be maintained on off-road travel surfaces. • A fill-only construction approach will be used, except at specific locations of road cuts. • Where cutting of the subgrade is required per design (for example, at road cuts), erosion and sedimentation control measures will be implemented (per GNWT, 2013). • The placement of material will follow design specifications for material type, including maximum ice content. • Construction will be avoided on highly saturated soil (primarily during freshet) where practical or suitable ground equipment will be used to prevent unnecessary soil damage. • Steep grades where subsidence may occur as a result of permafrost thaw will be avoided, where possible. • Thermal regimes of the embankment and the alignment should be monitored using ground temperature cables (thermistor strings). • Area of ground disturbance will be limited by following the pre-existing winter road alignment.

Potential Effect	Applicable Activities	Mitigation Measures
Camp operations leading potential permafrost thaw	<ul style="list-style-type: none"> • Camp construction and operations 	<ul style="list-style-type: none"> • Surface disturbance to undisturbed terrain will be limited as much as possible. Project work will be confined to the Project footprint located within the pre-existing winter road alignment. • Avoid locating camps on areas of ice-rich ground • Elevate camp buildings and tanks, where needed, to protect permafrost • Accumulated snow drifts may be plowed or flattened to reduce the potential long-term effects on permafrost.
Potential permafrost thaw resulting from changes to the drainage pattern, erosion and/or ponding	<ul style="list-style-type: none"> • Mobilizing and demobilizing construction equipment to and from work sites • Site preparation (ROW) • Road construction • Construction of watercourse crossing and drainage structures • Road operations and maintenance • Quarry operations • Temporary workspaces and laydowns 	<ul style="list-style-type: none"> • Use effective road design measures, including stabilizing slopes and culvert installation • Limit the area of ground disturbance to the Project footprint, where possible • Provide sufficient cross drains along the roadway to facilitate water movement and maintain drainage patterns • Borrow pit floors will be sloped to reduce ponding of water. • Erosion and drainage patterns will be observed and documented in support of the ESCP. The number of cross drains and locations will be increased, if required, and will provide remedial erosion protection. • During construction, when it is not possible or practical to provide organic surface cover for all disturbed areas, use runoff control methods to protect permafrost soils, including: <ul style="list-style-type: none"> – the diversion of water entering the site – the modification of slope surfaces – the reduction of slope gradients – controlling flow velocity – providing adequate or increased drainage – diverting flows away from exposed soil areas for mitigating permafrost degradation • Install culverts as per design and as informed by the findings of the hydrology assessment and observe performance during construction. Drainage culverts will be installed according to specifications to facilitate water movement and maintain drainage patterns. • Remove blockages from culverts to maintain flow and fish passage • Design for culverts will include requirements for bedding materials and geotextile to protect surrounding permafrost from thaw. Rip rap will be incorporated into culvert design to avoid erosion around each culvert. • Modify the location or number of drainage culverts in consultation with the Engineer, as based on observed site conditions. • There shall be no grading of stream banks at approaches. • Refer to the drainage and erosion control guidelines outlined in the Project’s ESC, and follow guidelines outlined in the Northern Land Use Guidelines – Access: Roads and Trails (GNWT, 2015a), Pits and Quarries (GNWT, 2015b), and the Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions (TAC, 2010).
Potential permafrost thaw resulting from snow accumulation along sides of road embankment	<ul style="list-style-type: none"> • Road construction • Construction of watercourse crossing and drainage structures 	<ul style="list-style-type: none"> • Accumulated snow drifts may be plowed or flattened to reduce the potential long-term effects on permafrost. • Snow removal, if required, will be focused on the lee side of higher sections and where snow tends to drift. • In areas where snow drifting becomes a reoccurring issue, the below strategies may be implemented to reduce drifting and accumulation: <ul style="list-style-type: none"> – Snow fencing can be installed upwind of road embankments to keep snow drifts off the road surface and away from drainage ditches. – Additional embankment material can be added along side slopes to decrease the slope gradient.

Potential Effect	Applicable Activities	Mitigation Measures
Potential permafrost thaw resulting from natural conditions (forest fires, climate change) or from modified drainage along the roadway	<ul style="list-style-type: none"> • Mobilizing and demobilizing construction equipment to and from work sites • Site preparation (ROW) • Road construction • Construction of watercourse crossing and drainage structures • Quarry operations • Temporary workspaces and laydowns 	<ul style="list-style-type: none"> • Disturbance of the active layer during construction and maintenance activities will be limited. • Areas, such as forest fire areas, where permafrost thaw may be accelerated in the future, will be identified and monitored.



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT QUARRY DEVELOPMENT PLAN FRAMEWORK

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Appendix A	Geotechnical Report
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Abbreviations

ARD	acid rock drainage
DFO	Fisheries and Oceans Canada
ECC	Environment and Climate Change
GNWT	Government of the Northwest Territories
INF	Department of Infrastructure
kg	kilogram
km	kilometre
m	metre
ML	metal leaching
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	<i>Mackenzie Valley Resource Management Act</i>
the Project	Mackenzie Valley Highway Project
QDP	Quarry Development Plan
ROW	right-of-way
SCP	Spill Contingency Plan
SLWB	Sahtu Land and Water Board

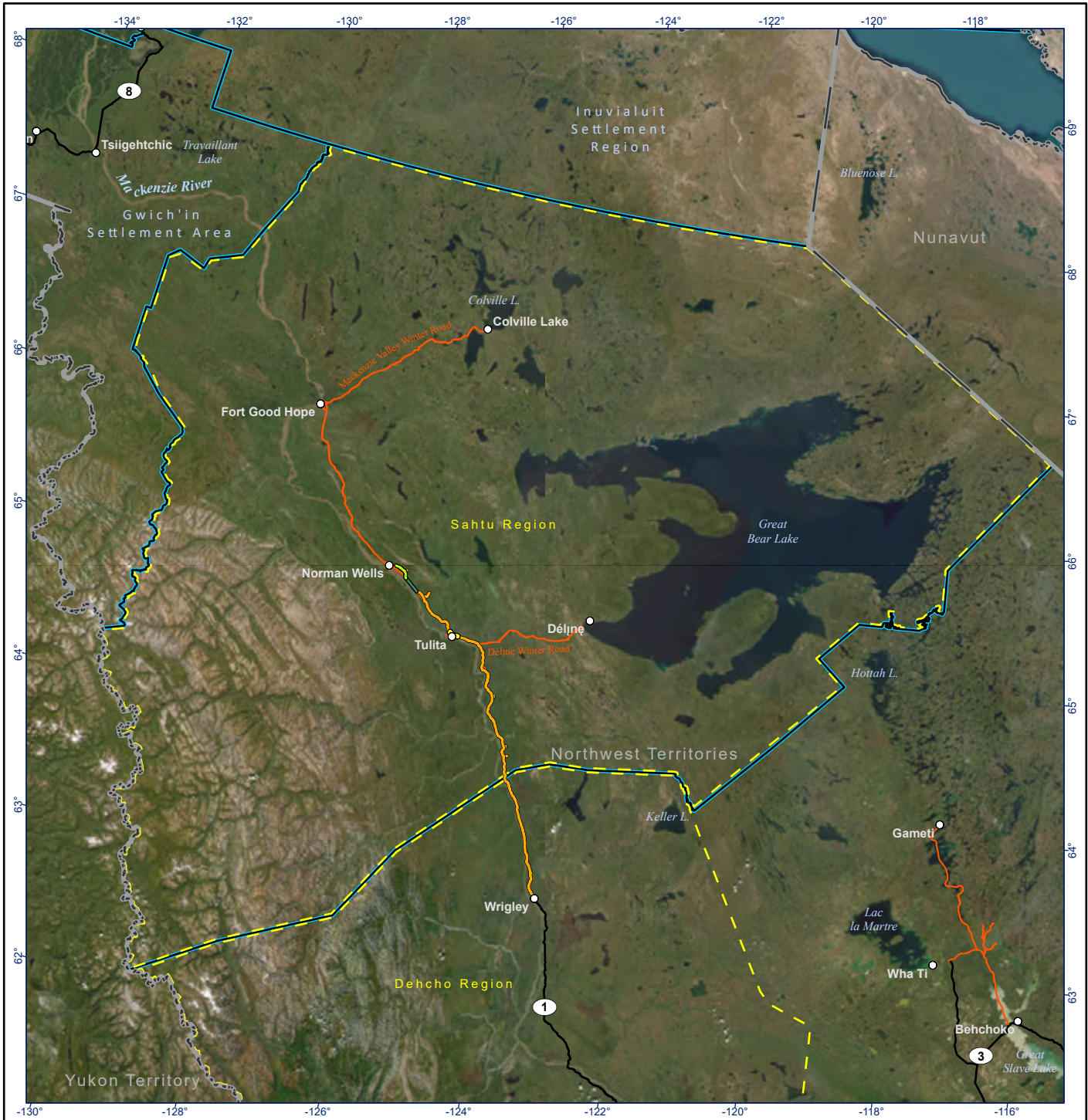
1 Introduction

This Quarry Development Plan (QDP) for Source XXX [insert number] has been developed to support the proposed construction, operation, and reclamation of quarry and borrow sources associated with the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is located in the Sahtu and Dehcho regions of the Northwest Territories. It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells, and includes the development of quarry and borrow sources. The QDP was developed in accordance with applicable guidelines and best practices in the Northwest Territories and is one of several plans developed for the construction and operations and maintenance phases of the Project. This QDP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Quarry Permit(s), Land Use Permit(s), and Water Licence(s) when issued to the GNWT.

This QDP is a draft framework and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not intended to support applications to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board. Each quarry/borrow source will require its own QDP.

The primary goal of this QDP is to prevent or mitigate potential effects of quarry operations. It has been developed based on the GNWT's *Northern Land Use Guidelines - Pits and Quarries* (GNWT, 2015a). The QDP will become effective upon commencement of project construction.

The QDP will be reviewed and updated with feedback from the environmental assessment process. Revisions will also be performed, as needed, to adapt and incorporate any changes related to environmental factors, pertinent project-specific changes during construction (e.g., site conditions and design modifications), the GNWT Department of Infrastructure (INF) and contractor practices, experiences, and policies, and include results from ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, including regulatory agencies.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
- Community
- Northwest Territories Highway
- Winter Road
- Settlement Area Boundary
- Region Boundary
- Territorial Boundary

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 1:4,500,000



Project Location Prepared by DS on 8/4/2023
 Wrigley to Norman Wells, NWT TR by EB on 8/4/2023

Client/Project 144903025-0172 REV/B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.

1.1

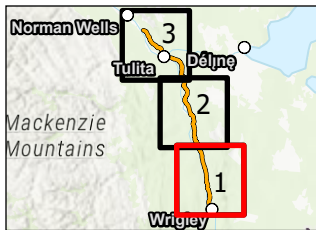
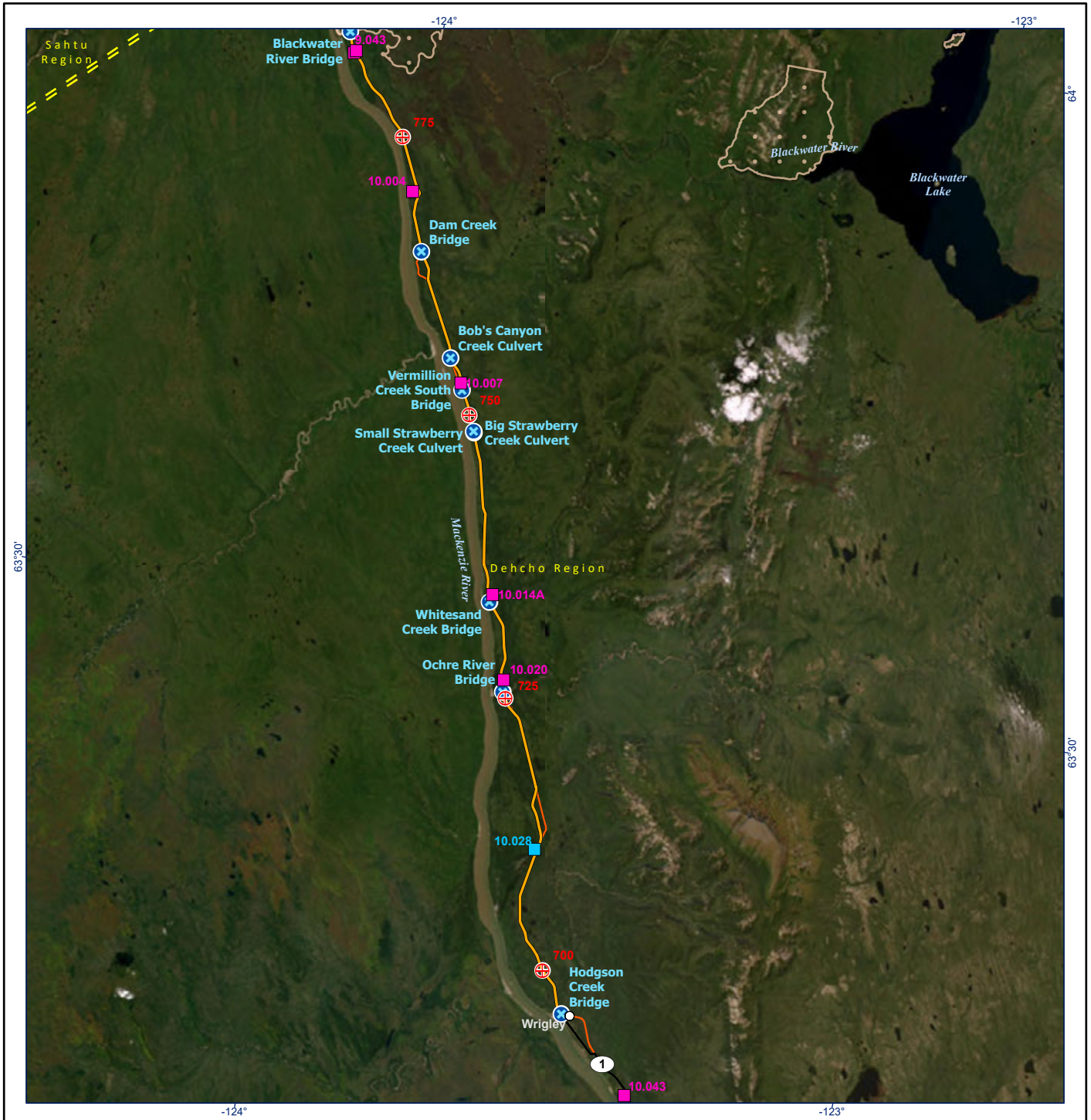
Title

Project Overview

Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2020

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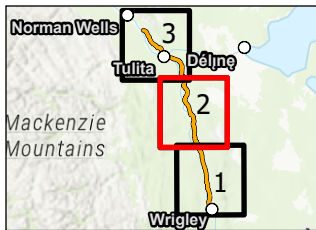
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 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Kálo-Stantec 2022, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd.
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2021

- Proposed Mackenzie Valley Highway Kilometre Marker (Approximate)
- Existing or Planned Bridge Crossing (Not in Scope of Project)
- Proposed Mackenzie Valley Highway Project Route
- Proposed Bear Rock Alignment Option
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge Project (Not in Scope of Project)
- Proposed Borrow Source
- Proposed Rock Quarry Source
- Proposed Borrow Access
- Proposed Rock Quarry Access
- Community
- Northwest Territories Highway
- Mackenzie Valley Winter Road (Not in Scope of Project)
- Region Boundary
- Sahtu Land

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 (At original document size of 8.5x11)
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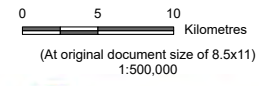
Project Location Wrigley to Norman Wells, NWT
Client/Project Government of the Northwest Territories Mackenzie Valley Highway Project
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023
 144903025-0179 REVA

Figure No. 1.2.1
Title Mackenzie Valley Highway Project - Overview
 Page 1 of 3



Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
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- Proposed Rock Quarry Access
- Community
- Northwest Territories Highway
- Mackenzie Valley Winter Road (Not in Scope of Project)
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Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

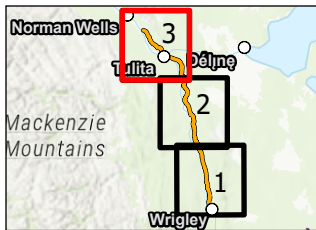
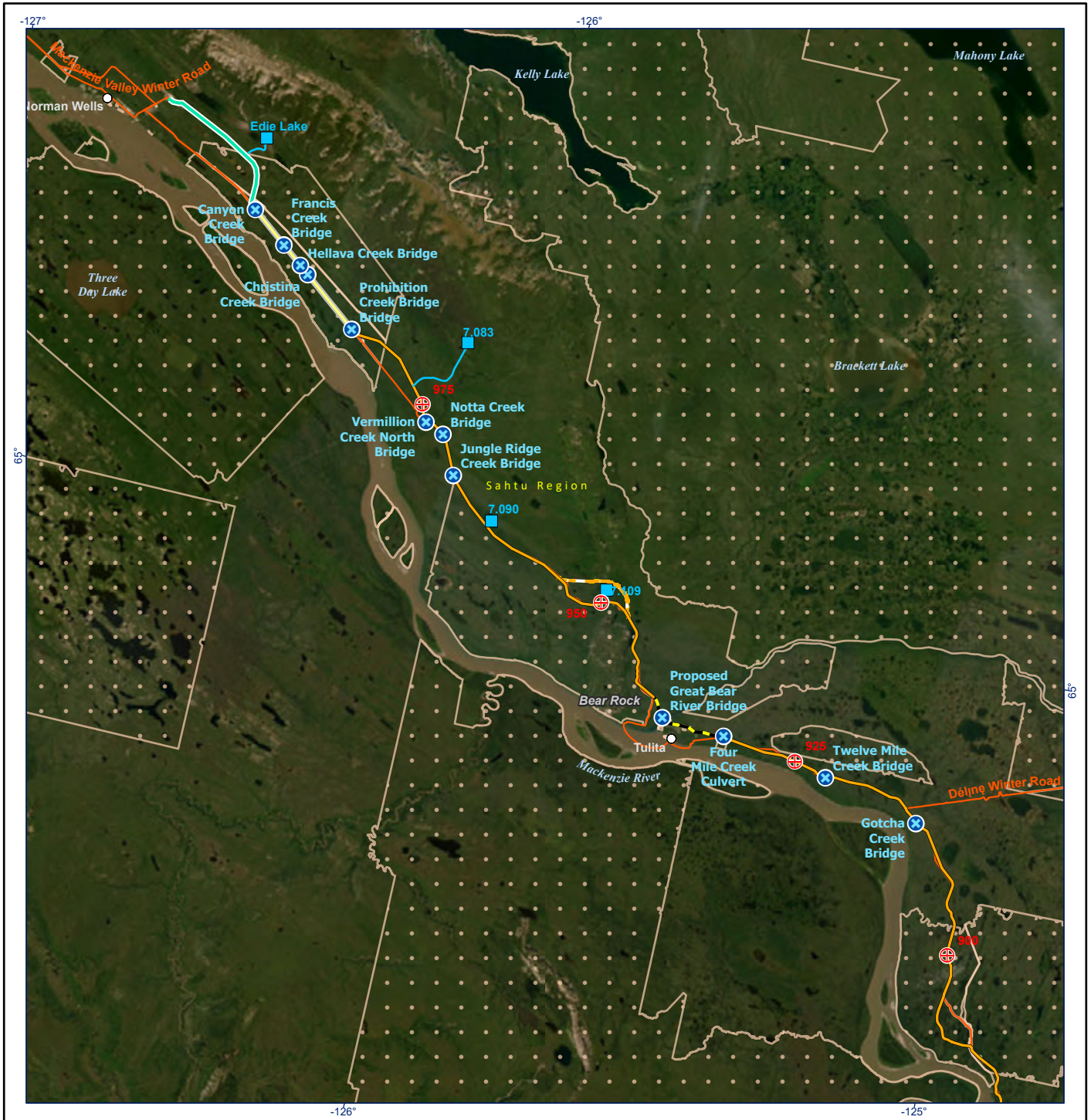
Client/Project: 144903025-0179 REVA

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No.
1.2.2

Title
Mackenzie Valley Highway Project - Overview

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Notes

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3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
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Project Location Wrigley to Norman Wells, NWT
Client/Project Government of the Northwest Territories
Mackenzie Valley Highway Project

Prepared by DS on 8/4/2023
TR by EB on 8/4/2023

144903025-0179 REVA

Figure No.
1.2.3

Title
Mackenzie Valley Highway Project - Overview

Page 3 of 3

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1.1 Project Contacts

In the event of a spill, inquiries about spills, spill management, and this plan, key contacts include:

Primary GNWT-INF Dehcho contact:

[Insert Name]
Regional superintendent, Dehcho Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary GNWT-INF Sahtu contact:

[Insert Name]
Regional superintendent, Sahtu Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary [Contractor] contact:

[Insert Name]
[Title]
[Company name]
[mailing address]
[Phone]
[Fax]
[Email]

1.2 Roles and Responsibilities

The contractor [to be] selected by the GNWT-INF to construct the Project is responsible for implementing the QDP and complying with all permits and licences issued to the GNWT. Roles and responsibilities are outlined in Table 1.1.

Table 1.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this QDP under the direction of the Contractor Supervisor • Continue implementing the QDP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this QDP and related plans are available onsite at all times • Verify that the measures in the QDP are adequately applied • Liaise with GNWT Lands Inspector, GNWT Water Resources Officer and Engineer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and worksite inspection activities • Report issues or deviations to the QDP to GNWT Project contacts and the Contract Supervisor • Oversee completion of the Project • Support the Contractor Supervisor, as required
Department of Infrastructure, Government of the Northwest Territories (GNWT INF)	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with GNWT Lands Inspector, GNWT Water Resources Officer, government agencies, and public and Indigenous Governments and Indigenous Organizations (as required) • Confirm all spill reports and clean up are completed as required by authorizations

1.3 Distribution List

The QDP [will be] distributed to the following key Project contacts and regulators:

- Project Contactor and Personnel: Contractor Supervisor, Contractor Project Manager, Contractor Camp Manager, Contractor Lead Hands
- Water Resources Officer, Government of the Northwest Territories - Environment and Climate Change (GNWT-ECC)
- Inspector, GNWT-ECC
- Water Management and Monitoring Division (GNWT-ECC)
- GNWT Public Relations (ECC, INF)
- Environmental Protection, Environment Canada
- Area Manager, Fisheries and Oceans Canada (DFO)
- Environmental Protection and Waste Management Division, GNWT
- Mackenzie Valley Land and Water Board
- Sahtu Land and Water Board
- Norman Wells Renewable Resources Council
- Tulita Renewable Resources Council
- Tulita District Land Corporation
- Applicable GNWT-INF employees

1.4 Legislation, Guidelines and Policy

This plan has been developed in consideration of the applicable legislation and guidelines, including:

- *Fisheries Act* and Regulations (1985, as amended 2019)
- Northern Land Use Guidelines - Pits and Quarries (GNWT, 2015a)
- Northern Land Use Guidelines – Access Roads and Trails (GNWT, 2015b)
- Northwest Territories *Water Act* and Regulations (2014)

1.5 Regulatory Approvals

[Describe the regulatory authorizations needed to develop and operate the quarry / borrow source based on its location and land ownership.]

2 Description of the Borrow Pit / Quarry

2.1 Geotechnical Report

[Reference and summarize investigations completed to delineate and prove the source material quality and volume.] This may include:

- Test hole locations and methods
- Summary of results
- Material properties
- Depth of overburden
- Groundwater
- Ground ice content

2.2 Acid Rock Drainage and Metal Leaching Potential Assessment

[Reference and summarize investigations completed to characterize acid rock drainage/metal leaching (ARD/ML) potential using applicable guidance.]

- *[List all mitigation measures applicable to this section]*

3 Site Conditions

To be completed based on site-specific investigations.

- Surface water
- Archaeological resources
- Vegetation and rare plants
- Wildlife and wildlife habitat, including species at risk
- Terrain and permafrost
- Traditional and local land use

4 Site Preparation

This section will describe:

- Site access and timing
- Vegetation clearing
- Salvage and storage of organics and overburden
- Topographic survey

[List all mitigation measures applicable to this section]

5 Pit / Quarry Operation

This section will describe:

- Development sequence and progression with pit layout
- Methods of blasting and/or excavation
- Progressive reclamation
- Processing, crushing, and stockpiling

[List all mitigation measures applicable to this section]

6 Closure and Reclamation

6.1 Desired Future Condition of Site

Describe based on guidance and community input

- *[List all commitments applicable to this section]*

6.2 Environmental Protection

Describe mitigation measures to prevent ponding, erosion, permafrost degradation, etc.

- *[List all commitments applicable to this section]*

6.3 Habitat Restoration

Describe mitigation measures for: revegetation, aesthetics

- *[List all commitments applicable to this section]*

6.4 Public Safety

Describe mitigation measures to mitigate safety risk to the public

- *[List all commitments applicable to this section]*

6.5 Access Roads

Describe plans and mitigation measures to close and reclaim the access road.

- *[List all commitments applicable to this section]*

7 Monitoring and Reporting

Describe monitoring and reporting requirements, including:

- Survey and quantities
- Water quality
- Progressive reclamation
- As-build survey and report
- Ongoing monitoring (if any) being undertaken

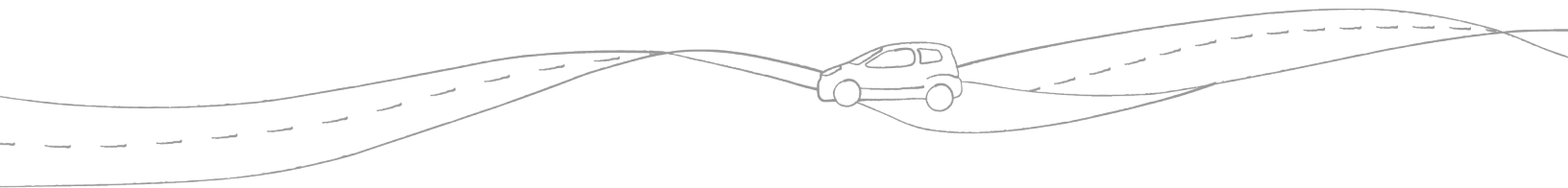
8 References

GNWT (Government of Northwest Territories). 2015a. Northern Land Use Guidelines: Pits and Quarries. GNWT. Yellowknife, NT. Available at:
[https://www.lands.gov.nt.ca/sites/lands/files/resources/nlug - pits and quarries -
16 september 2015.pdf](https://www.lands.gov.nt.ca/sites/lands/files/resources/nlug-_pits_and_quarries_-_16_september_2015.pdf). Accessed August 2020.

GNWT. 2015b. Northern Land Use Guidelines: Roads and Trails. GNWT. Yellowknife, NT.
Available at:
[https://www.lands.gov.nt.ca/sites/lands/files/resources/nlug_roadstrails_2015_english_1
6 sept 2015.pdf](https://www.lands.gov.nt.ca/sites/lands/files/resources/nlug_roadstrails_2015_english_16_sept_2015.pdf). Accessed August 2021.

Appendix A – Geotechnical Report

[Placeholder – to be provided by Contractor prior to construction]



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT SPILL CONTINGENCY PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

GNWT	Government of the Northwest Territories
GNWT-ECC	Government of the Northwest Territories - Environment and Climate Change
GPS	global positioning system
INF	Department of Infrastructure
kg	kilogram
km	kilometre
L	litres
lb	pound
m	metre
MSDS	material safety data sheet
the Project	Mackenzie Valley Highway, the Project
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	<i>Mackenzie Valley Resource Management Act</i>
NWT	Northwest Territories
PPE	personal protective equipment
ROW	right-of-way
SCP	Spill Contingency Plan
SLWB	Sahtu Land and Water Board

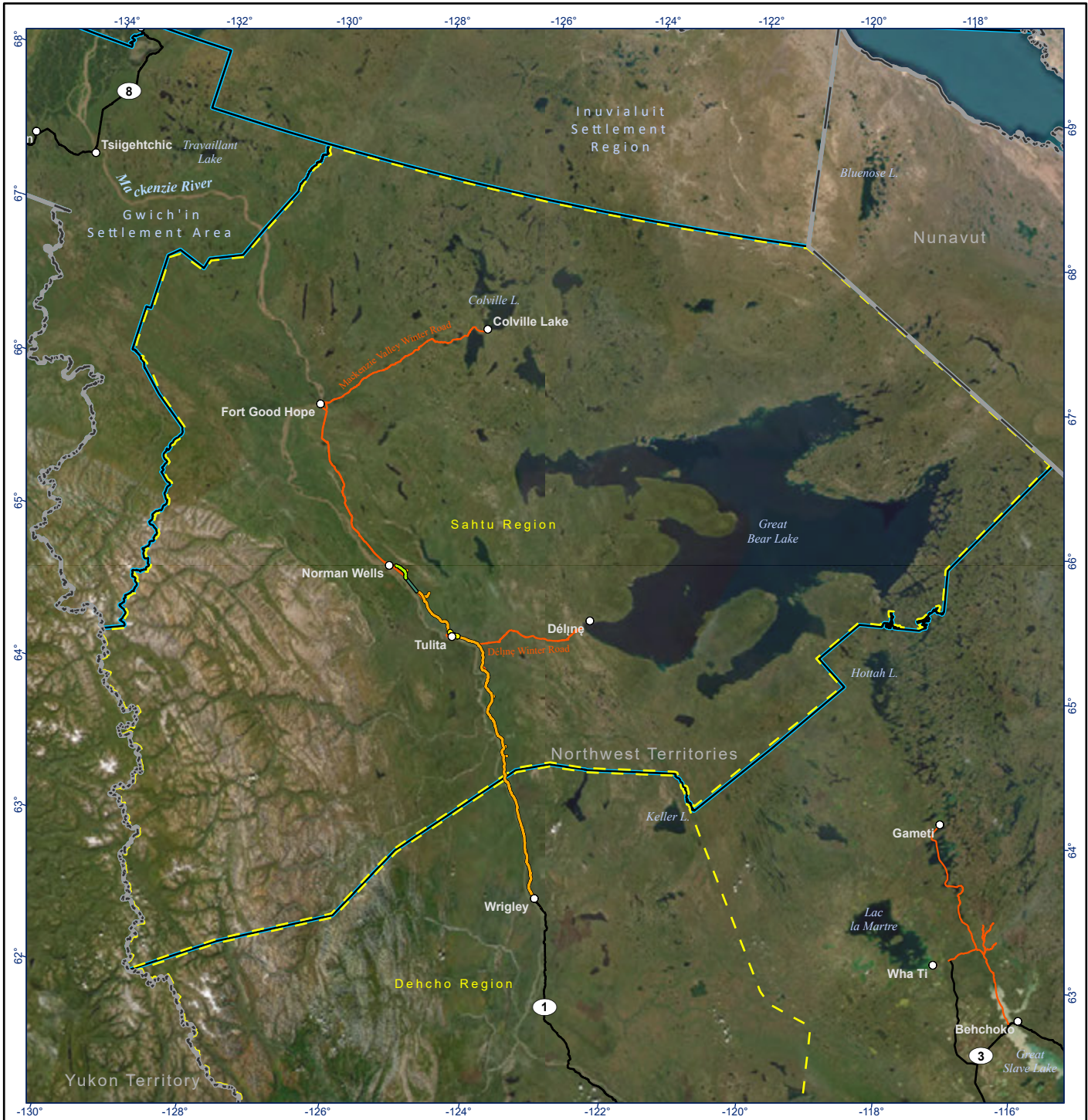
1 Introduction

This Spill Contingency Plan (SCP) has been developed to support the construction and operations and maintenance of the Mackenzie Valley Highway Project (the Project) by the Government of the Northwest Territories (GNWT). The Project is located in the Sahtu and Dehcho regions of the Northwest Territories (NWT). It extends the all-season highway between Wrigley, Tulita, and 28 kilometres (km) southeast of Norman Wells and includes the development of quarry and borrow sources (Figure 1.1). The SCP was developed in accordance with applicable guidelines and best practices in the NWT and is one of several plans developed for the construction and operations and maintenance phases of the Project. This SCP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the GNWT. **This SCP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not intended to support applications to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.**

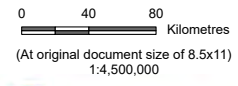
The primary goal of this SCP is to prevent or mitigate potential effects of unauthorized releases (spills) and to present project personnel with the appropriate action response should a spill occur. This SCP accompanies and complements the construction Emergency Response Plan. Major spill-related emergencies will be handled by an emergency response team. A similar approach to communications, training, and messaging around spill contingency aligns with the Emergency Response Plan principles.

This version of this plan was developed based on the Guidelines for Spill Contingency Planning prepared by Indian and Northern Affairs Canada (INAC, 2007) and the Spill Contingency Planning and Reporting Regulations issued under the *Environmental Protection Act*. The SCP and future revisions will be submitted to the Mackenzie Valley and the Sahtu Land and Water Boards in accordance with the Project Water Licenses and Land-Use Permits. Following approval of the SCP by regulatory agencies, the SCP will become effective upon commencement of project construction.

The SCP will be reviewed and updated with feedback from the environmental assessment process. Revisions will also be performed as needed to adapt and incorporate any changes related to environmental factors, pertinent project-specific changes during construction (e.g., site conditions and design modifications), and the GNWT Department of Infrastructure (INF) and contractor practices, experiences, and policies, and will include results from ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties, including regulatory agencies.



- Proposed Mackenzie Valley Highway Project Route
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Great Bear River Bridge Project (Proposed)
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Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0172 REV/B

Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. **1.1**
 Title

Project Overview

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: Centre for Geomatics Government of NWT, Government of Canada, Stantec
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
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1.1 Purpose and Approach

This SCP provides methods, strategies, and actions aimed at mitigating effects on the environment due to spills from project activities. This plan also describes a response approach with an emphasis on state of readiness, which will enable prompt and effective response to possible spill events.

The purpose of this plan is to establish and implement direction for preventing, responding to, and reporting on spills. This plan identifies key information for project personnel such as response organization, action planning, resource inventory, and training. The SCP also identifies potential effects and mitigation measures using best practices adapted from legislation, policies, guidelines, and professional judgement, to avoid or reduce spill-related effects. The SCP describes how the Project:

- Meets relevant authorization terms and conditions, relevant standards, control plans, and procedures for training, communications, investigation, and corrective actions
- Meets commitments made during the environmental assessment or subsequent regulatory review processes

1.2 Project Contacts

In the event of a spill or inquiries about spills, spill management, and this plan, the following key contacts include:

Primary GNWT-INF Dehcho contact:

[Insert Name]
Regional superintendent, Dehcho Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary GNWT-INF Sahtu contact:

[Insert Name]
Regional superintendent, Sahtu Region
Department of Infrastructure
Government of the Northwest Territories
[mailing address]
[Phone]
[Fax]
[Email]

Primary [Contractor] contact:

[Insert Name]
[Title]
[Company name]
[mailing address]
[Phone]
[Fax]
[Email]

1.3 Roles and Responsibilities

The contractor [to be] selected by the GNWT-INF to construct the Project is responsible for implementing the SCP and complying with all permits and licences issued to the GNWT. Roles and responsibilities are outlined in Table 1.1.

Table 1.1 Roles and Responsibilities

Entity	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this SCP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Continue implementing the SCP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this SCP is available on site at all times • Report and document spills to the NWT Spill Line and Inspector • Verify that personnel are trained and competent in the SCP's application • Verify that the measures in the SCP are adequately applied • Verify that spill response supplies and inventory are maintained • Coordinate mitigative and remedial measures, where required • Conduct regular worksite inspections • Coordinate additional equipment and/or workforce (if necessary) • Liaise with the GNWT Lands Inspector, the GNWT Water Resources Officer and Engineer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and worksite inspection or spill response activities • Report spill incidents to the GNWT Project contacts and the Contract Supervisor • Oversee completion of the Project • Support the Contractor Supervisor, as required
Department of Infrastructure, Government of the Northwest Territories (GNWT-INF)	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with the GNWT Lands Inspector, the GNWT Water Resources Officer, government agencies, and public and Indigenous Governments and Indigenous Organizations (as required) • Confirm all spill reports and clean up are completed, as required by authorizations

1.4 Distribution List

The SCP [will be] distributed to the following key project contacts and regulators:

- Project Contactor and Personnel: Contractor Supervisor, Contractor Project Manager, Contractor Camp Manager, Contractor Lead Hands
- Inspector, GNWT Lands
- Water Resources Officer, Government of the Northwest Territories - Environment and Climate Change (GNWT-ECC)
- Water Management and Monitoring Division (GNWT-ECC)
- GNWT Public Relations (ECC, INF)
- Environmental Protection, Environment Canada
- Area Manager, Fisheries and Oceans Canada
- Environmental Protection and Waste Management Division, GNWT
- Mackenzie Valley Land and Water Board
- Sahtu Land and Water Board
- Norman Wells Renewable Resources Council
- Tulita Renewable Resources Council
- Tulita District Land Corporation
- Applicable GNWT-INF employees

Key regulatory agencies to contact in the event of a spill include:

Regulatory Agency	Contact
NWT Spill Line	(867) 920-8130
Workers' Safety and Compensation Commission – 24 Hour Incident Reporting Line	1-800-661-0792
Department of Lands, GNWT (Inspector)	[TBC]
Environment and Natural Resources, GNWT (Water Resource officer)	[TBC]
Sahtu Land and Water Board	(867) 598-2413
Mackenzie Valley Land and Water Board	(867) 669-0506
Fisheries and Oceans Canada	1-866-290-3731
Environment and Climate Change Canada	(780) 951-8600

1.5 Legislation, Guidelines and Policy

This plan has been developed in consideration of the applicable legislation and guidelines, including:

- *Fisheries Act* and Regulations (1985, as amended 2019)
- *Transportation of Dangerous Goods Act* and Regulations (1992)
- Northwest Territories *Environmental Protection Act* and regulations (including the Spill Contingency Planning and Reporting Regulations) (1998)
- *Mackenzie Valley Resource Management Act* (MVRMA, 1998) and Land-Use Regulations
- Northwest Territories *Water Act* and Regulations (2014)
- Guidelines for Spill Contingency Planning (INAC, 2007)
- Guideline for Hazardous Waste Management (GNWT-ENR, 2017)

1.6 Training

All project personnel will receive training on the purpose and procedures provided in this SCP.

All personnel will receive training in safe work procedures related to handling of petroleum products and refueling equipment.

2 Project Description and Activities

The Project occurs in the Dehcho and Sahtu regions under the regulatory authorities of the Mackenzie Valley Land and Water Board (MVLWB) and the Sahtu Land and Water Board (SLWB) given power and effect by the MVRMA. Development of the Project will deliver 321 km of all-season road access in the areas of Norman Wells, Tulita, and Wrigley, to the east of the Mackenzie River (Deh Cho). The area is currently serviced by the Mackenzie Valley Winter Road. Construction of the Project will create approximately 281 km of new all-season gravel highway embankment and intermittent pullouts.

The Project is located within two distinct physiographic regions: the Mackenzie Plain and the Franklin Mountains. North of Tulita, the Highway is found within the Taiga Plains Ecozone. South of Tulita, the Highway lies within the Taiga Cordillera Ecozone. The area supports numerous wildlife, fish, and bird species.

The Project interacts with several communities with traditional use areas. Community members participate in hunting, trapping, fishing, berry picking, and other land-based activities. In addition to traditional land uses, the Sahtu Land Use Plan (SLUPB, 2023) also identifies several zones in the vicinity of Project such as conservation zones and special management zones, where traditional, cultural, or heritage sites are found.

The Project includes the following activities to which this plan applies:

- Mobilizing and demobilizing construction equipment to and from work sites
- Site preparation:
 - Clearing, stripping, and grubbing vegetation and organic material from the alignment right-of-way (ROW) and within proposed work areas
 - Construction of a winter travel lane(s)
- Road construction and maintenance:
 - Placing geotextile
 - Hauling and end-dumping embankment rock fill
 - Placing and compacting granular sub-base and base course
 - Snow clearing and grading
 - Construction of watercourse crossing and drainage structures
 - Temporary crossings
 - Excavation of watercourse base for culvert installation
 - Excavation of watercourse bank for apron and rip rap installation
 - Placement and backfill of culverts

- Apron and rip rap installation
- Beaver dam and/or beaver lodge removal
- Culvert clearing and maintenance
- Quarry operations:
 - Drilling
 - Excavation
 - Blasting
 - Crushing and stockpiling
 - Water management
- Temporary workspaces and laydowns:
 - Siting
 - Site clearing and grading
 - Site use and maintenance
 - Reclamation
- Camp accommodations and associated facilities
 - Camp operations

2.1 Potential Contaminants

Table 2.1 identifies hazardous materials that may be used or generated by the Project. Spills may result in accidents or malfunctions involving refueling, leaking storage drums or tanks, spills during material handling or transfer, leakages from containment, overflow of tanks, and human error. **The Project Contractor will update Table 2.1 when known materials, capacity, and container types can be confirmed prior to commencement of construction activities.**

Table 2.1 Type, Amount and Location of Main Hazardous Materials

Type of Material and Volume	Capacity of Containers (L)	Number	Containment Type	Storage Location (Appendix A)
Diesel Fuel			Double walled tank, secondary containment	Bulk fuel storage area
Gasoline			Double walled tank, secondary containment	Bulk fuel storage area
Propane			Tank	
Oil and Hydraulic Fluid			Tote tank, in secondary containment facility	
Sewage – Camp 1	20,000 L/Day		Insulated holding tank	Camp accommodation
Greywater – Camp 1			Insulated holding tank	
Sewage – Camp 2	20,000 L/Day		Insulated holding tank	Camp accommodation
Greywater – Camp 2			Insulated holding tank	
Compressed Gas (oxygen, acetylene)	100 lb		Tank	
Coolant			Tote tank, in secondary containment facility	
Waste Oil			Double walled tank	
Ammonium Nitrate				

2.2 Contaminant Pathways

For the duration of construction, heavy equipment and machinery will be required for construction activities. Equipment use and associated activities such as refueling and equipment maintenance increases potential for unintended leaks, breakages such as hydraulic hoses or fuel lines, and releases from fuel and oil storage containers. This can result in a release of contaminants with potential to affect aquatic, terrestrial, wildlife, or human components of the environment.

Camp operations include management of wastes such as solid waste and wastewater (greywater and sewage). A breakage in containment or improper handling procedures can lead to an unintended release of these wastes to the environment.

The development of road cuts and quarries and ongoing material processing include manufacture, transport, and storage of explosives; blasting; and management of pit water. An accidental release of explosives during storage or transport or the accidental release of pit water into a watercourse could have adverse effects on the environment.

2.3 Preventative Measures

The GNWT's priority is to implement policies and procedures that, as a first priority, reduce the likelihood of spills occurring, and secondly, reduce the magnitude of their consequences should a spill occur. Primary spill prevention measures include:

- Fuel and lubricants will be stored in containers with secondary containment capable of containing 110% of the largest container.
- Fuel-fired equipment such as generators and pumps will have secondary containment installed capable of containing fuel drips or leaks during operations and refueling.
- Drip trays are to be used for stationary equipment 24/7. Vehicles and heavy equipment parked for more than two hours require a drip tray.
- Sewage and greywater must be stored in approved holding tanks for this purpose prior to removal from site or disposed in accordance with the land use permit.
- Areas and containers used to store project wastes will be constructed, operated, and maintained in a manner to prevent waste from discharging to the surrounding environment.
- Fuel handling and refueling will be in accordance with an Operating Procedure.
- Onsite morning safety meetings will be held regularly to limit accidents and malfunctions in the field, and to review any incidents that have occurred for corrective actions.
- Machinery will be maintained and regularly inspected for fuel, oil, or other fluid leaks. Machinery found to be leaking will be withdrawn from service until repaired.
- Fuel storage areas will be checked daily for leaks and condition of containers. Damaged containers will be replaced and contents transferred to approved containers.

2.4 Reducing Potential Effects

While the priority should be to reduce the likelihood of spills occurring, specific measures can reduce the magnitude of the consequences should a spill occur by reducing the distance that the spill travels, the volume that is spilled, or facilitating the ability to respond to the spill should it occur. For example, spills of petroleum products on land may have less serious effects than a spill that reaches a fish-bearing watercourse.

Mitigation measures that reduce the effects on the environment, should a spill occur, are listed below:

- Material Safety Data Sheets (MSDS) for hazardous substances are to be always stored on site.
- Fuels and oils/lubricants must be stored more than 100 metres (m) from the ordinary high water mark bank of a watercourse or waterbody.

- Mobile equipment will be refueled more than 100 m away from the bank ordinary high water mark of a watercourse or waterbody.
- Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high water mark and in a manner to prevent any deleterious substances from entering the water.
- Machinery will not be left in any waterbody.
- Ponded water will be directed away from watercourses.
- Emergency spill response kits will be kept in vehicles and at fuel storage locations.
- All site personnel will receive SCP training and will have awareness of spill prevention.

3 Spill Response

In the event of a spill, it is important to respond quickly and effectively to reduce the consequences of the spill. Spill response includes organization, procedures, and training.

3.1 Organization

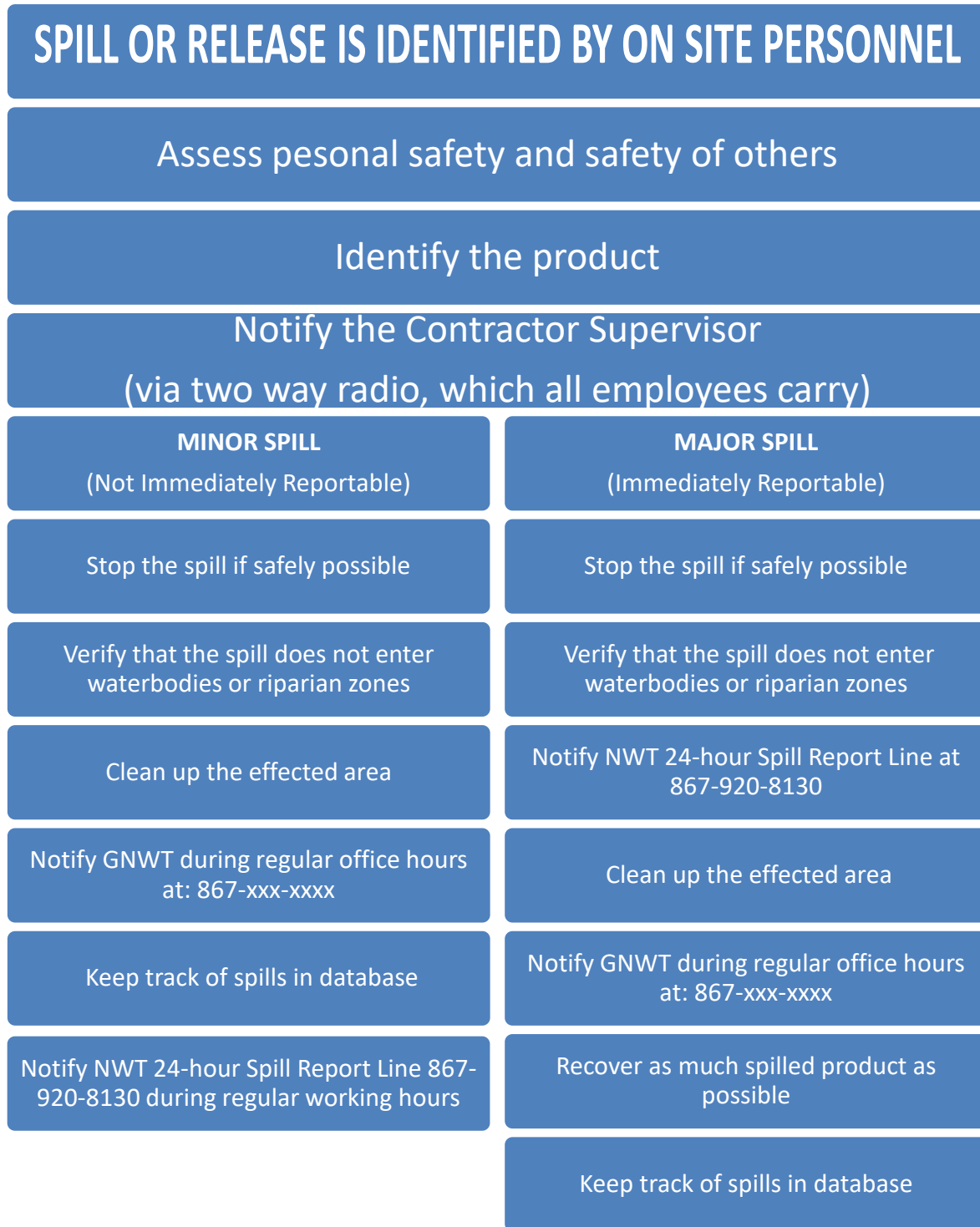
The contractor [is] responsible for preparing and implementing the SCP. When site personnel identify a spill, they will immediately contact the Contractor Supervisor or designate. The Contractor Supervisor will request or collect the necessary field information from site personnel to complete the NWT Spill Report form. A major spill is immediately reportable and is defined as a release of a substance that meets or surpasses the volumes outlined in Table 3.1. Minor spills will be tracked in the spills database, documented by the Contractor Supervisor, and submitted to the appropriate authority by request or during annual reporting. If a minor spill occurs, the reporting form will be kept onsite as a record.

The Contractor Supervisor will contact the NWT Spill Report Line, the Lands Inspector, the ECC Water Resource Officer, and the GNWT representative at the earliest or appropriate opportunity for major spills.

The flowchart provided in Figure 3.1 identifies the spill response organizational hierarchy, ordering key actions and communication contacts, in the event of an incident. Each aspect of the chart details a description of the duties required and other useful information.

The Project Contractor and all personnel involved on site will possess radio communication or satellite phones to verify timely responses notifications should a spill event occur or be encountered.

Figure 3.1 Spill Response Organizational Hierarchy (INAC, 2007)



3.2 Spill Response Procedures

Upon encountering a spill or release, the following actions will be taken by the first person and/or response team at the scene:

- Assess the risk to yourself, to others, to the environment, and to the property/project site. **Proceed only if it is safe to do so.**
- Communicate the spill to the Contractor Supervisor and anyone in the immediate area – be sure to inform on the substance, quantity, location, source/cause, and obvious safety or environmental danger (if possible, depending on scene conditions).
- Ask for assistance to assist with spill response, control (depending on the scene conditions).
- Protect yourself by putting on personal protective equipment (PPE) and check the MSDS for any hazards associated with the spilled substance. If unsure, wait until the Contractor Supervisor, designate, or help arrives.
- Stop the spill at the source from spilling further – this may mean turning off a tap, rolling a drum so that a puncture is facing upward, plugging a puncture, or decanting material into a secondary container. Confirm the quantity spilled.
- Contain the spread and reduce the area of contamination by using nearby spill kit materials such as absorbents, booms, or physical barriers.
- The Contractor Supervisor will report any major reportable spills to the NWT Spill Report Line at 867-920-8130. The Lands Inspector and the ECC Water Resources Officer will also be contacted. The GNWT project representative will be contacted at the earliest opportunity.
- Clean up the spill and any contaminated material (soil, snow, water). Contaminated material should be placed into drums at the waste storage area. Record the volume of contaminated material removed.
- Safely dispose of all contaminated PPE and spill control materials.
- Refill and seal spill kits and related supplies.
- The Contractor Supervisor will record the spill event details in the spill database and perform any follow up actions (i.e., confirmatory sampling), as required.
- The Contractor Supervisor will investigate, revise work procedures, and debrief with site personnel, with a focus on continual improvement to prevent future incidents.

3.3 Reportable Spills

In the NWT, immediately reportable spills are defined by the type of substance that is spilled and a trigger quantity. Should a spill meet the reportable quantities outlined in Table 3.1 or if the spill is suspected to cause considerable harm, the Contractor Supervisor must call the NWT Spill Line at: 1-867-920-8130. Spills exceeding quantities outlined in the table are immediately reportable and mandatory to report. All other spills are considered minor and are tracked in the project spills database to be reported on annually or when requested from the Inspector. Small, under-threshold spills should be reported during regular office hours.

Table 3.1 Reportable Spill Quantities in the NWT

Substance	Reportable Quantity
Explosives Compressed gas (toxic/corrosive) Infectious substances Sewage and Wastewater (unless otherwise authorized) Radioactive materials Unknown substance	Any amount
Compressed gas (Flammable) Compressed gas (Non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100 L
Flammable liquid (fuels)	≥ 100 L
Flammable solid Substances liable to spontaneous combustion Water reactant substances	≥ 25 kg
Oxidizing substances	≥ 50 L or 50 kg
Organic peroxides Environmentally hazardous substances intended for disposal	≥ 1 L or 1 kg
Toxic substances Corrosive substances	≥ 5 L or 5 kg
Corrosive substances Miscellaneous products, substances, or organisms	≥ 50 L or 50 kg-
Other contaminants--for example waste or spent chemicals, used or waste oil, vehicle fluids, wastewater.	≥ 100 L or 100 kg
Flammable liquid Vehicle fluid	≥ 20 L When released on a frozen water body that is being used as a working surface

Substance	Reportable Quantity
Reported releases or potential releases of any size that: <ul style="list-style-type: none"> • Are near or in an open waterbody; • Are near or in a designated sensitive environment or habitat; • Pose an imminent threat to human health or safety; or • Pose an imminent threat to a listed species at risk or its critical habitat 	Any amount

3.4 How to Report a Spill

Fill out the NWT Spill Report Form (Appendix B) before calling in the spill report. Once the information is collected, contact the 24-Hour NWT Spill Line at (867) 920-8130. Do not delay contacting the Spill Line if you do not have all form information on hand as this can be provided as a follow up. Alternatively, if email is available, email the completed Spill Report Form to spills@gov.nt.ca.

In the event of a spill, site personnel will need to quickly collect and communicate the following information to support formal reporting process:

1. Date and time of spill
2. Location of spill
3. Direction spill is moving
4. Name and phone number of a contact person close to the location of the spill
5. Type of contaminant spilled and quantity
6. Cause of spill
7. Whether spill is continuing or has stopped
8. Description of existing containment
9. Action taken to contain, recover, clean up, and dispose of spilled contaminant
10. Name, address, and phone number of person reporting the spill
11. Name of owner or person in charge of management or control of contaminants at the time of the spill

3.5 Hazardous Materials and Potential Discharge Events

Based on the anticipated hazardous materials to be used at the project site and volumes stored, Table 3.2 details possible worst-case spill events. The worst-case event is based on the material container capacity should the entire contents be released. The Project Contractor will provide updated material sources, volumes, and discharge direction for Table 3.2 once available, prior to commencement of construction activities.

Table 3.2 Project Hazardous Materials and Potential Discharge Event Volumes

Material (sources)	Potential Discharge Event	Discharge Volume (worse case)	Direction of Potential Discharge
Diesel	Valve malfunction		
Gasoline	Valve malfunction		
Propane	Valve malfunction		
Oil and Hydraulic Fluid	Tote puncture		
Sewage – Camp 1	Pipe breakage, tank overflow, valve malfunction		
Greywater – Camp 1	Pipe breakage, tank overflow, valve malfunction		
Sewage – Camp 2	Pipe breakage, tank overflow, valve malfunction		
Greywater – Camp 2	Pipe breakage, tank overflow, valve malfunction		
Compressed Gas (oxygen, acetylene)	Valve malfunction		
Coolant	Tote puncture		
Waste Oil	Valve malfunction		
Ammonium Nitrate	Bag breakage, emulsion truck valve malfunction, water runoff intercepting ammonium nitrate storage area		

3.6 Spill Response Equipment

Emergency spill kits will be maintained at the project site. The contractor will follow up with a spill kit location map update for this plan prior to commencement of construction activities. The following locations are anticipated to host dedicated spill kits:

- Camp kitchens
- Camp generators
- Fuel storage areas
- Designated refueling areas
- Hazardous waste storage area

Each kit contains the following items stored into a 55-gallon plastic drums:

- Tyvek® coveralls
- 10 pairs of disposable gloves
- 2 x 100 absorbent pad packs
- 1 x 20 kilogram (kg) granular absorbent bag
- 4 x 2" diameter floating absorbent booms
- 10 yellow storage bags
- One shovel

Each vehicle will be equipped with a spill kit, to include:

- [number required] pairs disposable gloves
- 20 absorbent pads
- 2 clear or yellow storage bags

Suitable communication equipment and all emergency numbers are to be available to all supervisory personnel.

3.7 Potential Discharge Events and Clean Up Guidelines

3.7.1 Spills on Land

Land spills can be contained and cleaned up by:

- Creating a soil berm down slope of leaking material. In winter a snow berm and impermeable liner may be used
- Placing impermeable material at the foot of and over top of the berm to allow pooling of leaked material
- Using appropriate absorbent material to soak up the fuel. It may also be used to transfer fuel into drums or pails for re-use of the pads. Larger quantities of fuel may be pumped into empty drums
- Using a light covering of absorbent material to remove films of petroleum products
- In winter, moving contaminated snow or ice into drums or onto impermeable material
- Transporting material to an approved disposal/recovery site

3.7.2 Spills on Snow

Snow spills can be contained and cleaned up by:

- Constructing a trench or ditch to channel and control the flow of spilled product
- Compacting any snow lying along the outside perimeter of the control ditch
- Constructing a snow dike or dam
- Using impermeable lining material to create an impervious barrier
- Locating the topographic lowest point of the spill area and create snow channels to direct unabsorbed material away from water courses
- Collecting the spilled material for disposal

3.7.3 Spills on Ice

Spills on ice can be contained and cleaned up by:

- Containing the spill using the methods mentioned above for snow
- Preventing spilled material from penetrating ice and entering water
- Removing any contaminated material quickly
- Using an auger to locate material that has seeped under ice, because containment is challenging if material gets under the ice
- Cutting slots with chain saws and remove blocks
- Using suction hose if available to clean up spill

3.7.4 Spills on Water

Spills on water can be contained and cleaned up by:

- Blocking the spill from entering into water using booms and absorbent pads, trenches, or other barriers (e.g., bridge drain plugs)
- Deploying booms, skimmers and sorbent pads if spilled material enters an open water body, to contain and recover the spill material, if feasible
- Removing minor spills with sorbent pads
- Pumping and disposing of contaminated water if a major spill in water occurs. Additional actions will be deployed as determined in discussion with regulatory authorities
- Cleaning up contaminated areas, including downstream shorelines (non-frozen conditions), in consultation with spill response specialists and the appropriate government agencies
- Auguring will be conducted if spilled materials enter a frozen water body through or under the ice to flowing or standing water, to determine the extent of the spill plume. If feasible, a vacuum truck will be brought to the site to skim off the contaminants. As well, the appropriate regulatory agencies will be contacted and a post-break-up monitoring and reclamation plan will be implemented to determine the extent of the effects of the spill on the water body and its banks.

3.7.5 Spot Spills

Spot Spills can be contained and cleaned up by:

- Cleaning up small spot spills (those below reportable quantities) immediately
- Excavating affected soil into an empty drum or lined container, and limiting the destruction of root zone
- Suspending activities in the immediate vicinity until the Site Foreman grants permission to resume
- Flagging and recording the global positioning system (GPS) coordinates of locations where spot spills have occurred by the person in charge of the spill. Flags will be removed once reporting is complete.
- Disposing of heavily contaminated soil and vegetation and/or removed contaminated materials at an approved waste facility

4 Follow up Reporting

For reportable spills (Section 3.3), a detailed follow up report is required to be provided within 30 days of the incident. The follow up report must include:

- Investigation of the root cause of the spill
- Additional cleanup or remedial actions completed
- Assessment of effects to the environment resulting from the spill
- Corrective actions taken to prevent or reduce the potential for recurrence
- Ongoing monitoring (if any) being undertaken

5 References

CIRNAC (Crown-Indigenous Relations and Northern Affairs Canada). 1998. Mackenzie Valley Land Use Regulations. Available at: <https://laws-lois.justice.gc.ca/eng/regulations/SOR-98-429/FullText.html>. Accessed June 2023.

GNWT-ENR (The Government of the Northwest Territories - Environment and Natural Resources). 2017. Guideline for Hazardous Waste Management. Available at: https://www.enr.gov.nt.ca/sites/enr/files/resources/128-hazardous_waste-interactive_web_0.pdf. Accessed June 2023.

INAC (Indian and Northern Affairs Canada). 2007. Guidelines for Spill Contingency Planning. Available at: https://www.gov.nt.ca/sites/ecc/files/guidelines_for_spill_contingency_planning_2007.pdf. Accessed June 2023.

SLUPB (Sahtú Land Use Planning Board). 2023. Sahtú Land Use Plan. Government of Northwest Territories. Fort Good Hope. Ratified but not available as of July 19, 2023; see <https://sahtulanduseplan.org/plan>.

Appendix A – Material Location Storage Map

[Placeholder – to be provided by Contractor prior to construction]

Appendix B – NWT Spill Report Form

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND
OTHER HAZARDOUS MATERIALS



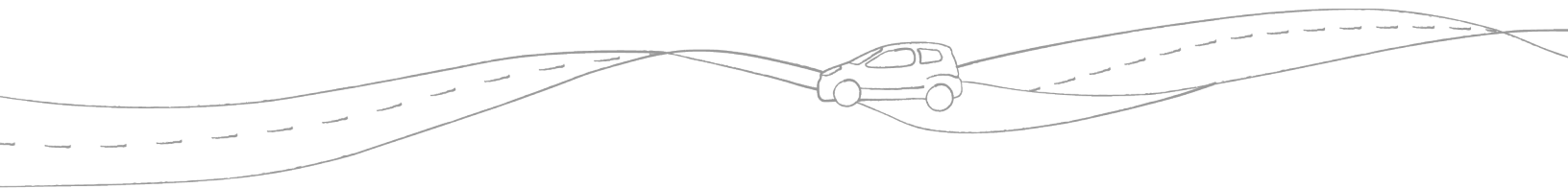
NT-NU 24-HOUR SPILL REPORT LINE
Tel: (867) 920-8130 • Email: spills@gov.nt.ca

REPORT LINE USE ONLY

A	Report Date:	MM	DD	YY	Report Time:	<input type="checkbox"/> Original Spill Report OR <input type="checkbox"/> Update # _____ to the Original Spill Report	Report Number:
	B	Occurrence Date:	MM	DD	YY		
C	Land Use Permit Number (if applicable):				Water Licence Number (if applicable):		
D	Geographic Place Name or Distance and Direction from the Named Location:					Region:	
E	Latitude:			Longitude:			
F	Responsible Party or Vessel Name:				Responsible Party Address or Office Location:		
G	Any Contractor Involved:				Contractor Address or Office Location:		
H	Product Spilled: <input type="checkbox"/> Potential Spill		Quantity in Litres, Kilograms or Cubic Metres:		U.N. Number:		
I	Spill Source:		Spill Cause:		Area of Contamination in Square Metres:		
J	Factors Affecting Spill or Recovery:		Describe Any Assistance Required:		Hazards to Persons, Property or Environment:		
K	Additional information, Comments, Actions Proposed or Taken to Contain, Recover or Dispose of Spilled Product and Contaminated Materials:						
L	Reported to Spill Line by:	Position:	Employer:	Location Calling From:	Telephone:		
M	Any Alternate Contact:	Position:	Employer:	Alternate Contact Location:	Alternate Telephone:		

REPORT LINE USE ONLY

N	Received at Spill Line by:	Position:	Employer:	Location Called:	Report Line Number:
	Lead Agency: <input type="checkbox"/> EC <input type="checkbox"/> CCG/TCMSS <input type="checkbox"/> GNWT <input type="checkbox"/> GN <input type="checkbox"/> ILA			Significance: <input type="checkbox"/> Minor	
<input type="checkbox"/> AANDC <input type="checkbox"/> NEB <input type="checkbox"/> Other: _____			<input type="checkbox"/> Major <input type="checkbox"/> Unknown		
Agency:	Contact Name:	Contact Time:	Remarks:		
Lead Agency:					
First Support Agency:					
Second Support Agency:					
Third Support Agency:					



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT WASTE MANAGEMENT PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		DRAFT for Environmental Assessment	K'alo-Stantec	2023-10-11

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Appendix A – Incinerator Management Plan

Abbreviations

CCME	Canadian Council of Ministers of the Environment
GNWT	Government of the Northwest Territories
GNWT-INF	Government of the Northwest Territories Department of Infrastructure
kg	kilogram
km	kilometre
MVLWB	Mackenzie Valley Land and Water Board
MVWR	Mackenzie Valley Winter Road
NWT	Northwest Territories
the Project	Mackenzie Valley Highway Project
ROW	right-of-way
SLUP	Sahtu Land Use Plan
SLWB	Sahtu Land and Water Board
WMP	Waste Management Plan

1 Introduction

1.1 Purpose

The purpose of this Waste Management Plan (WMP) is to identify measures to reduce, recycle, treat, and dispose of wastes associated with the Mackenzie Valley Highway Project (the Project) in accordance with permits, applicable regulations, guidelines, and best practices for remote operations. The overall goal of the plan is to inform project-specific waste management practices to reduce effects of the Project on the environment.

The WMP is intended to guide site personnel on the waste management objectives and procedures to be followed during the construction of the Project. The plan objectives are:

- Reduce and manage the effects of waste on the environment
- Provide the necessary direction for site personnel on how to meet waste management responsibilities that originate from legislation, guidelines, and project authorizations, such as the Land Use Permit and Water Licence
- Describe role responsibilities, controls, procedures, training, communication, inspection, and corrective actions as applicable to managing waste at the project site

1.2 Revisions

This WMP was developed based on the Mackenzie Valley Land and Water Board (MVLWB) Guidelines for Developing a Waste Management Plan and other applicable guidelines. This WMP is expected to be a requirement of, and will be complementary to, terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the Government of the Northwest Territories (GNWT). **This WMP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not intended to support applications to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.** The WMP will be finalized for regulatory approval by the contractor selected by the Government of Northwest Territories Department of Infrastructure (GNWT-INF) to complete the construction of the Project. The contractor may provide their own plan, consistent with the contents of this draft. The plan will be submitted to the regional Land and Water Boards following decision on the project environmental assessment and prior to commencement of the Project's construction activities. The plan will become effective once approved by the respective Land and Water Boards.

1.3 Project Description

The Project occurs within the Dehcho and Sahtu regions under the regulatory authorities of the MVLWB and the Sahtu Land and Water Board (SLWB).

The Project will include construction of approximately 281 kilometres (km) of new all-season gravel highway between Hodgson Creek (located 1 km north of Wrigley) and Prohibition Creek (located 28 km southeast of Norman Wells). The Project will connect to existing watercourse crossing structures (bridges and culverts) along the Mackenzie Valley Winter Road (MVWR), previously constructed highway between Prohibition Creek and Norman Wells, and the Great Bear River Bridge project in Tulita, which will be advanced as a separate project.

The Project will also include the construction and operation of temporary and permanent quarry and borrow sources along the proposed highway alignment, as well as the operations and maintenance of a contiguous total of approximately 321 km of highway between Wrigley, Tulita, and Norman Wells.

The Project is located within two distinct physiographic regions: the Mackenzie Plain and the Franklin Mountains. North of Tulita, the Highway is found within the Taiga Plains Ecozone. South of the community of Tulita, the Highway lies within the Taiga Cordillera Ecozone. The area supports numerous wildlife, fish, and bird species.

The Project interacts with several communities with traditional use areas. Community members participate in hunting, trapping, fishing, berry picking, and other land-based activities. In addition to traditional land uses, the Sahtu Land Use Plan (SLUPB, 2023) also identifies several zones in the vicinity of Project such as conservation zones and special management zones, where traditional, cultural, or heritage sites are found.

The Project includes the following physical works and activities to which this plan applies:

- Widening of the existing cleared MVWR right-of-way (ROW) and clearing of intermittent sections of new ROW
- Construction of approximately 281 km of new all-season gravel highway embankment (102 km in the Dehcho Region, 179 km in the Sahtu Region) and intermittent pullouts
- Construction of approximately 85 culverts as watercourse crossing structures
- Construction and operation of approximately six temporary borrow sources and quarries and associated all-season access roads
- Construction and operation of approximately nine permanent borrow sources and quarries and associated all-season access roads
- Water withdrawal and water use for road construction and maintenance
- Construction and operation of temporary support infrastructure and workspaces, including camps, maintenance yards, laydown and staging areas, and fuel storage areas

- Staging, supply and resupply of equipment, materials, fuel, and personnel
- Construction and operation of permanent maintenance yards
- Closure and reclamation of temporary borrow sources, quarries, and workspaces
- Demobilization of equipment and materials
- Closure and reclamation of portions of the MVWR ROW not used for the Project
- Operations and maintenance activities including snow clearing, grading, dust control, and bridge and culvert maintenance.
- Use of the highway by the public

The Project does not include construction of the Great Bear River Bridge; operations and maintenance of the MVWR; and, use of existing and authorized municipal, commercial, or public infrastructure or services, such as municipal solid waste and wastewater facilities, transportation services and the MVWR.

1.4 Project Contacts

In the event of waste management inquiries the following key contacts include:

Primary GNWT-INF Dehcho contact:

[Insert Name]

Regional superintendent, Dehcho Region

Department of Infrastructure

Government of the Northwest Territories

[mailing address]

[Phone]

[Fax]

[Email]

Primary GNWT-INF Sahtu contact:

[Insert Name]

Regional superintendent, Sahtu Region

Department of Infrastructure

Government of the Northwest Territories

[mailing address]

[Phone]

[Fax]

[Email]

Primary [Contractor] contact:

[Insert Name]

[Title]

[Company name]

[mailing address]

[Phone]

[Fax]

[Email]

1.5 Responsibilities

This WMP applies to the Contract Supervisor and its subcontractors for all aspects of the Project. The Project Owner is the GNWT. The following personnel are key project contacts should an inquiry or notification related to waste management occur.

Table 1.1 Roles and Responsibilities

Who	Responsibility
Contractor	<ul style="list-style-type: none"> • Implement this WMP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Continue implementing the WMP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this WMP is available on site at all times • Verify that personnel are trained and competent in the WMP application • Verify that the measures in the WMP are adequately applied • Coordinate mitigative and remedial measures, where required • Conduct regular worksite inspections • Liaise with Project Inspectors
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of construction, mitigation, and worksite inspection for waste management activities • Oversee completion of the Project • Support the Contractor Supervisor as required
GNWT-INF	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with the GNWT Lands Inspector, the GNWT Water Resources Officer, government agencies, and public and Indigenous Governments and Indigenous Organizations (as required) • Obtain agreement with municipal governments to receive project wastes in existing municipal waste and wastewater facilities

1.6 Legislation, Guidelines and Policy

This plan has been developed in consideration of the applicable legislation and guidelines, including:

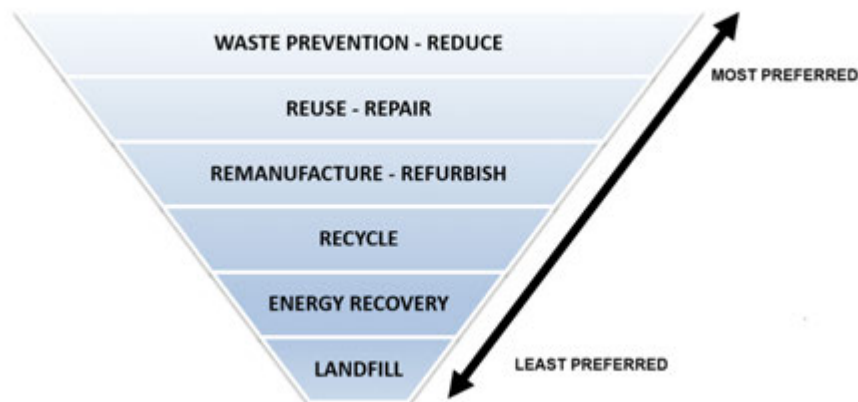
- Northwest Territories *Environmental Protection Act* and regulations (1988)
- Mackenzie Valley *Resource Management Act* (MVRMA) and Land-Use Regulations (CIRNAC, 1998)
- Mackenzie Valley Land and Water Boards Guidelines for Developing a Waste Management Plan (MVLWB, 2011)
- Northwest Territories *Waters Act* and Regulations (2014)
- Guideline for Hazardous Waste Management (GNWT-ENR, 2017)
- Reducing Municipal Solid Waste (Environment and Climate Change Canada [ECCC], 2021)

2 Waste Management

Project waste will be handled based on the approach illustrated in the Waste Management Hierarchy (Figure 2.1). Primarily, the waste generated by the Project will be reduced through selection of supplies and materials and project planning. Waste will be managed at the project site to the extent practicable to limit the need for waste backhaul via application of the waste management hierarchy, which demonstrates the most preferred removal methods. Labelled waste receptacles or storages will be established and available at key project locations. All wastes will be segregated by type to facilitate appropriate waste storage, handling, transfer, and disposal actions.

Certain camp wastes such as sewage, greywater, and domestic wastes are unsuitable for incineration and will be disposed of at licensed municipal facilities, subject to approval of the municipal government and the Inspector, as required, or in accordance with the land use permit. Other wastes, such as recyclables and hazardous wastes, will be transferred to an accredited waste transfer company for disposal. Wastes suitable for incineration will be incinerated on site.

Figure 2.1 Flow Chart of Waste Management Hierarchy



Source: Figure Reproduced from ECCC, 2021

2.1 Waste Locations

There will be several waste management or waste storage locations established at the project site. It is assumed that there will be two project construction camps per construction segment. Each camp will include waste transfer and temporary waste management facilities.

2.2 Waste Types and Potential Impacts

The following waste types may be generated by the Project. Waste types and potential volumes are summarized in Table 2.1:

- Domestic Waste
 - Includes food waste, camp waste, office waste, packaging
- Sewage
 - Includes toilet waste but not greywater
- Greywater
 - Wastewater from showers, kitchen, laundry, camp cleaning
- Hazardous Waste
 - Such as batteries, aerosols, solvents, oily rags, glycol, fluorescent lights, empty fuel or oil containers, contaminated soil, used hydraulic hoses, fire extinguishers
- Inert Waste
 - Such as scrap metal, ceramics, glass
- Non-recoverable Waste
 - Such as plastics, rubber (tires, hoses), wood (palettes, lumber)

Food-contaminated wastes and certain hazardous wastes (such as glycol) can become wildlife attractants if not managed properly. Wildlife can become habituated to food waste sources, leading to potential human-wildlife conflicts. Sewage and greywater, if not stored and disposed of properly, can lead to contamination of soils and water. Hazardous waste can adversely affect human and ecological health if it is ingested, absorbed, or inhaled directly, or through contamination of soil, water, or vegetation. Burning and incineration, as methods of managing waste, can release harmful air emissions if not done properly. Table 2.1 summarizes the potential impacts from improper management of each waste type for the Project.

Table 2.1 Waste Generation Source, Volume and Potential Impacts

Waste Type	Source	Volume	Potential Effects
Domestic Waste	Kitchen, camp operations, materials resupply	Estimated at 30 kg per day during peak construction activity	Air emissions from burning or incineration, change in wildlife health; increased wildlife mortality risk
Sewage	Camp and portable toilets, offices, effluent, sewage sludge	Estimated at 60 litres per day during peak construction activity	Change in water quality; change in wildlife or fish health; change in human health, increased wildlife mortality risk
Greywater	Camp operations	Up to 3,600 litres per day during peak construction activity	Change in water quality; change in wildlife or fish health; increased wildlife mortality risk
Hazardous Waste	Camp operations, vehicle maintenance, equipment malfunctions, blasting operations	unknown	Soil or groundwater contamination, change in water quality; change in wildlife or fish health; change in human health
Inert Waste	Materials resupply	Estimated at 1,000 kg per year	none
Non-recoverable Waste	Camp operations, vehicle maintenance, materials resupply	Estimated at 1,000 kg per year	Change in air quality; change in water quality; change in wildlife or fish health; change in human health

2.3 Waste Management Procedures

2.3.1 Open Burning

Certain types of waste are suitable for open burning, these include:

- Wooden pallets
- Other untreated and unpainted wood
- Cardboard (non-food related)

A designated area will be used to store and burn suitable items on a periodic basis. The open burning method will be used at the project site to limit backhauling and/or pressures on community landfill facilities, where similar disposal methods are engaged. Furthermore, open burning is used due to logistical challenges associated with the absence of recycling facilities in the project area.

[Project-specific procedures and locations for open burning will be established by the contractor].

2.3.2 Incineration

Certain types of waste can be incinerated to reduce the amount of waste to be removed from site and to limit scent attractant to wildlife in the vicinity of the project site. These include:

- Food and food-contaminated waste
- Non-plastic packaging
- Cardboard (food-related)

The final type of incinerator is to be selected by the contractor. The incinerator will be suitable for burning mixed solid waste at high temperatures.

In the Northwest Territories (NWT), incinerators are regulated under the NWT *Environmental Protection Act*, the *Canadian Environmental Protection Act*, the *Hazardous Products Act*, and associated regulations. In the absence of an NWT air quality regulatory framework that applies to emissions from incinerators, performance limits for the Project will be in accordance with the emission guidelines set out by the Canadian Council of Ministers of the Environment (CCME):

- Canada-Wide Standard for Dioxins and Furans (CCME, 2001)
- Canada-Wide Standards for Mercury Emissions (CCME, 2000)

The contractor will be responsible for operating the incinerator in accordance with manufacturer's specifications and considering the composition of the waste stream for optimized combustion.

Bottom ash will be stored in odour-proof containers and tested prior to removal from site for disposal at a facility to accept either hazardous or non-hazardous waste.

For incinerator management planning, see Appendix A of this WMP.

[Project-specific procedures for incineration will be established by the contractor].

2.3.3 Sewage Disposal

Sewage may be managed and disposed of using methods as approved by the Inspector.

Storage and Offsite Disposal: Sewage will be stored in an above-ground temporary holding tank. The tank will be regularly emptied using vacuum truck for disposal to the municipal sewage lagoon in Norman Wells, Tulita, or Wrigley, as approved by the respective municipalities. The holding tank's maximum capacity shall include contingency capacity to account for delays in pump out (such as weather conditions). Wastewater treatment is not considered a viable option for short-term construction camps.

The contractor will be responsible for updating procedures related to the management of sewage waste.

[Project-specific procedures and locations of sewage holding and disposal facilities will be established by the contractor].

2.3.4 Greywater Disposal

Greywater may be managed and disposed of using one of the two methods below, as approved by the Inspector.

Storage and Offsite Disposal: Greywater will be stored in an above-ground temporary holding tank. The tank will be regularly emptied using vacuum truck for disposal to a municipal sewage lagoon in Norman Wells, Tulita, or Wrigley by approval of the municipality. The holding tank's maximum capacity shall include contingency capacity to account for delays in pump out (such as weather conditions). Offsite disposal was considered for treatment potential and associated environmental benefits in the context of the waste management hierarchy.

Greywater Sump: A greywater sump is considered a contingency option should holding tank capacity be exceeded. Greywater may be managed by pumping through a roughing sand pressure filter, and then discharged and stored in an excavated sump that will allow for slow infiltration into the soil. The roughing filter would remove any food wastes that would otherwise serve as a wildlife attractant. The sump would be located adjacent to the camp and greater than 31 m from any waterbody. A greywater sump was considered in the context of the waste management hierarchy to limit pressures on community facilities.

The appropriate guideline to be followed for this Project for grey water disposal is Northern Land Use Guidelines for Camp and Support Facilities (GNWT, 2015).

At decommissioning of the camp, the greywater sump will be filled with crushed material from the quarry and mounded to prevent settlements from causing a depression. The roughing filter would be removed from the site and either regenerated for future use or disposed of at an appropriate location.

The contractor will be responsible for updating the procedures related to the operation of the greywater system in accordance with the guidelines and by considering the composition of the waste stream. Should sump infrastructure be created as an aspect of the Project, the Contractor will seek engineering advice for the containment of grey water, in addition to engineered drawings and an operational maintenance plan. Furthermore, the Contractor will meet the Northern Land use Guidelines for Camp and Support Facilities requirements through an update this management plan.

[Project-specific procedures and locations for greywater management will be established by the contractor].

2.3.5 Waste Backhaul

Certain types of waste cannot be incinerated, treated, or disposed of onsite. Wastes to be backhauled to a facility accredited to accept the specific type of wastes include:

- Non-recoverable waste
- Hazardous waste
- Recyclables
- Inert waste
- Other solid waste if not approved for disposal to municipal facilities

All food-contaminated waste will be stored in odour-proof and wildlife-proof containers and will be removed for disposal regularly. Disposal of plastics will occur at municipal solid waste facilities by approval, as the closest and most logistically feasible option to receive plastic disposal items.

The storage, management, and disposal of hazardous wastes such as batteries, waste fuel and lubricants, oily rags, fluorescent bulbs, glycol, contaminated soil, and empty fuel drums will be in accordance with the Government of the Northwest Territories' Guideline for Hazardous Waste Management (GNWT-ENR, 2017).

Hazardous wastes will be segregated and stored in waterproof, labeled containers prior to removal from site. The transportation of hazardous wastes is regulated under the Transportation of Dangerous Goods Regulations (TC, 2020). All hazardous wastes will be manifested by a certified consignor. Once received, a copy of the manifest signed by the receiver (the facility accepting the waste) will be provided to the GNWT-INF for their records.

The Project may generate recyclable waste such as pop cans and plastic bottles. Recyclable wastes will be segregated and transported to a facility approved to accept recyclable wastes. Disposal of recyclable waste may occur at the Norman Wells Solid Waste Facility, if there is agreement to accept such wastes.

Inert waste types will also be generated by the Project, including items such as scrap metal or glass products. Inert waste will be segregated and transported to a facility approved to accept inert landfill wastes.

In the context of the waste management hierarchy, backhauling certain wastes will allow for safe disposal at an already established waste facility approved to accept such wastes.

2.3.6 Waste Stockpile

Inert materials and certain other non-recoverable wastes generated during construction, such as scrap metal, non-food-contaminated plastics, rubber, and glass, will be crushed if possible and stockpiled onsite for future removal. Materials will be arranged to not pose risk to humans or wildlife.

3 Training, Inspections, Reporting, Records

3.1 Training

All Project personnel will receive training on the purpose and procedures provided in this WMP.

All personnel will receive training in safe work procedures related to storage and handling.

3.2 Inspections

Onsite inspections concerning waste handling, storage, transportation, and disposal areas is required to be conducted by the Contractor Supervisor.

- Inspections of the Hazardous Waste Storage Yard, Waste Stockpile, waste infrastructure and waste receptacles are completed monthly to confirm site compliance with regulatory authorizations (e.g., fence, lock, standing water, waste labels, waste container integrity, general housekeeping, animal attraction).
- Waste inspections will confirm the amount and types of waste being stored to verify record keeping accuracy.
- Daily general site monitoring will identify and correct for instances of mismanaged waste or related infractions.
- All inspections and monitoring information will be documented.
- In the event of non-conformance, corrective action will be taken and documented.

3.3 Records and Reporting

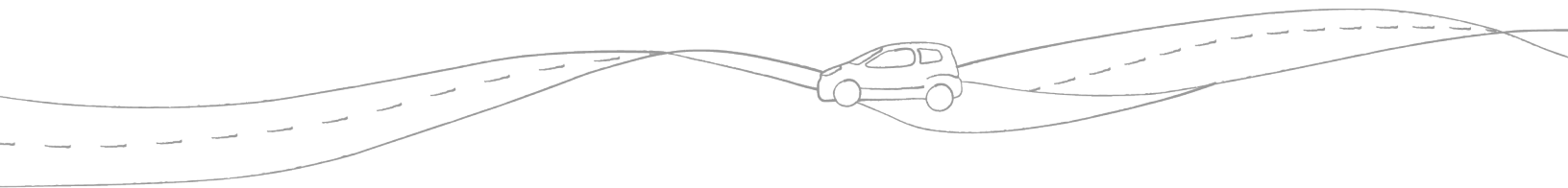
Prior to disposal, the Project Contractor will track the volume of wastes generated by the Project. Waste tracking will also require information related to the classification of each waste type, storage or holding location of wastes, disposal/treatment option, and destination disposal facility. These records will be used by the project team for continual improvement, analysis, and annual reporting. Additionally, the records can be provided to the Inspector if requested. The tracking information will be used to complete an onsite waste inventory.

All wastes shipped to an offsite receiver are tracked, recorded, and manifested using the GNWT-INF's 'Waste Generator Registration Number – XXXXXX.' Hazardous waste documentation will occur, as per the Guideline for the General Management of Hazardous Waste (GNWT-ENR, 2017) in the NWT. This information will be forwarded to the Department of Environment and Natural Resources of the GNWT.

4 References

- CCME (Canadian Council of Ministers of the Environment). 2000. Canada-Wide Standards for Mercury.
- CCME. 2001. Canada-Wide Standards for Dioxins and Furans.
- CIRNAC (Crown-Indigenous Relations and Northern Affairs Canada). 1998. Mackenzie Valley Land Use Regulations. Available at: <https://laws-lois.justice.gc.ca/eng/regulations/SOR-98-429/FullText.html>. Accessed June 2023.
- ECCC (Environment and Climate Change Canada). 2021. Reducing Municipal Solid Waste. Available at: [Reducing municipal solid waste - Canada.ca](https://www.ec.gc.ca/reducing-municipal-solid-waste). Accessed June 2023.
- GNWT (The Government of the Northwest Territories). 2015. Northern Land Use Guidelines, Camp and Support Facilities. Available at: https://www.lands.gov.nt.ca/sites/lands/files/resources/nlug_camps_2015_english_16_sept_2015.pdf. Accessed June 2023.
- GNWT-ENR (The Government of the Northwest Territories-Department of Environment and Natural Resources). 2017. Guideline for Hazardous Waste Management. Available at: https://www.enr.gov.nt.ca/sites/enr/files/resources/128-hazardous_waste-interactive_web_0.pdf. Accessed June 2023.
- MVLWB (Mackenzie Valley Land and Water Board). 2011. Guidelines for Developing a Waste Management Plan. Available at: https://mvlwb.com/sites/default/files/documents/MVLWB-Guidelines-for-Developing-a-Waste-Management-Plan-Mar-31_11-JCWG.pdf. Accessed June 2023.
- SLUPB (Sahtú Land Use Planning Board). 2023. Sahtú Land Use Plan. Government of Northwest Territories. Fort Good Hope. Ratified but not available as of July 19, 2023; see <https://sahtulanduseplan.org/plan>.
- TC (Transport Canada). 2020. Transportation of Dangerous Goods Regulations. Available at: <https://tc.canada.ca/en/corporate-services/acts-regulations/list-regulations/transportation-dangerous-goods-regulations>. Accessed June 2023.

Appendix A – Incinerator Management Plan



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT INCINERATOR MANAGEMENT PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
0		Draft for Environmental Assessment	K'alo-Stantec	2023-10-11

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Appendix A – Incinerator Manual

Appendix B – Leachate Disposal Standards for Solid Waste/Process Residuals

Appendix C – Incinerator Records

Abbreviations

CCME	Canadian Council of Ministers of the Environment
EC	Environment Canada
ECCC	Environment and Climate Change Canada
ENR	Environment and Natural Resources
GNWT	Government of the Northwest Territories
GNWT-INF	Government of the Northwest Territories - Infrastructure
IMP	Incinerator Management Plan
MVWR	Mackenzie Valley Winter Road
NWT	Northwest Territories
the Project	Mackenzie Valley Highway Project
WMP	Waste Management Plan

1 Introduction

This Incinerator Management Plan (IMP) describes the operational procedures intended to reduce adverse impacts to air and the receiving environment from the incineration of wastes associated with the Mackenzie Valley Highway Project (the Project). This IMP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not intended to support applications to regulatory agencies such as the Mackenzie Valley Land and Water Board or Sahtu Land and Water Board.

Incineration is commonly used at remote work sites to assist in the management of specific waste streams via thermal treatment. Incineration is a high temperature, dry oxidation process to reduce organic and combustible waste to an incombustible form (i.e., ash, heat, and flue gas). Incinerating waste reduces scent attractants, which reduces potential to attract wildlife, and reduces waste back-haulage to local landfills. Incinerators can also be advantageous to a remote site for disposal of used oil, which can be burned for heating.

This IMP accompanies and is a complementary document to the Waste Management Plan (WMP). Where appropriate, the IMP may reference the WMP. The IMP was developed to be in line with recommendations with key legislation and guidelines. In this management plan, the following key topics are as follows:

- Operational procedures for waste its incineration
- Location of incineration sites
- Incineration waste stream
- Ash disposal sampling
- Monitoring inspections and maintenance
- Training

The IMP is a requirement of the Water License XXXXXX and Land Use Permit XXXXXX. A revised version of this plan will be submitted for approval by the project Contractor, prior to commencement of project construction.

The IMP is a living document that will be reviewed and updated as needed to adapt and incorporate any changes in environmental factors, pertinent project-specific changes during construction (e.g., site conditions and design modifications), the Government of the Northwest Territories Department of Infrastructure (GNWT-INF) and Contractor practices, and applicable regulatory changes.

1.1 Project Contacts

In the event of an incinerator accident or malfunction, or for inquiries about project incineration activities, the following key contacts include:

Primary GNWT-INF Dehcho contact:

[Insert Name]

Regional superintendent, Dehcho Region

Department of Infrastructure

Government of the Northwest Territories

[mailing address]

[Phone]

[Fax]

[Email]

Primary GNWT-INF Sahtu contact:

[Insert Name]

Regional superintendent, Sahtu Region

Department of Infrastructure

Government of the Northwest Territories

[mailing address]

[Phone]

[Fax]

[Email]

Primary [contractor] contact:

[Insert Name]

[Title]

[Company name]

[mailing address]

[Phone]

[Fax]

[Email]

1.2 Roles and Responsibilities

The Contractor is responsible for implementing the IMP and complying with all permits and licences issued to the GNWT. Response roles and responsibilities are outlined below.

Table 1.1 Roles and Responsibilities

Who	Responsibility
Contractor	<ul style="list-style-type: none"> • Develop standard operating procedures associated with management of wastes by incineration • Maintain incinerators in good working order in accordance with manufacturer’s specifications • Implement the IMP under the direction of the Contractor Supervisor • Make personnel, equipment, and materials available, as required • Take appropriate response measures • Continue implementing the IMP until responsibility is transferred under the authority of the GNWT
Contractor Supervisor	<ul style="list-style-type: none"> • Supervise the contractor team • Verify that this IMP is available on-site at all times • Verify that personnel are trained and competent in the IMPs application • Verify that the mitigation measures in the IMP are adequately applied • Conduct regular worksite inspections • Liaise with the GNWT Lands Inspector and the GNWT Water Resources Officer
Contractor Project Manager	<ul style="list-style-type: none"> • Maintain records of incineration activities, mitigation measures, and worksite inspection activities • Support the Contractor Supervisor, as required • Oversee completion and distribution of reporting to the GNWT
GNWT-INF	<ul style="list-style-type: none"> • Comply with all permits and licences • Develop press releases and liaise with media directly (if required) • Liaise with government agencies and public and Indigenous Governments and Indigenous Organizations (as required) • Confirm all reports are completed as required by authorizations

1.3 Legislation and Guidelines

In the Northwest Territories (NWT), incinerators are regulated under the NWT *Environmental Protection Act*, the *Canadian Environmental Protection Act*, the *Hazardous Products Act*, and associated regulations. Additionally, guidelines developed by the Canada Council of Ministers of the Environment (CCME) were also reviewed in preparing this document.

- *Canadian Environmental Protection Act*
 - Toxic substances list: schedule 1
 - Cross-border Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2021-25)
 - Environment Canada (EC) Technical Document for Batch Waste Incineration (EC, 2010)
 - Canada-Wide Standards for Dioxins and Furans (CCME, 2001)
 - Canada-Wide Standards for Mercury (CCME, 2000)
- *Hazardous Products Act*
 - Hazardous Products Regulations (SOR/2015-17)
- *Environmental Protection Act* (Northwest Territories)
 - Used Oil and Waste Fuel Management Regulations (GNWT-ENR, 2003)
 - Environmental Guidelines for Ambient Air Quality Standards (GNWT-ENR, 2014)
 - Guide to Recycling Mercury-Containing Lamps (GNWT-ENR, 2012)
 - Guideline For Industrial Waste Discharges in the NWT (GNWT-ENR, 2004)
 - Guideline for Hazardous Waste Management (GNWT-ENR, 2017)

In the absence of an NWT air quality regulatory framework that applies to emissions from incinerators, performance limits for the Project will be in accordance with the emission guidelines set out by the CCME:

- Canada-Wide Standard for Dioxins and Furans (CCME, 2001)
- Canada-Wide Standards for Mercury Emissions (CCME, 2000)

Ash generation from the incineration process will require disposal. Sampling direction in the NWT Guideline for Hazardous Waste Management (GNWT-ENR, 2017) will inform safe disposal limits. Refer to the WMP for further details.

2 Waste Incineration Operational Procedures

2.1 Incinerator Selection

The Project Contractor will select the type of incinerator with consideration of the types of wastes and amounts to be generated by the Project. Site-specific factors and the requirement to meet the published standards/guidelines will also influence final selection of the incinerator. For example, manufacturers provide different models of controlled air dual-chamber incinerators based on waste volumes and type of waste. *[Incinerator specifications are to be provided as Appendix A to this IMP.]*

2.2 Incinerator Location

The Project will locate one incinerator at each camp location. Possible camp locations where an incinerator may be stationed include existing camp facilities within Norman Wells, dedicated camp locations within municipal boundaries of Tulita and/or Wrigley, or at one or more borrow sources or quarries to be accessed from the Mackenzie Valley Winter Road (MVWR). The Project Contractor will choose both the camp location and the location of the incinerator. Incinerators will be placed in a location that is optimized based on predominant wind direction to keep exhaust emissions away from key work areas and accommodations.

2.3 Waste Handling

The contractor will identify specific procedures for waste handling in a Standard Operating Procedure, including but not limited to:

- Hazard identification
- Pre-incineration waste segregation and handling
- Load limits
- Records of confirmatory sampling
- Waste reject records

2.4 Breakdown Contingency

If an incinerator should break down, alternate waste management actions will be taken until such time that a repair can be completed. The alternative methods will be dependent on the length of time that the incinerator is anticipated to be down.

- Short-term (up to several weeks) options include temporary storage of waste in sealed containers that are resistant to wildlife damage or entry. Open pit burning of food-contaminated cardboard and paper can be conducted daily to minimize waste that requires storage.
- Long-term (more than several weeks) options include backhauling waste on a periodic basis to the secondary camp incinerator. With approval from the local municipalities, waste may also be taken to municipal waste facilities.

2.5 Incinerator Operation

Operation of project incinerators will be performed according to manufacturer directions and the EC technical guidance document for Batch Waste Incineration (EC, 2010). Specific operational procedures will be updated by the project Contractor following the selection of an incinerator for the Project. General incinerator operational procedures will include:

- Hazard identification
- Operational parameters: such as calorific loading, burn cycling, moisture content, air requirement, fuel burn
- Pre-incineration waste sorting, segregation, and handling
- Incinerator load preparation, limits, calorific specifications
- Records of to be kept for each incineration event
- Waste reject records

2.6 Incinerator Waste Stream

2.6.1 Waste Types for Incineration

Table 2.1 indicates the types of wastes that may be incinerated in approved incinerators, based on the wastes expected to be generated by camp operations. Table 2.1 also details the waste types that are typical of the Project that will not be incinerated.

Table 2.1 Acceptable and Unacceptable Waste Types for Incineration

Waste Type	Suitable for Incineration	Limitations
Unpainted wood and wood with paint removed	✓	
Waste oil	✓	Must meet suitability criteria of Used Oil and Waste Fuel Management Regulations (GNWT, 2003)
Other organic liquids	✓	Must meet suitability criteria of Used Oil and Waste Fuel Management Regulations (GNWT, 2003)
Oily rags	✓	
Kitchen waste (no heavy plastics)	✓	Heavy plastics removed
Paper and cardboard	✓	
Heavy plastics, metal, paint cans	no	Heavy plastics to be washed for landfill disposal
Sewage wastes	no	
Inert materials (concrete, ceramics, ash)	no	
Appliances and electronic devices	no	
Compressed gas (propane tanks, aerosol can, pressurized containers)	no	
Hazardous wastes or toxic substances	no	
Batteries	no	
Light bulbs	no	
Rubber products	no	

2.6.2 Incinerator Ash Sampling & Disposal

Incinerator operations will result in process residual ash that will require removal. The ash will be sampled and analyzed against criteria prior to disposal based on the GNWT Department of Environment and Natural Resources (ENR) Guideline for Hazardous Waste Management Schedules I and II. The sampling is needed to verify that leachable metals, dioxins, and/or furans are not present in the residual ash. If the ash does not exceed the guidelines, it will be classified as a non-hazardous waste and disposed of in a landfill. If the ash is found to exceed one or more parameters of the guidelines, it will be classified as a hazardous waste and stored in containers prior to off-site removal and disposal. The Schedule I and II leachable disposal standards for solid waste and process residual are found in Appendix B.

3 Monitoring, Inspections and Maintenance

All waste that is intended for incineration will be monitored and tracked in a log. Site personnel will track waste volume, weight, fuel usage, and ash volume removal. All ash sampling results will be maintained as monitoring records. Site staff will monitor operational parameters (such as chamber temperature and load weights) during burn cycles and record data concerning the operational efficiency of the incinerator unit. *[A monitoring form is to be provided as Appendix C to this IMP].*

Site personnel will also conduct inspections to verify that safe incineration practices. Prior to incineration start up, site personnel will conduct a circle check and pre-operational inspection of the unit and work area. Daily inspections by staff will be required to audit the workspace for scent attractant, evidence of wildlife presence, litter, spills, and improperly stored waste. Operators will also inspect incineration loads for unapproved waste types prior to starting a burn cycle.

Each incinerator will require routine maintenance, as per the manufacturer's prerequisites. A maintenance log will be created to reflect maintenance activities, dates, personnel involved, observations, issue identification, and repairs. Descriptions of malfunctions and related repairs or corrective actions will be logged as part of the maintenance history for each incinerator. Regular maintenance will be required as a key aspect for safe incineration.

4 Training

All incinerator operators will be required to complete training prior to initiating incineration activities. The training will be created based on the training manual provided by the incinerator manufacturer. Training will include awareness of Environment and Climate Change Canada's (ECCC's) Technical Document for Batch Waste Incineration (EC, 2010).

The training will cover topics such as:

- Job hazards related to incineration operation
- Safety procedures, personal protective equipment, and risk assessment
- Identification of waste types and waste composition for burn efficiency
- Incinerator start up, operation, shut-down, and emergency shut-down procedures
- Incinerator ash sampling, ash removal, and safe disposal
- Maintenance procedures
- Record keeping

All site personnel will receive waste management awareness training to verify that they are aware of incineration requirements, dangers, and risk associated with improper segregation of waste, as it relates to incinerator operation.

5 References

- CCME (Canadian Council of Ministers of the Environment). 2000. Canada-Wide Standards for Mercury.
- CCME. 2001. Canada-Wide Standards for Dioxins and Furans.
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Appendix A – Incinerator Manual

[Placeholder]

Appendix B – Leachate Disposal Standards for Solid Waste/Process Residuals

Item	Parameter	Concentration (mg/L)	Item	Parameter	Concentration (mg/L)
1.	Antimony	0.6	25.	Ethyl benzene	0.24
2.	Arsenic	2.5	26.	Fluoride	150
3.	Barium	100	27.	Hexachlorobenzene	0.13
4.	Benzene	0.5	28.	Hexachlorobutadiene	0.5
5.	Beryllium	5.0	29.	Hexachloroethane	3.0
6.	Boron	500	30.	Lead	5.0
7.	Cadmium	0.5	31.	Mercury	0.1
8.	Carbon tetrachloride (Tetrachloromethane)	0.5	32.	Methyl ethyl ketone / Ethyl methyl ketone	200
9.	Chloramines	300	33.	Naphthalene	0.5
10.	Chlorobenzene (Monochlorobenzene)	8.0	34.	Nitrate + Nitrite	1000
11.	Chloroform	6.0	35.	Nitrilotriacetic acid (NTA)	40
12.	Chromium	5.0	36.	Nitrite	320
13.	Cobalt	100	37.	Nitrobenzene	2
14.	Copper	100	38.	Pentachlorophenol	6.0
15.	Cresol (Mixture – total of all isomers, when isomers cannot be differentiated)	200	39.	Pyridine	5.0
16.	Cyanide	20	40.	Selenium	1.0
17.	2,4-DCP / (2,4-Dichlorophenol)	90	41.	Silver	5.0
18.	1,2-Dichlorobenzene (o-Dichlorobenzene)	20	42.	Tetrachloroethylene	3.0
19.	1,4-Dichlorobenzene (p-Dichlorobenzene)	0.5	43.	2,3,4,6-Tetrachlorophenol / (2,3,4,6-TeCP)	10
20.	1,2-Dichloroethane (Ethylene dichloride)	0.5	44.	Toluene	2.4
21.	1,1-Dichloroethylene (Vinylidene chloride)	1.4	45.	Trichloroethylene	0.5
22.	Dichloromethane (also see – methylene chloride)	5.0	46.	Trihalomethanes – Total (also see – Chloroform)	10
23.	2,4-Dinitrotoluene	0.13	47.	Uranium	2.0
24.	Polychlorinated dibenzo dioxins and furans (TEQ)	0.0000015	48.	Xylene	0.5
			49.	Zinc	500

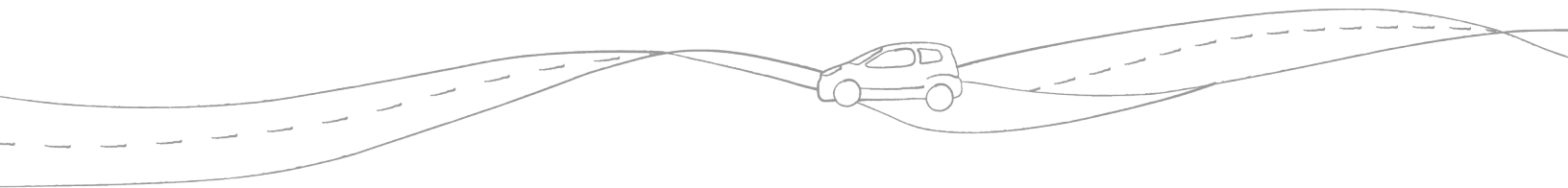
Schedule II: Dioxin Toxicity Equivalency Factors

Column I – Congeners	Column II – TEF*
2,3,7,8-tetrachlorodibenzo-p-dioxin	1.0
1,2,3,7,8-pentachlorodibenzo-p-dioxin	0.5
1,2,3,4,7,8-hexachlorodibenzo-p-dioxin	0.1
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin	0.1
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin	0.1
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	0.01
octachlorodibenzo-p-dioxin	0.001
2,3,7,8-tetrachlorodibenzofuran	0.1
1,2,3,7,8-pentachlorodibenzofuran	0.05
2,3,4,7,8-pentachlorodibenzofuran	0.5
1,2,3,4,7,8-hexachlorodibenzofuran	0.1
1,2,3,6,7,8-hexachlorodibenzofuran	0.1
1,2,3,7,8,9-hexachlorodibenzofuran	0.1
2,3,4,6,7,8-hexachlorodibenzofuran	0.1
1,2,3,4,6,7,8-heptachlorodibenzofuran	0.01
1,2,3,4,7,8,9-heptachlorodibenzofuran	0.01
octachlorodibenzofuran	0.001

* Toxicity Equivalency Factor

Appendix C – Incinerator Records

[Placeholder]



MACKENZIE VALLEY HIGHWAY PROJECT

DRAFT WILDLIFE MANAGEMENT AND MONITORING PLAN

Mandate commitment of the 19th Legislative Assembly

October 2023

Plan Maintenance and Control

Plan Document History

Version #	Section(s) Revised	Description of Revision	Prepared by	Issue Date
1.0	n/a	Draft for Environmental Assessment	K'alo-Stantec	2023-10-11

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Abbreviations

ARD/ML	acid rock drainage and metal leaching
BNE	Bluenose-East
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CR	Conformity Requirement
CWS	Canadian Wildlife Service
CZ	Conservation Zone
DAR	Developer's Assessment Report
DFO	Fisheries and Oceans Canada
DLUPC	Dehcho Land Use Planning Committee
ECC	Department of Environment and Climate Change
ECCC	Department of Environment and Climate Change Canada
GNWT	The Government of the Northwest Territories
h	hour
ha	hectare
IBA	Important Bird Area
INF	Department of Infrastructure
km	kilometre
LAA	Local Assessment Area
m	metre
MBCA	<i>Migratory Birds Convention Act</i>
MBR	Migratory Birds Regulations
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVWR	Mackenzie Valley Winter Road
NWRRC	Norman Wells Renewable Resources Council
NWT	Northwest Territories
PCA	Parks Canada Agency
PDA	Project Development Area
the Project	Mackenzie Valley Highway Project

**Mackenzie Valley Highway
DRAFT Wildlife Management and Monitoring Plan**
Abbreviations

RAA	Regional Assessment Area
ROW	Right-of-Way
RRC	Renewable Resources Council
SAR	Species at Risk
SARA	<i>Species at Risk Act</i>
SARC	Species at Risk Committee
SCP	Spill Contingency Plan
SLUP	Sahtu Land Use Plan
SLUPB	Sahtú Land Use Planning Board
SOCC	Species of Conservation Concern
SRRB	Sahtú Renewable Resources Board
TLRU	Traditional land and resource use
TRRC	Tulita Renewable Resources Council
UAV	unmanned aerial vehicle
VC	Valued component
WMIS	Wildlife Management Information System
WMMP	Wildlife Management and Monitoring Plan

1 Introduction

On August 19, 2021, the Government of the Northwest Territories (GNWT) Minister of Environment and Natural Resources (now Environment and Climate Change [ECC]) informed the Deputy Minister of Department of Infrastructure (INF) of the requirement for a Wildlife Management and Monitoring Plan (WMMP) for the Mackenzie Valley Highway Project (the Project) per section 95 of the *Wildlife Act*. The Project includes construction and operation of a new two-lane gravel highway to replace the seasonal use of the Mackenzie Valley Winter Road (MVWR) between Wrigley, Tulita and Prohibition Creek, 28 kilometres (km) south of Norman Wells, and the development of quarry and borrow sources (Figure 1.1.1 to Figure 1.1.3). The letter recommended that the GNWT-INF prepare a Tier 2 WMMP, following the guidance of the *WMMP Process and Content Guidelines* (GNWT, 2021a).

Though the WMMP is a specific requirement of the *Wildlife Act*, the WMMP for the Project does not exclude any wildlife potentially affected by the Project from its scope. The WMMP addresses a broader range of species for which general prohibitions under the *Wildlife Act*, *Species at Risk Act*, and *Migratory Birds Convention Act* and associated regulations apply.

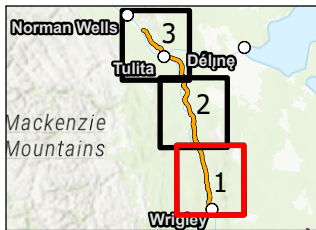
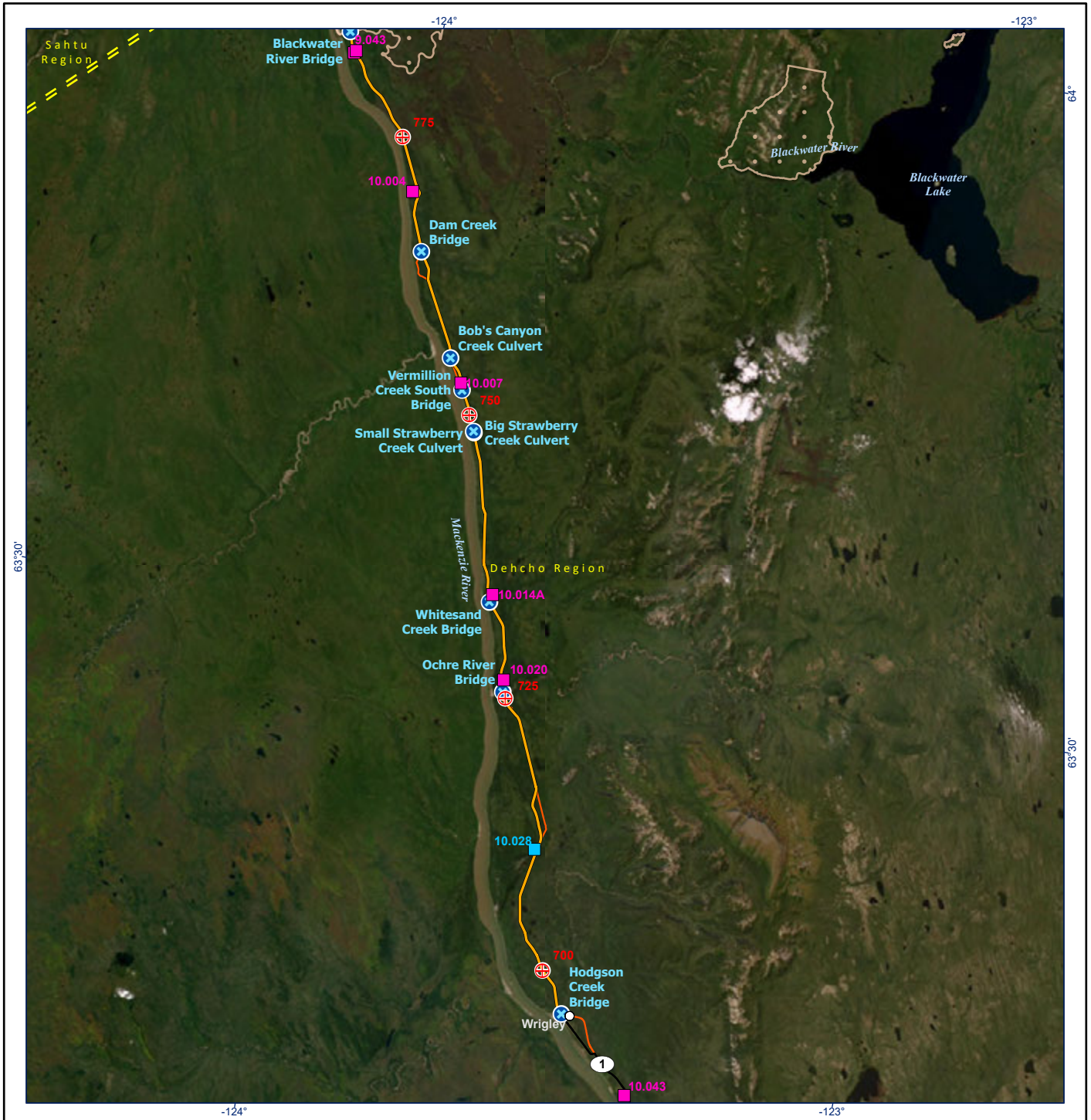
1.1 Purpose and Objectives

This Tier 2 WMMP was developed to support the construction, and operations and maintenance of the Project by the GNWT. The WMMP will incorporate the final mitigation measures of the environmental assessment of the Project, as appropriate, and will be complementary to terms and conditions contained in Land Use Permit(s) and Water Licence(s) when issued to the GNWT. **This WMMP is draft and has been prepared to support the environmental assessment of the Project by the Mackenzie Valley Environmental Impact Review Board. It is not yet being submitted for approval by the Minister of Environment and Climate Change.**

The WMMP has been developed to describe the mitigation measures and monitoring programs that will be implemented to reduce potential effects of the Project on wildlife and wildlife habitat, which includes valued components (VCs) assessed in the Project's Developer's Assessment Report (DAR), including wildlife and wildlife habitat (Chapter 19), birds and bird habitat (Chapter 20), and caribou (*Rangifer tarandus*) and moose (*Alces alces*) (Chapter 10). Caribou and moose were selected and assessed separate from other wildlife in accordance with the terms of reference (Mackenzie Valley Environmental Impact Review Board [MVEIRB, 2015]).

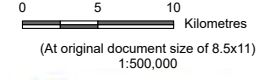
The objectives of the WMMP are to:

- Describe the mitigation measures that will be implemented to avoid and/or reduce potential project effects on wildlife and wildlife habitat
- Describe the monitoring programs that will be implemented to quantify and evaluate the effectiveness of mitigation measures and to confirm the assessment predictions
- Describe the adaptive management approach and action levels that will be used to adjust mitigation measures where necessary to meet management goals



Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics. n.d. Inventory of Landscape Change Map Viewer, GNWT. Centre for Geomatics. n.d. Open Data, MVLWB. n.d. Public Registry, Sahtu Land and Water Board. n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Kálo-Stantec 2022, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd.
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS
 Imagery dates: 2015 - 2021

- Proposed Mackenzie Valley Highway Kilometre Marker (Approximate)
- Existing or Planned Bridge Crossing (Not in Scope of Project)
- Proposed Mackenzie Valley Highway Project Route
- Proposed Bear Rock Alignment Option
- Canyon Creek All Season Access Road (Constructed)
- Prohibition Creek Access Road (In Construction)
- Proposed Great Bear River Bridge Project (Not in Scope of Project)
- Proposed Granular Borrow Source
- Proposed Rock Quarry Source
- Proposed Granular Borrow Access
- Proposed Rock Quarry Access
- Community
- Northwest Territories Highway
- Mackenzie Valley Winter Road (Not in Scope of Project)
- Region Boundary
- Sahtu Land



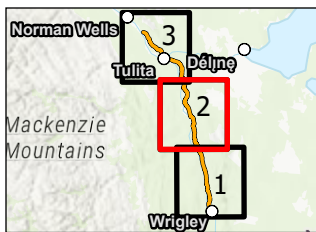
Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0179 REVA

Government of the Northwest Territories
 Mackenzie Valley Highway Project

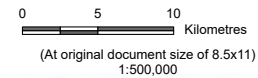
Figure No.
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Title
Mackenzie Valley Highway Project - Overview



Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Kálo-Stantec 2022, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd.
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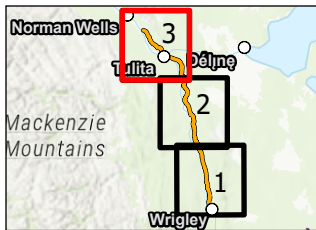
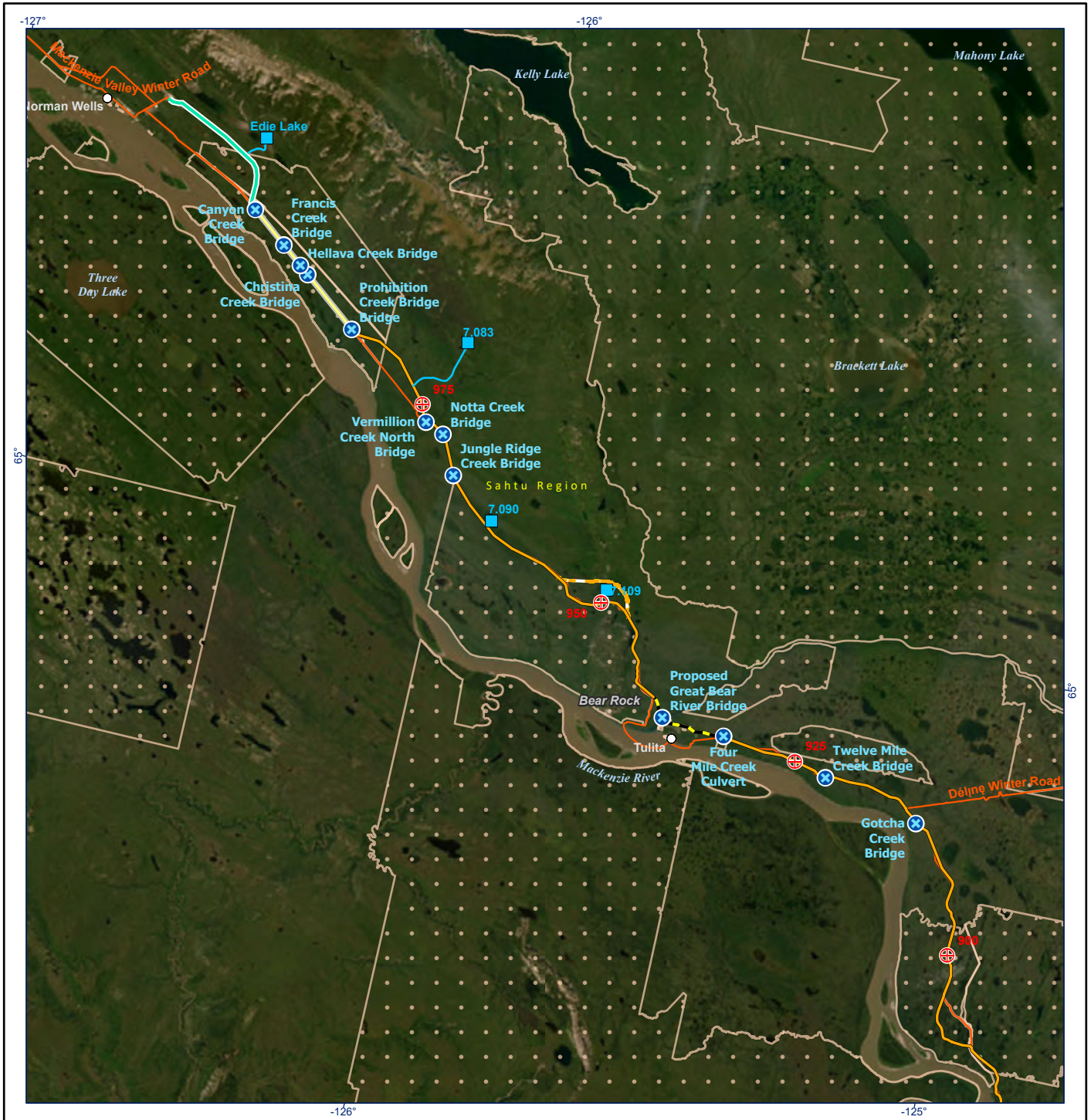


Project Location: Wrigley to Norman Wells, NWT
 Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

Client/Project: 144903025-0179 REVA
 Government of the Northwest Territories
 Mackenzie Valley Highway Project

Figure No. 1.1.2
 Title

Mackenzie Valley Highway Project - Overview



Notes

1. Coordinate System: NAD 1983 Northwest Territories Lambert
2. Data Sources: GNWT (Government of the Northwest Territories) Centre for Geomatics, n.d. Inventory of Landscape Change Map Viewer, GNWT, Centre for Geomatics, n.d. Open Data, MVLWB, n.d. Public Registry, Sahtu Land and Water Board, n.d. Public Registry, Environment and Natural Resources GNWT, Government of Canada, Kalo-Stantec 2022, Stantec, Wilson and Haas 2012, and Caslys Consulting Ltd.
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- Region Boundary
- Sahtu Land

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Project Location Wrigley to Norman Wells, NWT
Client/Project Government of the Northwest Territories
 Mackenzie Valley Highway Project

Prepared by DS on 8/4/2023
 TR by EB on 8/4/2023

144903025-0179 REVA

Figure No.
1.1.3

Title
Mackenzie Valley Highway Project - Overview

Page 3 of 3

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1.2 Measures, Conditions, and Developer Commitments Concordance Table

A concordance table of measures, conditions and developer commitments is provided in Table 1.1.

Table 1.1 Measures, Conditions and Developers Commitments Concordance Table

Condition	Reviewer Comments	INF Response

1.3 Engagement

The GNWT has engaged with Indigenous Governments, Indigenous Organizations, and other affected parties. Detailed information regarding these engagement activities is presented in Chapters 2, 3 and 11 of the DAR.

Through the project-specific engagement program delivered between 2010-2012 and 2021-2023, including project-specific traditional land and resource use (TLRU) studies, and through a review of publicly available TLRU information, Indigenous Governments, Indigenous Organizations, and other affected parties shared information, expressed concerns, and provided recommendations related to wildlife and wildlife habitat, birds and bird habitat, as well as caribou, moose and harvesting. This feedback has been considered and summarized in Table 1.2, and was integrated into the DAR.

Table 1.2 Summary of Engagement Feedback Related to Wildlife

Comment	Source	GNWT Response
Engaged Indigenous Governments, Indigenous Organizations and specific other affected parties identified wildlife species of importance.	Auld and Kershaw, 2005; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; McDonald, 2010; NWRRC 2023; TRRC, 2022; SRRB, 2007, 2021; SLUPB, 2013	The GNWT has reviewed and considered the species of importance and important habitats identified by Indigenous Governments, Indigenous Organizations and other affected parties.
Engaged Indigenous Governments, Indigenous Organizations, and specific other affected parties identified important wildlife habitats and areas, and hunting and trapping locations near the Project.	DLUPC, 2006; Dessau, 2012 (PR#13); NWRRC, 2023; TRRC, 2022; SLUPB 2022	
Engagement participants expressed concern about ecosystems and wildlife, and in particular caribou, moose, muskox, bears, bats, beaver, and other furbearers. They expressed concern that effects on wildlife and wildlife habitat may negatively affect culturally significant sites. They attributed these effects to construction activities, increased noise, increased traffic collisions, harvesting pressure, and climate change.	August 2021 Engagement; April to July 2022 Engagement; November to December 2022 Engagement; November 2022 to February 2023 Engagement	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on wildlife and wildlife habitat.</p> <p>Wildlife monitors will assess for the presence of wildlife on or near the project development area (PDA) during project activities.</p> <p>A project-specific Spill Contingency Plan (SCP) will include procedures to prevent and respond to spills.</p> <p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties during advancement of project design and planning.</p> <p>The GNWT will work with the Sahtú Renewable Resources Board (SRRB) and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.</p>
Dehcho First Nations reported concern about the consumption of potentially contaminated bear meat from bears that forage in dumps or other contaminated sites.	Dehcho First Nations, 2011	
Norman Wells Renewable Resources Council (NWRRC) study participants raised concerns about the effects of spills on wildlife health.	NWRRC, 2023	

Comment	Source	GNWT Response
Birds		
Important bird habitat and harvesting locations have been identified near the Project by Sahtú Dene and Métis, Pehdzéh Kì First Nation, Dehcho First Nations, and NWRRC and Tulita Renewable Resources Council (TRRC) study participants through project-specific TLRU studies.	5658 NWT Ltd. and GNWT, 2011 (PR#16); Dehcho First Nations, 2011; Dessau, 2012 (PR#13); IMG-Golder, 2006; NWRRC, 2023; SLUPB, 2013, 2022; TRRC, 2022	The GNWT has reviewed and considered the bird species of importance and important habitats and harvesting areas identified by Indigenous Governments, Indigenous Organizations, and specific other affected parties.
Engaged Indigenous Governments, Indigenous Organizations, and specific other affected parties identified bird species of importance.	Auld and Kershaw, 2005; Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; McDonald, 2010; NWRRC, 2023; TRRC, 2022; SRRB, 2007, 2021; SLUPB, 2013	
Local knowledge from TRRC and NWRRC study participants identified the proposed Great Bear River Bridge area and Bluefish Creek to Sucker Creek (chain of lakes) as important migration routes and habitat for migratory birds.	NWRRC, 2023; TRRC, 2022	The GNWT has identified mitigation measures to reduce effects on birds and bird habitat. Vegetation clearing will be done outside of the migratory bird nesting season. Wildlife monitors will assess for the presence of nesting birds on or near workspaces during project activities.
Sahtu Dene and Métis reported that Petinìzah (Bear Rock) CZ (Zone #32) provides habitat for a variety of bird species, including nesting areas for raptors. Dehcho First Nations and Pehdzéh Kì First Nation identified the Pehdzéh Kì N'deh area ¹ as important wetland habitat for waterfowl around the Wrigley area and north of Blackwater River. Dehcho First Nations and Pehdzéh Kì First Nation also identified all drainages intersecting the Project as potential waterfowl habitat.	SLUPB, 2013; Dessau, 2012 (PR#13)	The GNWT has identified mitigation measures to reduce effects on birds and bird habitat. The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties during advancement of project design and planning. The GNWT will work with SRRB and other resource managers to address uncertainty regarding the effects of increased access created by the Project on harvested resources in the study areas. This would include monitoring of harvest that can be used to identify the need for management actions to be taken by the appropriate resource management organization.

Comment	Source	GNWT Response
NWRRRC study participants reported that changes have been observed in bird migration and expressed concern that birds are moving in a different direction and are not observed as often in the TLRU study area as previously.	NWRRRC, 2023	
NWRRRC study participants communicated that birds stop along the Mackenzie Valley Winter Road to eat.	NWRRRC, 2023	
Community engagement participants reported that protection of songbirds and their respective habitat is a priority.	November 2022 to February 2023 Engagement	
TRRC study participants raised concerns about potential effects on waterfowl during construction and operations and maintenance along Great Bear River and explained that migration patterns have already shifted because of changing weather in the Sahtu Region.	TRRC, 2022	The proposed construction of the Great Bear River Bridge is not in the scope of the Project; however, the Project's WMMP will outline how risks to migratory birds will be managed during highway operations.
Caribou and Moose		
Indigenous Governments, Indigenous Organizations, and specific other affected parties identified important caribou habitat and harvesting areas within the Caribou and Moose LAA.	Dehcho First Nations, 2011; IMG-Golder Corporation, 2006; McDonald, 2011; SLUPB, 2013; NWRRRC, 2023	The GNWT has reviewed and considered the important habitats and harvesting areas identified by Indigenous Governments and Indigenous Organizations.
Indigenous Governments, Indigenous Organizations, and specific other affected parties identified important moose habitat and harvesting areas within the Caribou and Moose LAA.	Dessau, 2012 (PR#13); NWRRRC, 2023; SLUPB, 2013, 2022	

Comment	Source	GNWT Response
<p>Community engagement participants expressed concern about increased exposure of boreal caribou near Tulita along the MVWR.</p> <p>Community engagement participants expressed concern around lack of range and protection plans for moose and caribou.</p>	<p>April to July 2022 Engagement</p>	<p>The GNWT has identified mitigation measures to reduce the effects of the Project on moose and caribou.</p> <p>Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities.</p> <p>Currently, outfitters are not permitted to outfit moose or caribou harvest outside of outfitter zones in the mountains (GNWT, 2021b).</p>
<p>Dehcho First Nations and Pehdzéh Kì First Nation reported that caribou are more sensitive to habitat loss (than other wildlife), which increases exposure of boreal caribou to wolf predation. Concerns have been raised about the potential of future development and cumulative effects on harvesting boreal caribou for TLRU, in relation to increasing wolf predation and habitat loss.</p>	<p>Dehcho First Nations, 2011; IMG-Golder Corporation, 2006</p>	<p>Project personnel will be prohibited from hunting wildlife while staying in work camps for the Project.</p> <p>Personnel will not feed or harass wildlife while working on the Project.</p> <p>Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP.</p>
<p>The NWRRC and TRRC study participants reported that boreal caribou avoid the winter roads due to sensory disturbance (i.e., noise, pollution), and raised concerns about the effects of future road construction and operations, which have the potential to affect the availability and accessibility of caribou for cultural use within proximity of the highway. NWRRC participants raised concerns that land users will have to travel further to hunt boreal caribou once the Project is underway.</p>	<p>NWRRC, 2023; TRRC, 2022</p>	<p>The highway alignment will reflect community engagement input to the extent practicable.</p> <p>The GNWT is committed to ongoing engagement with Indigenous Governments, Indigenous Organizations, and other affected parties during advancement of project design and planning.</p>

Comment	Source	GNWT Response
<p>Dehcho First Nations and Pehdzéh Kì First Nation, NWRRC and TRRC TLRU study participants reported that caribou are more sensitive to development activities (than other wildlife). Concerns have been raised about the potential of future development and cumulative effects on harvesting boreal caribou for TLRU, including increased non-resident hunters.</p> <p>Community engagement participants reported that in the past caribou would come close to or in Mackenzie River (Deh Cho) from the east side, but now caribou are moving further away due to disturbances.</p>	<p>Dehcho First Nations 2011; IMG-Golder Corporation, 2006; NWRRC, 2023; TRRC, 2022; April to July 2022 Engagement</p>	
<p>Dehcho First Nations and Sahtu community members and NWRRC study participants reported that potential project effects on moose along the MVWR and within the Caribou and Moose LAA include increased hunting pressure by non-resident hunters and increased fatalities of moose because of increased traffic in the area.</p>	<p>NWRRC, 2023; Dessau, 2012 (PR#13)</p>	
<p>NWRRC study participants reported that potential project effects on moose include the effect of noise and existing effects on moose in the TLRU study area. The intensity of noise can affect the level of response in wildlife, particularly moose.</p> <p>Community engagement participants expressed concern about blasting activities scaring the moose.</p>	<p>NWRRC, 2023; November to December 2022 Engagement</p>	

Comment	Source	GNWT Response
Dehcho First Nations reported potential pathways which may influence moose, including direct disturbance to calving habitats and preferred habitats (for preferred food, i.e., lichens) such as wetlands and marshes, as well as migration routes and corridors.	Dehcho First Nations, 2011; McDonald, 2010	
Community engagement participants expressed concern for wildlife, in particular moose habitat, as the new all-season road may result in poaching. Participants expressed that there is increasing importance to protect country food access, including moose and moose habitat.	April to July 2022 Engagement	
Community engagement participants stated that easier access to game is not a bad thing as long as people are not overharvesting; this applies not just to sustenance harvesters but recreational harvesters as well. Participants requested that the GNWT consult with experienced hunters on the proposed route to avoid important habitat, including caribou mating grounds.	April to July 2022 Engagement	
Community engagement participants expressed concern about the creation of borrow sources and their effects on key species such as moose and caribou; participants requested that moose habitats, such as willow and little creeks, be maintained. Engagement participants recommended that the Project be rerouted around moose pastures.	April to July 2022 Engagement	

Comment	Source	GNWT Response
<p>Community engagement participants explained that caribou avoid culverts and migrate around them because the noise of the wind tunneling through the culverts scares them away. The land has natural vibrations and when there are heavy loads traveling on the road, more vibration is created. Participants requested that vibration levels be monitored before and after construction.</p>	<p>November to December 2022 Engagement</p>	
<p>Community engagement participants stated that there may be an increase of hunters along the highway, in addition to wildlife effects as a result of building the road and vehicles travelling down the road; they recommended a 5- or 10-year moratorium on hunting to protect and monitor the baseline of the caribou and the moose, explaining that the outfitters in the mountains are going after the big ones and will now have new access.</p>	<p>November 2022 to February 2023 Engagement</p>	
<p>Study participants reported instances of non-resident workers in the Caribou and Moose LAA releasing wildlife from traps and feeding wildlife. NWRRC expressed concern about feeding wildlife because wildlife will look forward to human interaction and may need to be put down.</p>	<p>NWRRC, 2023</p>	

1.4 Associated Operational and Management Plans

Other operational and management plans that have been developed for the Project will be used to mitigate potential effects on wildlife and wildlife habitat including:

- Erosion and Sedimentation Control Plan
- Explosives Management Plan
- Quarry Development Plans for each borrow source and quarry
- Permafrost Protection Plan
- Spill Contingency Plan
- Waste Management Plan, including Incinerator Management Plan

1.5 Statutory Requirements and Guidelines

Federal and Northwest Territories Acts and regulations that apply to wildlife in relation to the Project are summarized in Table 1.3. A detailed description of relevant sections of the *Wildlife Act* are provided in Appendix A.

Table 1.3 Summary of Federal and Territorial Regulatory Requirements Applicable to Wildlife and Wildlife Habitat

Legislation/Regulations	Responsible Agency	Requirements
<i>Species at Risk Act</i> (SARA)	ECCC	Species at risk and their habitats are protected under SARA, which prohibits: (1) the killing, harming, or harassing of endangered or threatened species at risk (SAR; SARA sections 32 and 36); and (2) the destruction of critical habitat of and endangered or threatened SAR (SARA sections 58, 60, and 61).
<i>Migratory Birds Convention Act</i> (MBCA) and Migratory Birds Regulations, 2022	ECCC	<p>The MBCA, and Migratory Birds Regulations (MBR), prohibits the capture, killing, taking, injuring or harassment of a migratory bird as well as the disturbance, destruction, or taking of a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird. However, a nest may be disturbed if the nest does not contain a live bird or viable egg with the exceptions of 18 bird species listed on Schedule 1 (e.g., pileated woodpecker), which are protected year- round under the modernized MBR 2022.</p> <p>The protection of birds under the Act is afforded to all native bird species expected to occur in the assessment areas, except upland gamebirds, raptors, belted kingfisher, owls, corvids, and icterid blackbirds, which are protected under territorial legislation.</p>

Legislation/Regulations	Responsible Agency	Requirements
<i>Wildlife Act</i>	GNWT-ECC	The <i>Wildlife Act</i> provides general provisions for regulating the activities relating to the harvest and protection of wild animals in NWT. Section 1(1) defines “wildlife” as “all species of vertebrates and invertebrates found wild in nature in the Northwest Territories,” and Section 51(1) includes protections for birds and bird nests.
<i>Species at Risk (NWT) Act</i>	GNWT-ECC	<p>The <i>Species at Risk (NWT) Act</i> sets out the processes to assess, list, protect and recover species at risk specifically for the Northwest Territories (NWT). The <i>Species at Risk (NWT) Act</i> applies to any wild animal or plant species managed by the GNWT. It applies on both public and private lands, including private lands owned under a land claims agreement.</p> <p>The <i>Species at Risk Act</i> and the <i>Species at Risk (NWT) Act</i> are designed to work in a complementary fashion with other legislation and cooperatively with Indigenous people to protect species at risk and their habitats (GNWT 2022a).</p>
Mackenzie Valley Land Use Regulations	Mackenzie Valley Land and Water Board	Land use permits may include provisions for the protection of wildlife habitat.
Sahtu Land Use Plan (Sahtú Land Use Planning Board [SLUPB], 2013)	SLUPB	<p>General Conformity Requirements (CR), specifically:</p> <p>CR#7. Fish and Wildlife</p> <p>1) Land use activities must be designed using the most current information for identified species of interest and species at risk as obtained from the GNWT-ENR ([now Environment and Climate Change [ECC]), CWS, DFO, PCA, the SRRB and the local RRCs.</p> <p>2) Impacts to wildlife, their habitat and migration patterns, and important community harvesting areas must be prevented or mitigated to the extent possible.</p> <p>a) In particular, all reasonable steps should be taken to follow the horizontal setbacks and minimum flight altitudes identified in Table 4 [of the SLUP] when near habitat sites during sensitive periods described in that table, unless human safety is of concern, and measures are developed with the appropriate organizations and the RRC to mitigate impacts to these species and their habitat.</p> <p>b) In addition, DFO has established in-water construction timing windows for the protection of fish and fish habitat. These are updated from time to time and are available at http://www.dfo-mpo.gc.ca/regions/central/habitat/oseo/provinces-territories-territoires/nt/os-eo21-eng.htm. During these periods, no in-water work or shoreline work is allowed except under site- or project-specific review and with the implementation of protective measures.</p>

Legislation/Regulations	Responsible Agency	Requirements
<p>Sahtu Land Use Plan (Sahtú Land Use Planning Board [SLUPB], 2013) (cont'd)</p>	<p><i>See above</i></p>	<p>c) Barren-ground caribou and woodland caribou are especially important to communities and have been shown to be sensitive to disturbance. Map 3 [of the SLUP] shows important rutting and wintering habitat for barren-ground caribou (Oct 8-Mar 31), boreal and mountain woodland caribou range, and the summer habitat of the South Nahanni Herd of Mountain Woodland Caribou. All land use activities occurring in these areas during the specified times are required to address impacts to caribou and their habitat.</p> <p>CR#8. Species Introduced</p> <p>Land use activities must not result in the intentional introduction of non-native plant and animal species, or of domestic animal species or subspecies, except by special approval by the appropriate authority. All reasonable precautions must be taken to prevent the introduction of non-native species or sub-species.</p> <p>CR#9. Sensitive Species and Features</p> <p>1) Any land use activity requiring a land use permit or water license must be designed using the most current available information on the location of rare or may-be-at-risk plants, hot and warm springs, mineral licks, karst topography, amphibian sightings, and ice patches and carried out in a manner that minimizes impacts to these features.</p> <p>2) Specifically, land use activities:</p> <p>a) must not take place within 1,000 m of any known mineral lick, unless the activity cannot feasibly meet this requirement, and it can be demonstrated that alternative mitigation measures will protect the lick</p> <p>b) that are situated within the boundary of glacial refugia or within 500 m of known hot or warm springs and have the potential to impact rare or maybe-at-risk plants shall require a plant survey. Any rare or maybe-at-risk plants found in the survey shall be monitored for impacts from the activity.</p> <p>c) situated within the area of ice patches identified in Map 4 [of the SLUP]</p> <p>3) The location of any hot or warm spring or mineral lick discovered while carrying out an authorized activity must be reported to nwt_pas@gov.nt.ca and any amphibian sightings to nwtsoer@gov.nt.ca.</p>

Legislation/Regulations	Responsible Agency	Requirements
Sahtu Land Use Plan (Sahtú Land Use Planning Board [SLUPB], 2013) (cont'd)	<i>See above</i>	<p>CR#11. Project-specific Monitoring</p> <p>Any land use activity requiring a land use permit or water license must include site-specific monitoring, that is sufficient to monitor the effectiveness of the activity's proposed mitigation measures and any impacts to the values in the surrounding area, as defined in the Plan's Background Report, zone descriptions and in discussions with communities.</p> <p>CR#14. Protection of Special Values</p> <p>Any land use activity proposed within a Special Management Zone, Conservation Zone or Proposed Conservation Initiative must be designed and carried out in a manner that protects, respects, or takes into account the values of the zone as directed in the Plan's Zone Descriptions.</p>

Other guidelines and documents that were considered in the preparation of this WMMP include the following:

- Wildlife Management and Monitoring Plan (WMMP): Process and Content Guidelines (GNWT, 2021a)
- Northern Land Use Guidelines (GNWT, 2015)
- Species Status Report Boreal Caribou (*Rangifer tarandus caribou*) in the Northwest Territories. May 2022. Yellowknife, Northwest Territories (SARC, 2022)
- Guidelines for Exploration and Development Projects in Boreal Caribou Habitat in the Northwest Territories (GNWT, 2022b)
- A Framework for Boreal Caribou Range Planning (GNWT, 2019)
- Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada (EC, 2012)
- Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada (ECCC, 2018a)
- Management Plan for Bats in the Northwest Territories. Conference of Management Authorities, Yellowknife, NT (CMA, 2020)

2 Project Overview

2.1 Project Description

The Project is the extension of the Mackenzie Highway (Northwest Territories Highway #1) between Hodgson Creek (located approximately 1 km north of Wrigley) and Prohibition Creek (located approximately 28 km southeast of Norman Wells) to replace the MVWR in this section. The Project is located on public lands and Sahtu Settlement Lands within the Dehcho Region and the Tulita District of the Sahtu Region, as shown in Figure 1.1.1 to Figure 1.1.3. As segments of the highway are constructed and opened for public use, corresponding segments of the MVWR will be closed and reclaimed.

The Project includes the following physical works and activities:

- Widening of the existing cleared MVWR right-of-way (ROW) and clearing of intermittent sections of new ROW to a width of 60 metres (m)
- Construction of approximately 281 km of new all-season gravel highway embankment (102 km in Dehcho Region, 179 km in Sahtu Region) and intermittent pullouts
- Construction of approximately 85 culverts as watercourse crossing structures
- Construction and operation of approximately 15 borrow sources and quarries and associated all-season access roads
 - 6 temporary borrow sources and quarries to be used for construction only
 - 9 permanent borrow sources and quarries to be used for construction, and operations and maintenance
- Water withdrawal and water use for road construction and maintenance
- Construction and operation of temporary support infrastructure and workspaces, including camps, maintenance yards, laydown and staging areas, and fuel storage areas
- Staging, supply, and resupply of equipment, materials, fuel, and personnel
- Construction and operation of permanent maintenance yards
- Closure and reclamation of temporary borrow sources, quarries, and workspaces
- Demobilization of equipment and materials
- Closure and reclamation of portions of the MVWR ROW not used for the Project
- Operations and maintenance activities including snow clearing, grading, dust control, and bridge and culvert maintenance
- Use of the highway by the public

The Project does **not** include:

- Construction of the Great Bear River Bridge and access, which is considered a reasonably foreseeable project
- Operations and maintenance of the MVWR as required for public safety, including repair or upgrades of existing watercourse crossing structures, until such time that the Mackenzie Valley Highway (the Project) replaces the MVWR
- Use of existing and authorized municipal, commercial, or public infrastructure or services, such as municipal solid waste and wastewater facilities, transportation services and the MVWR

2.2 Spatial and Temporal Boundaries

2.2.1 Spatial Boundaries

The Project Development Area (PDA), Local Assessment Area (LAA), and Regional Assessment Area (RAA) were used to assess potential project effects and cumulative effects on wildlife and wildlife habitat (Figure 2.1). These spatial boundaries are included in this WMMP because proposed mitigation measures and monitoring programs vary by spatial scale.

- **Project Development Area (PDA):** The area of direct project disturbance within which works and activities will occur (footprint). This includes a new two-lane gravel highway, 60 m wide highway ROW mostly following the MVWR, laydown and staging areas, maintenance yards, construction camps, and quarry/borrow sites with access roads on a 30 m ROW.
- **Local Assessment Area (LAA):** The area within which measurable project-related effects (direct or indirect) are expected to occur. This is a 1 km buffer around the preliminary road alignment (as the centreline of an Alignment Routing Corridor), except around quarries where the LAA is a 2 km buffer around the PDA. The size of the buffer is based on measurable effects of noise on wildlife (e.g., Benitez-Lopez et al., 2010; Shannon et al., 2016) while also considering recommended setback distances for wildlife and wildlife habitat features (Appendix B; GNWT, 2015). The size of the LAA is also consistent with guidance provided by ECCC (Dufour, 2020, pers. comm.). For caribou and moose, the LAA is the area within approximately 15 km of the PDA (the Caribou and Moose LAA).
- **Regional Assessment Area (RAA):** The area that provides context for determining the significance of project-specific effects and potential cumulative effects. The RAA is a 15 km buffer of the PDA that is used to capture a wide range of wildlife and bird species and habitats that could be potentially affected cumulatively by the Project and other past, present, and reasonably foreseeable projects. The size of the RAA is consistent with other highway projects in the NWT (e.g., Inuvik to Tuktoyaktuk Highway [Kiggiak - EBA Consulting Ltd., 2011]) and follows recommendations from Environment and Climate Change Canada (ECCC; Dufour, 2020, pers. comm.).

2.2.2 Temporal Boundaries

Construction phase: The Project will take approximately 10 years to construct, over a timeframe of up to 20 years. The construction schedule is conceptual and reflects a phased approach to construction, such that the Project is not likely to be constructed as a single, continuous project. The conceptual schedule assumes the highway will be constructed in three segments: Wrigley north to the Dehcho/Sahtu border (102 km), Tulita south to the Dehcho/Sahtu border (134 km), and Tulita north to the Prohibition Creek Access Road (45 km).

Operations and maintenance phase: The operations and maintenance phase of the Project will likely commence in a similarly staged approach once construction of a particular segment has been completed. The operations and maintenance phase is considered indeterminate as the Project will not be decommissioned.

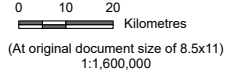
There is no closure and reclamation phase, as areas no longer needed for construction or operations and maintenance will be closed and reclaimed during the construction phase.

2.3 Project Map

The Project's location and wildlife assessment boundaries are shown in Figure 2.1.



- Proposed Mackenzie Valley Highway Alignment - Issued for EA 2022
- Granular Borrow / Rock Quarry Site and Access
- Wildlife Local Assessment Area
- Wildlife Regional Assessment Area and Caribou and Moose Local Assessment Area
- Community
- All-Season Road
- Winter Road
- District Boundary
- - - Region Boundary
- Settlement Area Boundary



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0182 REVA

Government of Northwest Territories
 Mackenzie Valley Highway Project
 Figure No. **2.1**
Wildlife, Caribou and Moose Local and Regional Assessment Areas
DRAFT

Notes
 1. Coordinate System: NAD 1983 Northwest Territories Lambert
 2. Data Sources: Centre of Geomatics of Government of NWT, Government of Canada, Stantec
 3. Background: World Topographic Map: Esri, FAO, NOAA, USGS, NRCAN
 World Imagery: Earthstar Geographics
 World Hillshade: Esri, USGS

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3 Project Effects

3.1 Wildlife Species at Risk and Conservation Concern

The WMMP focuses on wildlife species at risk and species of conservation concern that are known to occur in the RAA including wildlife species or species groups that have harvesting, cultural or economic value (e.g., moose, waterfowl). Culturally important wildlife and bird species identified by Indigenous Governments, Indigenous Organizations, and other affected parties are provided in Appendix B.

Wildlife habitat in the Dehcho Region portion of the LAA is dominated by coniferous forest (43.6%), wetlands (19.8%), and open water (19.3%), while the LAA that overlaps the Sahtu Region is dominated by coniferous forest (28.7%), wetlands (25.2%), and shrubland (20.6%). Between 1960 and 2019, 18.5% of the LAA within the Dehcho Region and 75.2% of the LAA within the Sahtu Region has been subject to forest fire (Appendix 18A; K’alo-Stantec 2022).

The RAA has potential to provide habitat for 202 bird species, 42 mammals, 2 amphibians, and numerous invertebrate species (GNWT, 2020a). The RAA is also within the range of 11 bird species at risk (SAR)/species of conservation concern (SOCC), 5 mammal SAR/SOCC, and 4 invertebrate SAR/SOCC (Table 3.1; GNWT, 2020a, 2020b; GNWT 2022a, Government of Canada, 2023).

Table 3.1 Wildlife Species at Risk and Species of Conservation Concern (*) with Potential to Occur in the Regional Assessment Area

Species		Status in NWT ¹		Status in Canada ²	
Common Name	Scientific Name	SARC Assessment	Species at Risk (NWT) Act	COSEWIC	SARA
Birds					
Yellow rail	<i>Coturnicops noveboracensis</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Lesser yellowlegs*	<i>Tringa flavipes</i>	Not Applicable	Not Applicable	Threatened	Not Listed
Red-necked phalarope	<i>Phalaropus lobatus</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Short-eared owl	<i>Asio flammeus</i>	Not Assessed	No Status	Threatened	Special Concern
Common nighthawk	<i>Chordeiles minor</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Olive-sided flycatcher	<i>Contopus cooperi</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Bank swallow	<i>Riparia riparia</i>	Not Applicable	Not Applicable	Threatened	Threatened

Species		Status in NWT ¹		Status in Canada ²	
Common Name	Scientific Name	SARC Assessment	Species at Risk (NWT) Act	COSEWIC	SARA
Barn swallow	<i>Hirundo rustica</i>	Not Applicable	Not Applicable	Special Concern	Threatened
Harris's sparrow*	<i>Zonotrichia querula</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Rusty blackbird	<i>Euphagus carolinus</i>	Not Assessed	No Status	Special Concern	Special Concern
Horned grebe	<i>Podiceps auritus</i>	Not Applicable	Not Applicable	Special Concern	Special Concern
Mammals					
Little brown myotis	<i>Myotis lucifugus</i>	Special Concern	Special Concern	Endangered	Endangered
Grizzly bear	<i>Ursus arctos</i>	Special Concern	Not Listed	Special Concern	Special Concern
Wolverine	<i>Gulo</i>	Not at Risk	Not Listed	Special Concern	Special Concern
Boreal caribou ¹	<i>Rangifer tarandus caribou</i>	Threatened	Threatened	Threatened	Threatened
Barren-ground caribou ¹	<i>Rangifer tarandus groenlandicus</i>	Threatened	Threatened	Threatened	Not Listed
Invertebrates					
Gypsy cuckoo bumble bee	<i>Bombus bohemicus</i>	Data deficient	Not Listed	Endangered	Endangered
Suckley's cuckoo bumble bee*	<i>Bombus suckleyi</i>	Not Assessed	Not Listed	Threatened	Not Listed
Yellow-banded bumble bee	<i>Bombus terricola</i>	Not at Risk	Not Listed	Special Concern	Special Concern
Transverse lady beetle	<i>Coccinella transversoguttata</i>	Not Assessed	Not Listed	Special Concern	Special Concern

Notes:

- ¹ Species at risk in NWT assessed by the Species at Risk Committee (SARC) and listed under the territorial *Species at Risk (NWT) Act* (CMA, 2023). Not applicable: *Species at Risk (NWT) Act* does not apply to this species (CMA, 2023)
- ² Species at risk in Canada assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed under Schedule 1 of the federal *Species at Risk Act* (Government of Canada, 2023)
- * Species of conservation concern are defined as species listed as special concern, threatened, or endangered by the NWT Species at Risk Assessment Committee (CMA, 2023) or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; Government of Canada, 2023).

3.2 Wildlife and Wildlife Habitat

Construction and operation of the Project will result in residual effects on wildlife VCs including direct habitat loss and alteration, indirect habitat loss due to sensory disturbance (e.g., noise, lights, dust), changes in wildlife movement, increased mortality risk (including harvesting) and potential changes to wildlife health. Proposed mitigation measures and monitoring programs designed to avoid or reduce potential project effects on wildlife and wildlife habitat are provided in Section 4 and Section 5 respectively.

3.3 Affected Species or Habitat Features

The Project has potential to directly and/or indirectly affect wildlife SAR, SOCC as well as species that have cultural importance to Indigenous Governments, Indigenous Organizations, and other affected parties. The Project also has potential to affect wildlife habitat features (e.g., raptor nests, dens) that these wildlife species depend on to meet seasonal habitat requirements.

Many wildlife species are culturally important to local communities for subsistence hunting and trapping (Auld and Kershaw, 2005; DLUPC, 2006; SLUPB, 2013; SRRB, 2021). Historical records exist within the LAA and RAA for 11 of 12 SAR/SOCC (all but yellow rail) with the potential to occur in the RAA and all mammal and invertebrate SAR/SOCC (Government of Canada, 2023; GNWT, 2022a, 2020b, 2020c; eBird, 2020; ECCC, 2020a).

The LAA is partially within the Middle Mackenzie River Important Bird Area (IBA) that provides staging and migration habitat for migratory birds, especially waterfowl and other waterbird species (IBA Canada, 2020). There are relatively high concentrations of raptor nests in the Bear Rock Conservation Zone (CZ), which is a culturally sacred site that occurs in the RAA (SLUPB, 2013; GNWT, 2020c). Other sensitive features for birds such as nests, primarily for raptors, are located throughout the LAA and RAA (GNWT, 2020c).

3.4 Caribou and Moose

The caribou and moose VC encompasses the boreal ecotype of woodland caribou (*Rangifer tarandus caribou*; referred to as boreal caribou), barren-ground caribou (*Rangifer tarandus groenlandicus*) of the Bluenose-East (BNE) herd, and moose. The current annual range of barren-ground caribou of the Bluenose-East herd does not overlap the Caribou and Moose LAA. However, linear features, such as roads and trails, may improve hunter access to previously inaccessible areas, which may result in additional harvest and associated increase in mortality. As such, monitoring access and harvest as it relates to barren-ground caribou is addressed in this WMMP (see Section 5.2.8).

Construction and operations and maintenance of the Project could result in a direct loss (through vegetation clearing) and/or indirect loss (through sensory disturbance) of caribou and moose habitat. In addition, the Project could alter caribou and moose movement patterns as well as increase mortality risk through direct pathways (e.g., vehicle and equipment collisions) and indirect pathways (e.g., increased harvesting and predation). The Project could also expose caribou and

moose to contaminants or emissions that may affect their health and condition. The Project might also result in changes to their energetics and physical condition due to sensory disturbance, increased predation, and increased hunting pressure.

The federal recovery strategy for boreal caribou (ECCC, 2020b) identifies that boreal caribou require 65% undisturbed habitat in their range to maintain a self-sustaining local population (i.e., no more than 35% disturbed habitat). Accounting for fires ≤ 40 years old, and existing anthropogenic disturbances plus a 500 m buffer, there is a combined existing disturbance of 527,867 ha (52.2%) in the Caribou and Moose LAA. The current level of cumulative habitat disturbance in the Caribou and Moose LAA exceeds the 35% threshold identified by ECCC.

Applied at a different scale, there is 3,114,409 ha (20.9%) of disturbed habitat in the Sahtu Range Planning Region of the NT1 caribou range (below the conservation threshold), and 7,584,904 ha (46.7%) of disturbed habitat in the Southern NT1 Range Planning Region (above the threshold). The NT1 region as a whole has 13,730,535 ha (31.0%) of disturbed habitat (below the threshold).

The Project is expected to increase the existing total disturbance area by 0.003% (NT1 range), 0.004% (Sahtu Range Planning Region), 0.006% (Southern NWT Range Planning Region) and by 0.15% in the Caribou and Moose LAA. Regardless, there is a pre-existing high magnitude habitat effect in the Caribou and Moose LAA and the Southern NT1 Range Planning Region. The Project will contribute to an existing significant effect and the exceedance of a conservation-based threshold.

4 Mitigation Measures

The WMMP describes mitigation measures and monitoring programs to reduce predicted effects (e.g., direct and indirect habitat loss) on wildlife for each project effects pathway including change in habitat, change in movement, change in mortality risk, and change in wildlife health. The WMMP links mitigation measures (Section 4) to mitigation monitoring (Section 5.1) and wildlife effects monitoring (Section 5.2) to adaptive management actions (Section 6). Mitigation measures have been developed to reduce potential effects of the Project on wildlife using current standard practices on other NWT roads and highways, best practices or guidelines listed in Section 1.5, recommendations provided to the developer through the environmental assessment, as well as Traditional Knowledge and TLRU studies as applicable (TRRC, 2022; NWRRC, 2023).

4.1 Education and Training

Personnel will undergo a wildlife awareness program, which will include measures to reduce wildlife mortality (e.g., bear safety) and reporting procedures for wildlife-related incidents and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms included in the WMMP. Project staff will also be required to complete GNWT's Migratory Bird Awareness Training Webinar and obtain a certificate of completion.

Contractor(s) hired for road construction and maintenance will be responsible for educating and training project staff on applicable practices contained within the WMMP. All training will be documented and recorded in the WMMP Annual Report. Information provided to contract employees during training and prior to starting work will include:

- Review of project mitigation and operating protocols (e.g., wildlife right of way and speed limits)
- An understanding of wildlife response protocols including reporting requirements and procedures related to wildlife observations, wildlife incidents, and wildlife related accidents
- Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety) and reporting procedures for wildlife-related incidents and protocols to follow when a nest, den, or wildlife species of management concern is observed.
- Instruction to project staff to report wildlife observations using the Wildlife Sightings Log, and to report any incidents or concerns immediately to the Environmental Monitors
- Review of the requirements of the *Migratory Birds Convention Act* and *Wildlife Act*, which will include instructions not to disturb any birds or nests of observed birds and to immediately report discovered or observed nests to the Environmental Manager

- Directives that project personnel will be prohibited from hunting and fishing while housed in work camps for the Project
- Instructions on waste and wildlife attractant management including the implications of wildlife human-habituation, food conditioning, and unsecured wildlife attractants

4.2 Direct Habitat Loss and Alteration

Mitigation measures to avoid or reduce direct habitat loss or alteration include the following:

- Existing access and previously disturbed areas will be used for project infrastructure and workspaces, to the extent practical.
- Clearing will be limited to areas required for construction and safe operations.
- Travel of vehicles will be confined to existing roads and trails to avoid disturbing vegetated areas.
- Removal of vegetation will be limited to the width of the ROW and workspaces.
- The WMMP will be complied with in relation to species of birds not under GNWT's authority in addition to species under GNWT's authority.
- If an active bird nest is found, beneficial management practices (GNWT, 2020c) will be followed, including applying an appropriate setback and timing restriction and Government of the Northwest Territories - Environment and Climate Change (GNWT-ECC) and/or ECCC will be consulted, as appropriate.
- Vegetation buffers will be used as visual barriers and to protect riparian vegetation, as appropriate.
- Organic material and topsoil will be set aside for use during reclamation, where possible.
- Erosion and sedimentation control measures will be implemented per the Project Erosion and Sedimentation Control Plan and will be in place prior to construction activities and before the spring melt/freshet.
- Beaver dam removal will be done in accordance with the code of practice: Beaver dam breaching and removal (DFO, 2022) and conditions of a GNWT General Wildlife Permit.
- Drainage culverts will be constructed along the roadway to facilitate water movement and maintain drainage patterns.
- Riparian vegetation will be maintained whenever possible.
- A dust control program using water will be implemented during construction and operations.
- Temporary access roads, quarries, and workspaces not needed after construction will be closed and reclaimed.
- Closure and reclamation will promote re-establishment of vegetation.
- Site grading at closure will approximate pre-development conditions.

4.3 Indirect Habitat Loss (Sensory Disturbance)

The following mitigation measures will be implemented to reduce potential project-related indirect habitat loss due to sensory disturbance (e.g., noise, lights, dust). Construction and quarry development activities will adhere to the applicable recommended setbacks and timing restrictions for wildlife, where possible (see Appendix C).

- Vegetation clearing will be completed outside the core maternity roosting period for bats (May 1 to August 31). If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to determine bat occupancy before removal.
- Vegetation clearing will be completed outside the migratory bird nesting period of May 4 to August 22 (Zone B8; ECCC, 2018b) and will consider the Critical Breeding Periods for Raptor Species of the Northwest Territories (Shank and Poole, 2016) to avoid disturbing species that breed prior to the migratory bird nesting periods. If activities that could result in risk of harm to migratory birds cannot be avoided, pre-clearing nest surveys will be completed in accordance with ECCC's Guidelines to Reduce Risk to Migratory Birds (ECCC, 2022) and Beneficial Management Practices in the NWT (GNWT, 2020c).
- The WMMP will be complied with in relation to species of birds not under GNWT's authority in addition to species under GNWT's authority.
- If an active bird nest is found, beneficial management practices (GNWT, 2020c) will be followed, including applying an appropriate setback and timing restriction and Government of the Northwest Territories - Environment and Climate Change (GNWT-ECC) and/or ECCC will be consulted, as appropriate.
- Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities.
- Wildlife monitors will assess for the presence of nesting birds on or near workspaces during project activities.
- Vehicle speeds will be limited to 50 kilometres per hour (km/h) on unfinished project road surfaces.
- Vehicles and equipment will be equipped with manufacturer-recommended noise muffling equipment.
- A dust control program using water will be implemented during construction and operations.
- A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads.

4.4 Wildlife Movement

The following mitigation measures will be implemented to reduce potential effects on wildlife movement.

- The Project will apply a 3:1 slope ratio to normal highway embankment side slopes.
- Vegetation buffers will be used as visual barriers and to protect riparian vegetation, as appropriate.
- Equipment idling will be discouraged or limited.
- Project vehicles will be operated on designated workspaces or existing roads only.
- The height of snowbanks will be limited to the extent possible and to a height of less than 1 m.
- Blasting activities will be limited to daytime hours, to the extent practical.
- A buffer strip of undisturbed vegetation of at least 30 m wide will be maintained between cleared areas and public roads.
- Drainage culverts will be constructed along the roadway to facilitate water movement and maintain drainage patterns.
- Quarry operations will be located a minimum of 100 m from the ordinary high-water mark of any waterbody.
- Construction and quarry development activities will adhere to the applicable recommended setbacks and timing restrictions for wildlife outlined in this WMMP (Appendix C), where possible.
- Breaks of approximately 10 m in width should be left in windrows at approximately 300 m intervals to reduce blockage of wildlife movement.
- Wildlife monitors will assess the presence of wildlife on or near the PDA during project activities.
- Closure and reclamation will promote establishment of vegetation.
- Site grading at closure will approximate pre-development conditions.
- Borrow source vegetated surface material, where present, will be replaced after development is completed.
- Vehicles and equipment will be equipped with manufacturer recommended noise muffling equipment.
- Construction and quarry development activities will be reduced, where possible and where spatial overlap is expected, during sensitive periods for wildlife.
- Temporary access roads, quarries and workspaces not needed after construction will be closed and reclaimed.

4.5 Mortality Risk

Construction and quarry development activities will adhere to the applicable recommended setbacks and timing restrictions for wildlife, where possible. Recommended timing restrictions to protect wildlife during sensitive periods (e.g., nesting, denning) are listed in Appendix C. Timing restrictions are mitigation measures designed to avoid or reduce sensory disturbance and/or risk of wildlife injury or mortality. The following mitigation measures will be implemented to reduce potential direct and/or indirect mortality on wildlife.

- Project infrastructure and camp layout will be designed to reduce potential wildlife-human conflict (e.g., bear safety) and/or prevent denning, nesting, and roosting through the application of deterrents (see Section 4.7).
- The Project will use previously disturbed areas for project infrastructure and workspaces, to the extent practical.
- Clearing will be limited to areas required for construction and safe operations.
- Removal of vegetation will be limited to the width of the ROW and workspaces.
- Project vehicles will be confined to existing infrastructure roads and trails as much as possible to avoid disturbing vegetated areas.
- Pre-construction surveys will be completed to identify potential wildlife habitat features within recommended setback distances along the ROW (e.g., nests, dens, mineral licks).
- Vegetation clearing will be completed outside the core maternity roosting period for bats of May 1 to August 31. If habitat tree removal or general tree clearing is required during the maternity roosting period, a qualified biologist will review the trees to determine bat occupancy before removal.
- Vegetation clearing will be completed outside the migratory bird nesting period of May 4 to August 22 (Zone B8; ECCC, 2018b) and will consider the Critical Breeding Periods for Raptor Species of the Northwest Territories (Shank and Poole, 2016) to avoid disturbing species that breed prior to the migratory bird nesting periods.
- If activities that could result in the risk of harm to migratory birds cannot be avoided, pre-clearing nest surveys will be completed in accordance with ECCC's Guidelines to Reduce Risk to Migratory Birds (ECCC, 2022) and Beneficial Management Practices for Migratory Birds in the NWT (GNWT, 2020c).
- If an active bird nest is found, beneficial management practices (GNWT, 2020c) will be followed, including applying an appropriate setback and timing restriction and GNWT-ECC and/or ECCC will be consulted, as appropriate.
- Personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality (e.g., bear safety), reporting procedures for wildlife-related incidents, and protocols to follow when a nest, den, or wildlife species of management concern is observed. This includes completing wildlife sighting and wildlife incident report forms.

- Construction and quarry development activities will be reduced, where possible and spatial overlap is expected, during sensitive periods for wildlife.
- Wildlife monitors will assess for the presence of wildlife on or near the PDA during project activities.
- An electric fence will be set up around temporary camps if deemed necessary to deter wildlife.
- Project personnel will be prohibited from hunting and fishing while housed in work camps for the Project.
- Personnel will not feed or harass wildlife while working on the Project.
- Construction and quarry development activities will be limited during sensitive periods for wildlife (see Appendix A).
- Public access to borrow sites and quarries and associated access routes will be restricted.
- Vehicle speeds will be limited to 50 km/h on unfinished project road surfaces.
- Big game species (e.g., caribou, moose, muskox) will have the right of way on all project infrastructure.
- Wildlife crossing locations will be identified and marked.
- Food and other wildlife attractants will be stored in bear-proof containers.
- Food waste will be stored and disposed of in a manner to avoid attracting wildlife.

4.6 Wildlife Health

Construction and operations and maintenance of the Project could increase hazards to wildlife (e.g., open pits, borrow sources, tailings ponds, roads, airstrips) including exposure to contaminants or other emissions that may affect the health and condition of wildlife. The following mitigation measures will be implemented to reduce potential hazards to wildlife.

- The Spill Contingency Plan will include procedures to prevent and respond to spills, including:
 - Fuel will be stored in containers with secondary containment capable of containing 110% of the largest container.
 - Fuel handling and refueling will be in accordance with an Operating Procedures.
 - Areas and containers used to store project wastes will be constructed, operated, and maintained in a manner to prevent waste from discharging to the surrounding environment.
 - Maintenance yards will have a liner or concrete installed under areas of vehicle storage and maintenance.
 - Vehicles parked for more than 2 hours will use drip trays.
- A project-specific Erosion and Sedimentation Control Plan will be developed and implemented.

- Sediment control measures will be in place prior to construction activities and before the spring melt/freshet.
- Sediment and erosion control measures will be regularly inspected to confirm they are performing as intended.
- Ponded water will be directed away from watercourses.
- Material with acid rock drainage and metal leaching (ARD/ML) potential will not be used for the Project.
- Rip rap will be free of silt and other debris.
- Riparian vegetation will be maintained whenever possible.
- Excavated spoil material will be disposed of at least 30 m from the watercourse.
- Snow fill temporary crossings will be constructed of clean snow fill.
- Machinery on-site will be in a clean condition and free of invasive species and noxious weeds.
- Washing, refueling, and servicing machinery and storage of fuel and other materials for machinery will be conducted a minimum of 100 m from the high-water mark and in a manner to prevent any deleterious substances from entering the water.
- Machinery will not be left in any waterbody.
- Quarry operations will be located a minimum of 100 m from the ordinary high-water mark of any waterbody.
- Blast rock will not enter a waterbody or watercourse.
- Material stockpiles will be kept a minimum of 30 m from a watercourse or waterbody with the appropriate erosion control mitigation in place to prevent sediment from entering a watercourse or waterbody.
- Blast mats will be used when blasting in sensitive wildlife environments.
- Incinerators will be operated in accordance with manufacturer's specifications and emissions will meet Canadian Council of Ministers of the Environment Canada Wide Standards for Dioxins & Furans and Mercury.
- Equipment, wastes, and contaminated soils will be removed once construction is completed.

4.7 Wildlife Deterrence Procedures

Birds will be deterred from nesting on infrastructure by placing covers/screens on vents, holes, and crevices where birds could potentially nest, and if necessary, through active (but non-lethal) disturbance of birds to discourage them from establishing a nest on a construction site. Physical deterrents will not be applied during the nesting season. If bird nesting occurs, the nest will not be disturbed until after the birds have left the area, with clearance to be discussed in consultation with GNWT-ECC and ECCC.

A bear deterrent procedure will be developed following consultation with ECC to determine appropriate bear deterrents (e.g., temporary fencing, bear bangers) and safety procedures (see Appendix D).

4.8 Closure and Reclamation

- Closure and reclamation will promote re-establishment of vegetation.
- Abandoned sections of the MVWR ROW and access roads will be closed and reclaimed.
- Site grading at closure will approximate pre-development conditions.
- Borrow source vegetated surface material, where present, will be replaced after development is completed.

4.9 Caribou and Moose Mitigation

Mitigation measures described in Sections 4.1 to 4.8 to reduce potential project effects related to change in habitat, movement, mortality risk and health also apply to boreal caribou and moose. In addition, mitigation measures will be implemented during construction and quarry and borrow source operations to avoid or reduce potential project effects during sensitive periods for caribou and moose. Sensitive periods, timing restrictions and setbacks for boreal caribou and moose are provided in Appendix C (see Table C.1).

5 Monitoring

5.1 Mitigation Monitoring

During construction and operations and maintenance, mitigation measures will be implemented to avoid or reduce potential project effects on wildlife habitat (e.g., direct habitat loss or alteration, sensory disturbance), wildlife movement as well as direct mortality risk (e.g., animal-vehicle collisions) and indirect mortality risk associated with access and harvesting.

Mitigation monitoring will be implemented to determine whether proposed mitigation measures have been implemented as described in Section 4. Mitigation monitoring will include recording wildlife presence on site by project personnel (wildlife sightings log), systematic surveillance surveys as well as recording wildlife incidents (e.g., injury, mortality, wildlife-human interactions) that require a management response.

5.1.1 Wildlife Sightings Log

Project staff will record wildlife observations following procedures described in Appendix D and complete the Wildlife Sightings Log data form (see Appendix E). Wildlife sighting data will be submitted to the Wildlife Management Information System (WMIS) on an annual basis.

5.1.2 Surveillance Surveys

Wildlife surveillance monitoring will be completed at project locations where there is risk of wildlife incidents (e.g., wildlife attractants) such as construction camps, waste management areas as well as project infrastructure where wildlife might find suitable shelter, denning or access to food. Surveillance surveys will provide systematic observations of wildlife sightings or sign (tracks, scat) in the PDA and provide a means to evaluate effectiveness of mitigation measures. Surveillance surveys will also include identification of potential bird nesting and/or bat roosting activity on project infrastructure to identify potential risks to birds/bats and develop site-specific mitigation as required (e.g., setback distances). Surveys will be completed at least once per week at defined project locations following procedures outlined in Appendix D using the wildlife surveillance form (see Appendix E).

5.1.3 Pre-construction Surveys

Pre-construction surveys will be completed when project activities are planned to occur during recommended timing restrictions (sensitive periods) for wildlife. Pre-construction survey protocols are provided in Appendix D.

The following pre-construction surveys will be completed as necessary:

- Bird nest sweeps following protocols outlined in the *Beneficial Management Practices for Migratory Birds in the Northwest Territories* (GNWT, 2020c) as well as identification of migratory bird nests listed on Schedule 1 of the Migratory Bird Regulations (MBR) (ECCC, 2022) as necessary (e.g., pileated woodpecker). Identification of raptor nests will be completed prior to construction if activities are planned during the raptor breeding seasons and included in pre-construction migratory bird nest sweeps as applicable (i.e., overlapping breeding periods).
- A pre-construction bear den survey will be completed to identify potential den sites if project construction activities are planned to occur during the black bear or grizzly bear denning period (October 1 to May 30) (see Appendix D). If a bear den is confirmed to be active, a site-specific setback buffer will be applied to protect denning bears based on project activity (i.e., 800 m or 1,500 m if blasting).
- Pre-construction surveys will be completed to identify the presence of wildlife and potential wildlife habitat features within recommended setback distances along the ROW (e.g., mineral licks).
- The location of any hot or warm spring or mineral lick discovered during pre-construction surveys or while carrying out the Project will be reported to nwt_pas@gov.nt.ca and any amphibian sightings will be reported to nwtsoer@gov.nt.ca.

5.1.4 Caribou and Moose

5.1.4.1 Pre-blast Surveys

Blasting may only proceed if no caribou or moose are detected in the 500 m blast radius or immediate blast zone. Environmental monitors will complete a 1-hour survey, within a 500 m radius of the blast zone perimeter. The survey will be conducted by foot or truck and will also include surveying within the immediate blast zone area to the extent that it is safe to do so. Scans for caribou and moose within the blast radius will be completed prior to all blasts, regardless of blast size. The application of unmanned aerial vehicles (UAV) (i.e., drones) will be considered to increase efficiency of observation during pre-blast surveys.

During calving/post-calving (for Dehcho and Sahtu regions combined between May 1 and July 12; GNWT, 2022b), boreal caribou collar data maps will be provided every 2 days to evaluate the presence of collared caribou within 6 km around areas where blasting will take place in the next week. If collared boreal caribou are within 1 km of the blast site, blasting will be delayed for 48 hours to determine if the caribou is calving (relatively stationary, e.g., hourly locations <1 km apart). If the caribou is calving, blasting will be suspended until a GNWT biologist indicates that calving is completed. If the caribou is moving more than 1 km/day, blasting will be suspended and re-evaluated every 48 hours until the caribou moves out of the area or it is confirmed that the caribou is calving within the 1 km buffer, in which case blasting will be suspended until a GNWT biologist indicates that calving is completed. Once no calving caribou are suspected in the 6 km radius, the pre-blast survey will be implemented, and all mitigation measures followed as required.

During late winter (for Dehcho and Sahtu regions combined between March 16 and April 5; GNWT, 2022b), collar data maps will be provided every 2 days to evaluate the presence of collared caribou within 4 km around areas where blasting will take place in the next week. If no caribou are present in the 4 km radius, the pre-blast survey will be implemented, and all mitigation measures followed as required.

During all other seasons of the year, collar data maps will be provided once a week to evaluate the presence of collared caribou within 4 km around areas where blasting will take place in the next week. If no caribou are present in the 4 km radius, the pre-blast survey will be implemented, and all mitigation measures followed as required.

5.1.4.2 Road Surveys

During construction, Environmental Monitors will travel through the PDA regularly to document caribou and moose observations. The goal is to identify areas with higher presence of caribou and/or moose and communicate associated risks to these species to project staff.

Observations of caribou and moose on or close to quarry access roads (including borrow pit) will also be documented. Road surveys will not be continued during the operations and maintenance phase of the Project.

5.1.5 Wildlife Incidents

A wildlife incident is defined as any wildlife interaction that requires a response by project personnel including the use of deterrents, wildlife injury or mortality as well as threats from wildlife to human safety or property. Wildlife injury or accidental mortality will be reported to an officer within 24 hours as per sub-section 8(1) of the Wildlife General Regulations (GNWT, 2020). All wildlife incidents will be summarized in annual reports.

5.2 Wildlife Effects Monitoring

Wildlife effects monitoring will be implemented to quantify project-related effects on wildlife and wildlife habitat and to determine the effectiveness of mitigation measures designed to reduce potential effects on wildlife habitat, wildlife movement and mortality risk. The wildlife effects monitoring will focus on caribou and moose as well as species at risk. Monitoring indicators and measurable targets have been developed as part of the adaptive management framework to quantify and evaluate mitigation effectiveness and where necessary adjust mitigation measures using identified action levels or thresholds as part of adaptive management. The adaptive management framework and thresholds are discussed in Section 6.

Overall, the objectives of wildlife effects monitoring are to:

- Measure the amount of direct habitat loss in the PDA and LAA on an annual basis until project completion
- Determine if improved year-round access created by the Project results in increased harvest mortality or harvest patterns of any wildlife that would suggest a conservation concern
- Track mortality of wildlife due to vehicle collisions

5.2.1 Caribou and Moose Monitoring

The proposed monitoring of the effects of the Project on caribou and moose will assess the effectiveness of mitigation measures designed to reduce potential direct and indirect changes in caribou and moose habitat, changes in their movements and changes in mortality risk.

The primary objectives of caribou and moose effects monitoring activities will be to:

- Determine the amount of direct habitat loss annually and at completion of construction
- Determine if the Project may act as a barrier to movement for boreal caribou through continued collar analysis during construction and operations and maintenance (see Section 5.2.3)
- Implement reporting of caribou and moose observations by all project staff using the Wildlife Sightings Log (Section 5.1.1) and immediate reporting of any incidents or concerns to the Environmental Monitors. Reported caribou and moose observations will add to the understanding of habitat use and highway crossings by these species.
- Monitor and determine changes in distribution, habitat use, and movements of boreal caribou and moose in the Caribou and Moose LAA before, during and after road construction (using collar information and surveys; see Section 5.2.3 and Section 5.2.4)
- Monitor and determine changes in distribution, habitat use, and movements of barren-ground caribou in the Caribou and Moose LAA and adjacent areas before, during and after road construction (using collar information and surveys; see Section 5.2.5)
- Monitor and determine frequency of vehicle collisions, including locations, date, injuries, and mortality (see also Section 5.2.6)

5.2.2 Boreal Caribou Collar Program

The boreal caribou collar program, as currently conducted by the GNWT-ECC, will continue to collect ongoing information on distribution, movements, and mortality, subject to periodic assessments and adjustments. Existing and newly collected data will be analyzed to obtain movement information to assist in determining adverse effects of the Project.

In accordance with an approved procedure, boreal caribou collar locations may be used by GNWT to notify construction crews of their proximity to active construction areas during the late-winter and calving/post-calving season, and additional mitigation measures may be triggered.

5.2.3 Boreal Caribou Collar Analysis

Previously collected baseline data from collared boreal caribou will be analyzed to obtain more accurate movement information in the vicinity of the MVWR. Analyses are expected to reveal if caribou are crossing the MVWR from which seasonal and/or spatial patterns may become apparent (considering that the current MVWR is only used during winter).

A key question is whether, and to what extent, the MVWR acts as a barrier to movement for boreal caribou. Available collar data of boreal caribou will be analyzed to determine whether the animals change their movement patterns in proximity to the MVWR, including their propensity to approach and/or cross the road than would otherwise be expected. Investigation of seasonal movements may yield insight into whether caribou movement is affected by (a) road activity or (b) the road footprint, and analyses may reveal the degree to which either may pose a barrier.

Ongoing collar-based monitoring during project construction and operations will compare boreal caribou movement data analyzed in relation to the MVWR with movement analysis to be conducted in relation to the Project.

A supplementary line of investigation examines if parturient female caribou (i.e., females about to give birth) occur in proximity to the MVWR during the calving season. Parturient females generally decrease their movements immediately prior to birth, with reduced movements in the days immediately following calving. Therefore, calving females will be identified as animals with hourly locations less than 1 km apart. The movement rates of cows during calving season will be analyzed to determine the timing and location of calving events and identify the proximity of calving locations to the MVWR.

5.2.4 Moose Surveys

Survey programs, currently conducted by the GNWT-ECC, will continue to collect ongoing information on distribution, abundance, and population trends of moose, subject to periodic assessments and adjustments. Overall, it is expected that GNWT-ECC will need to adapt and expand current moose survey programs to detect changes in distribution and abundance of moose along the highway, subject to availability of additional resources.

5.2.5 Barren-ground Caribou Surveys

Barren-ground caribou surveys, as currently conducted by the GNWT-ECC and other organizations, will continue to monitor the distribution, abundance, and population trends of the Bluenose-East herd, subject to periodic assessments and adjustments. Current collar-based monitoring of the Bluenose-East and other barren ground caribou herds will help to determine whether their annual distribution shifts and starts overlapping with the LAA.

5.2.6 Wildlife-Vehicle Collision Monitoring

The database for wildlife-vehicle collisions, implemented and maintained by GNWT-ECC, will be extended to include the MVWR and segments of the highway during and after construction. Collision locations will be added to the information to determine the necessity of appropriate signage to alert drivers of crossing locations and identification of other possible measures to avoid or reduce increased mortality risks.

The GNWT may also develop and implement a wildlife collision and sighting reporting system for GNWT employees based on the Alberta Wildlife Watch Program (<https://albertawildlifewatch.ca/>). Alberta has designed a smartphone app for use by employees, contractors and the public who travel the roads frequently to record wildlife sightings, carcasses and collisions easily and accurately.

5.2.7 Road and Traffic Monitoring

Monitoring traffic levels is important for operational considerations related to road maintenance as well as for gauging the effects of the highway on caribou and moose. Potential effects of the completed highway (i.e., during the operations and maintenance phase) include ongoing habitat alteration (i.e., sensory disturbance e.g., through dust and noise), changes in movement (if the highway and associated traffic pose a barrier to movement), changes in direct mortality (through wildlife-vehicle collisions; see also Section 5.2.6) and changes in indirect mortality (e.g., through increased access for hunters; see also Section 5.2.8).

To monitor the general flow of traffic on NWT highways, the GNWT-INF operates a series of permanent and seasonal mechanical traffic counters and conducts periodic visual counts and surveys. The GNWT-INF will install a combination of permanent traffic counting stations and temporary traffic counters along the highway. The resulting information will evaluate the accuracy of the predicted average daily traffic (i.e., approximately 50 vehicles per day year-round) and provide information on daily traffic levels during sensitive seasonal periods for caribou and moose.

5.2.8 Access and Harvest Monitoring

The Project may result in increased caribou and moose mortality stemming from a) hunting along the highway, b) greater hunter access from the highway into previously difficult-to-access areas, and c) extended seasonal access into harvesting areas for barren-ground caribou beyond the Caribou and Moose LAA. Increased access may change patterns of legal harvest in the region and increase illegal harvest resulting in increased levels of caribou and moose mortality. Several measures may be implemented in support of access and harvest monitoring:

- Create a new GNWT-ECC Renewable Resource Officer position in a community along the highway in support of monitoring activities to assess effects on caribou and moose and their habitat.

- Once the highway is operational, establish regular patrols throughout the year, particularly during fall resident moose harvest seasons and fall/winter caribou harvest seasons. Patrols would contribute to harvest and access monitoring as well as enforcement of hunting regulations and promoting the “Report a Poacher” toll-free line.
- The ongoing collection of annual large game harvest success for all non-Indigenous hunters will be continued.
- GNWT will work with relevant wildlife co-management organizations and Indigenous Governments, Indigenous Organizations, and select other affected parties, such as renewable resources councils to establish a voluntary Indigenous harvest monitoring and reporting program for the highway corridor.

The harvest monitoring and reporting program may include the following:

- focus on boreal caribou, barren-ground caribou and moose population trends in areas accessed by winter roads and trails from the Project
- be community-based and involve collaboration between co-management organization and GNWT-INF
- involve Traditional Knowledge holders and harvesters in monitoring harvesting trends
- confidentially report on harvesting numbers and trends annually to the GNWT-ECC and co-management organizations

5.2.9 Wildlife Health Monitoring

Wildlife health will continue to be monitored through local initiatives and collection of specimens from hunters. Health monitoring may include Traditional Knowledge and data from the voluntary harvester report program, which will be used to track changes in population numbers and health over time. The GNWT-ECC also records indices of health during collar deployment on boreal and barren-ground caribou and these existing programs contribute to monitoring wildlife health at regional scales.

5.2.10 Migratory Bird Species at Risk

Migratory bird species at risk will be monitored to determine species presence and relative abundance during construction. Similar to avian baseline surveys completed to support the DAR, effect monitoring surveys will be designed to focus on migratory bird species at risk most likely to interact with the Project (e.g., bank swallow [*Riparia riparia*], barn swallow [*Hirundo rustica*]) using recommended survey protocols. Specific survey objectives, study design and monitoring methods will be determined in consultation with, ECCC and the GNWT-ECC.

5.3 Project Footprint Size Reporting

The project's footprint size will be used to quantify the contribution of the Project to cumulative habitat disturbance at a regional scale. The size of the project's footprint (inclusive of cleared ROW, borrow sources and quarries, access roads and maintenance yards) will be reported in the WMMP Annual Reports.

6 Adaptive Management

An adaptive management approach will be applied to this WMMP focusing on focal wildlife species and species at risk to reduce residual effects related to change in habitat, wildlife movement and mortality risk. Monitoring results will provide the necessary data to evaluate the effectiveness of mitigation measures and provide opportunities to adjust and improve mitigation, as required.

6.1 Adaptive Co-Management

Adaptive management during the construction and operations and maintenance phases will occur primarily using an adaptive co-management approach, based on regularly issued and distributed reports to all stakeholders. These reports will describe all incidents, relevant wildlife observations and concerns regarding the environmental management of the Project, including implemented mitigation measures. Through the adaptive co-management process, stakeholders will collaborate to find consensus on a solution. Information provided through adaptive co-management should include both scientific and Traditional Knowledge. Passive adaptive management will be applied through the application of best management practices, and the response framework actions listed in Section 6.2. During the construction phase, a mitigation audit will be undertaken annually to document the success of the proposed mitigation measures. The mitigation audit will investigate:

- If all mitigation measures have been implemented
- Which mitigation measure is perceived to be or shown to be successful
- If new mitigation measures have been implemented in response to new issues
- If some mitigation measures are redundant

The results of the mitigation audit will be included in the WMMP Annual Report, and the WMMP will be revised if necessary to reflect lessons learned.

6.2 Response Framework

The phase response framework identifies thresholds and required actions. In each case, exceeding a threshold will also lead to an incident report, and will trigger an immediate review of the WMMP mitigation measures. Thresholds and actions during the construction phase may include:

- One caribou or moose killed or injured because of construction activities
- Destruction or disturbance of one active bird nest, one bat roost site or hibernaculum, or one mammal den
- One bear or other carnivore killed in defense of life and property because of attraction to the project areas
- Single incident or mortality for any individual that is a species of concern listed in Table 3.1
- Multiple separate mortality events, involving migratory birds, during a short period of time and/or at the same location

Thresholds and actions during the operations and maintenance phase may include:

- If there is evidence of specific sections of the road that are repeatedly crossed by caribou and moose, based on monitoring of collared boreal caribou, or reporting of sightings of moose, the GNWT will install signage to warn of collision risk in these areas and/or advise of reduction of speed limits in high-risk zones or at high-risk times.
- If collared barren-ground caribou are within 10 km of the highway, or there are reports of sightings of barren-ground caribou along the highway, the GNWT will initiate patrols along the road to determine the number of individual caribou involved. The GNWT and co-management organizations will discuss any required mitigation measures.
- Maps of collar locations will be provided on a more frequent basis if caribou occur close to the highway right of way, borrow sources or borrow source access roads during late winter and calving/post calving periods.
- If there is evidence that boreal caribou harvest levels in the NWT Hunting Areas intersected by the Project are increasing towards or exceeding unsustainable levels, the GNWT-ECC and co-management organizations will consult on implementation of additional mitigation measures necessary to keep boreal caribou harvest in the region within sustainable levels. Such measures may include the establishment of a no-hunting corridor along the Project's route.
- If the predicted annual average daily traffic (50 vehicles/day) is exceeded by 20% in two consecutive years

7 Reporting Protocols

A summary report that describes the results of the mitigation and monitoring components of the WMMP will be submitted to the GNWT-ECC and the SRRB. The summary report will include wildlife sightings, incidents, as well as a discussion of mitigation effectiveness and any proposed changes to mitigation or monitoring protocols. Comprehensive reports that provide a more detailed analysis of wildlife effects monitoring results (i.e., caribou) will also be prepared. The frequency of reporting for both summary and comprehensive reports will be determined in consultation with ECC - Wildlife Division.

8 Roles and Responsibilities

The GNWT-INF and associated contractors will be responsible for complying with terms and conditions set out in regulatory approvals, licenses and permits as well as implementing the mitigation and monitoring commitments described in this WMMP. The role of community wildlife monitors in implementing aspects of this WMMP will also be described following input from Indigenous Governments, Indigenous Organizations, and other affected parties.

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Appendix A – Statutory Requirements for Wildlife in the NWT

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NWT Wildlife Act		
Topic	Section of NWT Wildlife Act	Notes
Birds and nests	51. (1) Subject to section 17, no person shall, unless authorized by a licence or permit to do so, destroy, disturb or take (a) an egg of a bird; (b) the nest of a bird when the nest is occupied by a bird or its egg; or (c) the nest of a prescribed bird.	Prescribed birds for the purpose of paragraph 51(1)(c) and 52 of the <i>Wildlife Act</i> are birds of prey (raptors) as set out in Schedule B of the Wildlife General Regulations Bullet (c) protects unoccupied raptor nests
Wildlife abodes	52. 51. (2) Subject to section 17, no person shall, unless authorized by a licence or permit to do so, break into, destroy or damage a den, beaver dam or lodge, muskrat push-up or hibernaculum.	Subject to sub-section 5.3.(1) of the Wildlife General Regulations, no person shall damage, destroy, disturb, or otherwise adversely affect the summer abode of a bat (also referred to as a summer maternity roost), unless authorized by a licence or permit to do so.
Disturbance and harassment	53. Subject to section 17, no person shall, unless authorized by a licence or permit to do so, (a) engage in an activity that is likely to result in a significant disturbance to big game or other prescribed wildlife; or (b) unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife.	Prescribed birds for the purpose of paragraph 51(1)(c) and 52 of the Wildlife Act are birds of prey (raptors) as set out in Schedule B of the Wildlife General Regulations "big game" means species of wildlife prescribed as big game, or an individual of a species of big game;
Chasing Wildlife	55. Notwithstanding any other provision of this Act or the regulations, a person may chase wildlife away from a dwelling place, camp, work site, municipality or unincorporated community, or its immediate vicinity, if doing so is necessary to prevent injury or death to a person or damage to property.	"wildlife" means (a) all species of vertebrates and invertebrates found wild in nature in the Northwest Territories, and individuals of those species, except (i) fish as defined in section 2 of the <i>Fisheries Act</i> (Canada), and (ii) other prescribed species and subspecies, (b) species of wildlife referred to in paragraph (a) that are domesticated or held in captivity, and individuals of those species, and (c) prescribed species or subspecies of vertebrates and invertebrates, and individuals of those species or subspecies.

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NWT Wildlife Act		
Topic	Section of NWT Wildlife Act	Notes
Defence of life and property	<p>56. (1) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4), a person may harvest and consume wildlife or take and consume the eggs of birds if it is necessary to prevent starvation of a person.</p> <p>(2) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4), a person may kill wildlife if it is necessary to prevent injury or death to a person.</p> <p>(3) Notwithstanding any other provision of this Act or the regulations but subject to subsection (4) and any regulations specified as applying in respect of this section, a person may kill wildlife if it is necessary to prevent damage to property.</p> <p>(4) Subsections (1), (2) and (3) do not provide a defence to a contravention of this Act or the regulations for a person who resorts to harvesting or killing wildlife as a result of his or her mismanagement.</p>	
Reporting	<p>57. Subject to the regulations, a person shall, as soon as is practicable, report the harvest or kill of big game or other prescribed wildlife to an officer, if</p> <p>(a) under section 56, the person harvested big game or other prescribed wildlife to prevent starvation, or killed big game or other prescribed wildlife to prevent injury or death to a person or damage to property; and</p> <p>(b) the harvest or kill would, but for subsection 56(1), (2) or (3), be a contravention of this Act or the regulations.</p>	Section 7 of the Wildlife General Regulations indicates the information that must be included in the report.

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NWT Wildlife Act		
Topic	Section of NWT Wildlife Act	Notes
Accidental kill or wounding	58. A person who, with a motorized vehicle, accidentally kills or seriously wounds big game or other prescribed wildlife on a highway as defined in section 1 of the <i>Motor Vehicles Act</i> , shall report the event to an officer within the time fixed in the regulations.	Sub-section 8(1) of the Wildlife General Regulations requires that any person who accidentally kills or seriously wounds big game with a motorized vehicle on a highway must report the event to an officer within 24 hours after the incident. Sub-section 8(2) of the Wildlife General Regulations indicates the information that must be included in the report.
Feeding wildlife	65. (1) Subject to subsection (2), no person shall intentionally feed big game, fur-bearers or other prescribed wildlife. (2) Subsection (1) does not apply in respect of a person feeding wildlife lawfully kept in captivity or in circumstances permitted by the regulations.	
Wildlife Attractants	66. (1) No person shall deposit, place or leave in, on or about land or premises food, food waste or another substance if there is a reasonable likelihood that it could attract big game or other prescribed wildlife to the land or premises and endanger a person, a domestic animal or wildlife. (2) Subsection (1) does not apply in respect of (a) the drying or caching of meat, pelts or hides, except in a manner contrary to regulations respecting the treatment, caching and identification of wildlife and parts of wildlife left temporarily on the land; (b) a person lawfully harvesting fur-bearers with bait; or (c) other persons and circumstances exempted by the regulations.	
Damage to habitat	93. (1) No person shall substantially alter, damage or destroy habitat. (2) A person who establishes that he or she acted with legal justification in altering, damaging or destroying habitat shall not be convicted of an offence under subsection (1).	“habitat” means the area or type of site where a species or an individual of a species of wildlife naturally occurs or on which it depends, directly or indirectly, to carry out its life processes;

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NWT Wildlife Act		
Topic	Section of NWT Wildlife Act	Notes
Requirement for Wildlife Management and Monitoring Plan	95. (1) A developer or other person or body may be required, in accordance with the regulations, to prepare a wildlife management and monitoring plan for approval by the Minister, and to adhere to the approved plan, if the Minister is satisfied that a development, proposed development, or other activity is likely to (a) result in a significant disturbance to big game or other prescribed wildlife; (b) substantially alter, damage or destroy habitat; (c) pose a threat of serious harm to wildlife or habitat; or (d) significantly contribute to cumulative impacts on a large number of big game or other prescribed wildlife, or on habitat	
Contents of the Wildlife Management and Monitoring Plan	95. (2) A wildlife management and monitoring plan must include (a) a description of potential disturbance to big game and other prescribed wildlife, potential harm to wildlife and potential impacts on habitat; (b) a description of measures to be implemented for the mitigation of potential impacts; (c) the process for monitoring impacts and assessing whether mitigative measures are effective; and other prescribed requirements.	
Species at Risk (NWT) Act		
Topic	Section of the Act or Regulations	Notes
Designated Habitat	80. No person shall destroy any part of designated habitat.	
Species conservation	151. (1) The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of pre-listed species or listed species, including but not limited to (a) requiring the doing of things that may conserve the species; (b) prohibiting activities that may adversely affect the species; (c) imposing prohibitions against (i) killing, harming, harassing, capturing or taking an individual of a species.	For up-to-date information on Regulations and Permits issued under the Act go to http://nwt-species-at-risk.ca/en/Regulations

Species at Risk (NWT) Act		
Topic	Section of the Act or Regulations	Notes
Habitat conservation	152. The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of habitat of pre-listed species or listed species or the area in which the habitat is located or the surrounding area, including but not limited to (a) requiring the doing of things that may conserve the habitat or area; (b) prohibiting activities that may adversely affect the habitat or area; (c) imposing prohibitions against damaging or destroying the habitat or area; (d) controlling, restricting or prohibiting any use of, access to, or activity in the habitat or area; and (e) controlling, restricting or prohibiting the release of any substances in or into the habitat or area.	For up-to-date information on Regulations and Permits issued under the Act go to http://nwt-species-at-risk.ca/en/Regulations
Designating habitat	153. (1) The Commissioner, on the recommendation of the Minister, may, by regulation, designate habitat, or a component or combination of components of habitat, of a pre-listed species or a listed species.	For up-to-date information on Regulations and Permits issued under the Act go to http://nwt-species-at-risk.ca/en/Regulations
Designated habitat	154. The Commissioner, on the recommendation of the Minister, may make regulations respecting the conservation of designated habitat or the area in which designated habitat is located or the surrounding area, including but not limited to (a) requiring the doing of things that may conserve the designated habitat or area; (b) prohibiting activities that may adversely affect the designated habitat or area; (c) imposing prohibitions against damaging the designated habitat or area; (d) controlling, restricting or prohibiting any use of, access to, or activity in the designated habitat or area; and (e) controlling, restricting or prohibiting the release of any substances in or into the designated habitat or area.	For up-to-date information on Regulations and Permits issued under the Act go to http://nwt-species-at-risk.ca/en/Regulations

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Migratory Birds Convention Act		
Topic	Section of the Act or Regulations	Notes
Deposit of harmful substances	5.1 (1) No person or vessel shall deposit a substance that is harmful to migratory birds, or permit such a substance to be deposited, in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area.	
Disturbance and/or destruction of migratory birds, their nests and eggs	5(1) of the Migratory Bird Regulations states that no person shall hunt a migratory bird except under authority of a permit. 6. Subject to subsection 5(9), no person shall (a) disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, or	"Hunt" means to chase, pursue, worry, follow after or on the trail of, lie in wait for, or attempt in any manner to capture, kill, injure or harass a migratory bird, whether or not the migratory bird is captured, killed or injured. Currently, the regulations do not provide for authorizations or permits for the inadvertent harming or killing of migratory birds and the disturbance or destruction of their nests and eggs(a.k.a. "incidental take") in the course of industrial or other activities. For further advice on how to avoid incidental take or reduce risks to migratory birds and their nests and eggs, refer to the avoidance guidelines and frequently asked questions related to the protection of migratory bird nests and eggs as well as the fact sheet "Planning Ahead to Reduce Risks to Migratory Bird Nests" at: http://www.ec.gc.ca/paom-itmb/
Species at Risk Act (federal)		
Topic	Section of the Act or Regulations	Notes
Killing, harming, etc., listed wildlife species	32. (1) No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species.	"individual" means an individual of a wildlife species, whether living or dead, at any developmental stage and includes larvae, embryos, eggs, sperm, seeds, pollen, spores and asexual propagules.
Damage or destruction of residence	33. No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada.	"residence" means a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating.

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Species at Risk Act (federal)		
Topic	Section of the Act or Regulations	Notes
Prohibitions	35 a) in respect of individuals of aquatic species and their habitat or species of birds that are migratory birds protected by the Migratory Birds Convention Act, 1994; or (b) on land under the authority of the Minister or the Parks Canada Agency.	These prohibitions apply everywhere, regardless of land tenure.
Destruction of critical habitat	58. (1) Subject to this section, no person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species — or of any listed extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada — if (a) the critical habitat is on federal land, in the exclusive economic zone of Canada or on the continental shelf of Canada; (b) the listed species is an aquatic species; or (c) the listed species is a species of migratory birds protected by the Migratory Birds Convention Act, 1994.	“critical habitat” means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species’ critical habitat in the recovery strategy or in an action plan for the species.
Destruction of critical habitat	61. (1) No person shall destroy any part of the critical habitat of a listed endangered species or a listed threatened species that is in a province or territory and that is not part of federal lands. (1.1) Subsection (1) does not apply in respect of (a) an aquatic species; or (b) the critical habitat of a species of bird that is a migratory bird protected by the <i>Migratory Birds Convention Act, 1994</i> that is habitat referred to in subsection 58(5.1). (2) Subsection (1) applies only to the portions of the critical habitat that the Governor in Council may, on the recommendation of the Minister, by order, 59. specify.	

Species at Risk Act (federal)		
Topic	Section of the Act or Regulations	Notes
Agreements and Permits	<p>73. (1) The competent minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or the residences of its individuals.</p> <p>2) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that</p> <p>(a) the activity is scientific research relating to the conservation of the species and conducted by qualified persons;</p> <p>(b) the activity benefits the species or is required to enhance its chance of survival in the wild; or</p> <p>(c) affecting the species is incidental to the carrying out of the activity.</p> <p>(3) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that</p> <p>(a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;</p> <p>(b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and</p> <p>(c) the activity will not jeopardize the 62. survival or recovery of the species.</p>	

Appendix B – Wildlife Species of Cultural Importance

Table B.1 Culturally Important Wildlife Species

Common Name	Latin Name	Identified By
American widgeon	<i>Mareca americana</i>	SRRB
Arctic fox	<i>Alopex lagopus</i>	SRRB; NWRRC
Arctic hare	<i>Lepus arcticus</i>	SRRB; TRRC
Arctic ground squirrel	<i>Spermophilus parryii</i>	SRRB
Arctic loon	<i>Gavia arctica</i>	SRRB
Barren-ground caribou	<i>Rangifer tarandus groenlandicus</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Sahtu Dene and Métis; TRRC
Barrows goldeneye	<i>Bucephala islandica</i>	SRRB
Beaver	<i>Castor canadensis</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Wrigley Community; SRRB; TRRC; NWRRC
Black bear	<i>Ursus americanus</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Black scoter	<i>Melanitta nigra</i>	SRRB
Blue-winged teal	<i>Anas discors</i>	SRRB
Boreal woodland caribou	<i>Rangifer tarandus caribou</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Sahtu Dene and Métis; TRRC; NWRRC
Brant goose	<i>Branta bernicla</i>	SRRB
Bufflehead	<i>Bucephala</i>	SRRB
Canada goose	<i>Branta canadensis</i>	SRRB; NWRRC
Canvasback	<i>Aythya valisineria</i>	SRRB
Common goldeneye	<i>Bucephala clangula</i>	SRRB
Common loon	<i>Gavia immer</i>	SRRB
Common merganser	<i>Mergus merganser</i>	SRRB
Cougar	<i>Felis concolor</i>	SRRB
Coyote	<i>Canis latrans</i>	SRRB
Dall sheep	<i>Ovis dalli</i>	SRRB
Duck	Various	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Wrigley Community; TRRC; NWRRC

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Appendix B – Wildlife Species of Cultural Importance**

Common Name	Latin Name	Identified By
Ermine (<u>weasel</u>)	<i>Mustela erminea</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB
Fisher	<i>Martes pennanti</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB
Goose	Various	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Wrigley Community; NWRRC
Greater scaup	<i>Aythya marlia</i>	SRRB
Greater white-fronted goose	<i>Anser albifrons</i>	SRRB
Green-winged teal	<i>Anas crecca</i>	SRRB
Grizzly bear	<i>Ursus arctos</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; SRRB
Grouse/ptarmigan (e.g., willow ptarmigan/chicken)	Various (e.g., <i>Lagopus lagopus</i>)	Pehdzeh KiPehdzéh Kì First Nation; Wrigley Community; TRRC; NWRRC
Harlequin duck	<i>Histrionicus histrionicus</i>	SRRB
<u>Kingfisher</u>	<i>Megaceryle alcyon</i>	NWRRC
Least weasel	<i>Mustela nivalis</i>	Pehdzeh KiPehdzéh Kì First Nation
Lesser scaup	<i>Aythya affinis</i>	SRRB
Lynx	<i>Lynx canadensis</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Marmot	<i>Marmota spp.</i>	SRRB
Marten	<i>Martes americana</i>	Pehdzeh KiPehdzéh Kì First Nation; Wrigley Community; SRRB; NWRRC
Mink	<i>Neovison vison</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Moose	<i>Alces alces</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; Sahtu Dene and Métis; SRRB; TRRC; NWRRC
Mountain goat	<i>Oreamnos americanus</i>	SRRB
Muskrat	<i>Ondatra zibethica</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation; SRRB; TRRC; NWRRC
Muskox	<i>Ovibos mochatus</i>	SRRB; TRRC; NWRRC
Northern pintail	<i>Anas acuta</i>	SRRB
Northern river otter/ <u>otter</u>	<i>Lontra canadensis</i>	SRRB; Pehdzéh Kì First Nation
Norther shoveler	<i>Anas clypeata</i>	SRRB
Oldsquaw	<i>Clangula hyemalis</i>	SRRB

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Common Name	Latin Name	Identified By
Otter	<i>Lontra canadensis</i>	Pehdzeh KiPehdzéh Kì First Nation
Pacific loon	<i>Gavia pacifica</i>	SRRB
Porcupine	<i>Erethizon dorsatum</i>	Dehcho First Nations; Pehdzeh KiPehdzéh Kì First Nation: SRRB
Red breasted merganser	<i>Mergus serrator</i>	SRRB
Red fox	<i>Vulpes vulpes</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Red squirrel	<i>Tamiasciurus hudsonicus</i>	SRRB
Red-throated loon	<i>Gavia stella</i>	SRRB
Ring-necked duck	<i>Aythya collaris</i>	SRRB
Rock ptarmigan	<i>Lagopus mutus</i>	SRRB
Ruffed grouse	<i>Bonasa umbellus</i>	SRRB
Sandhill crane	<i>Grus canadensis</i>	SRRB
<u>Songbird</u>	<i>Oscines</i>	NWRRC
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	SRRB; NWRRC
Snow goose	<i>Chen caerulescens</i>	SRRB
Snowshoe hare	<i>Lepus americanus</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; TRRC
Snowy owl	<i>Nyctea scandiacus</i>	SRRB
Spruce grouse	<i>Canachites canadensis</i>	SRRB; NWRRC
Squirrel	Various	Pehdzeh KiPehdzéh Kì First Nation
Surf scoter	<i>Melanitta perspicillata</i>	SRRB
Trumpeter swan	<i>Cygnus buccinator</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Tundra swan	<i>Cygnus columbianus</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Weasel	<i>Mustela erminea</i>	SRRB
White-tailed deer	<i>Odocoileus virginianus</i>	SRRB
<u>Whiskey jack</u> (Canada jay)	<i>Perisoreus canadensis</i>	NWRRC
Willow ptarmigan	<i>Lagopus lagopus</i>	SRRB; NWRRC
White-winged scoter	<i>Melanitta fusca</i>	SRRB

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Common Name	Latin Name	Identified By
Wolf	<i>Canis lupus</i>	Pehdzeh KiPehdzéh Kì First Nation; Sahtu Dene and Métis; SRRB; TRRC; NWRRC
Wolverine	<i>Gulo gulo</i>	Pehdzeh KiPehdzéh Kì First Nation; SRRB; NWRRC
Yellow-billed loon	<i>Gavia adamsii</i>	SRRB

Appendix C - Recommended Activity Restriction Guidelines for Sensitive Wildlife Species

Table C.1 Recommended Activity Restriction Guidelines for Sensitive Wildlife Species¹

Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction ²	Recommended Setback Distance (m)
Ungulates (general)	Mineral/salt lick	General development activities	Year round	1,000
Caribou			<p><i>Late winter</i> (March 16 to April 5 for the Dehcho and Sahtu regions combined)³</p> <p><i>Calving/post-calving</i> (May 1 to July 12 for the Dehcho and Sahtu regions combined)³</p>	<p>Water crossings near blasting or seismic activity: Minimum setback distance of 10,000 m between May 15 and October 15.</p> <p>Shut-down distance if caribou are in the area: Minimum setback distance of 500 m year-round.</p> <p>Snowmobile distance if caribou are in the area: Minimum setback distance of 250 m during the snow period.</p> <p>Minimum setback distance of 250 m from mineral/salt licks between April 1 and July 15.</p> <p>All habitat types during ferry flights: Minimum flight altitude of 300 m year-round.</p> <p>When flying point to point in vicinity of caribou and moose: Minimum flight altitude of 610 m year-round.</p>
Moose			<i>Calving/post-calving</i> (May 15 to July 15) ^{4,5,6,7}	<p>Minimum setback distance of 250 m during sensitive periods (i.e., calving/post-calving).</p> <p>Minimum setback distance of 250 m from mineral/salt licks between April 1 and July 15.</p> <p>All habitat types during ferry flights: Minimum flight altitude of 300 m year-round.</p> <p>When flying point to point in vicinity of caribou and moose: Minimum flight altitude of 610 m year-round.</p>

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Appendix C - Recommended Activity Restriction Guidelines for Sensitive Wildlife Species

Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction²	Recommended Setback Distance (m)
Muskox	Species Presence	Shut down distance if muskox is in the area	Apr 1 – Jun 15	500
Cougar	Den	General development activities	Apr 15 – Jul 15	750
Lynx	Den	General development activities	Apr 1 – Jul 15	250
Grizzly bear, American black bear	Den	General development activities	Oct 1 – May 30	800 (1,500 for blasting activity)
		General development activities	Oct 1 – May 30	800
	Berry habitat	General development activities when bears are observed foraging	Jul 15 – Sep 15	300
Wolf	Den	General development activities	May 1 – Sep 15	800
Fox	Den	General development activities	May 1 – Jul 15	150
Wolverine	Den	General development activities	Oct 15 – Jul 15	2,000
All other wildlife	Den	Varies with region and species; contact the GNWT-ECC office	Birthing seasons	250

Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction ²	Recommended Setback Distance (m)
Bird Species at Risk				
Yellow rail	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300
Lesser yellowlegs	Nest	General development activities	May 1 – Aug 31	300
Red-necked phalarope	Nest	General development activities	May 1 – Aug 31	300
Short-eared owl	Nest	General development activities	May 1 – Aug 31	1,500
Common nighthawk	Nest	General development activities	May 1 – Aug 31	200
Olive-sided flycatcher	Nest	General development activities	May 1 – Aug 31	200
Bank swallow	Nesting colony	General development activities	May 1 – Aug 31	200
Barn swallow	Nest	General development activities	May 1 – Aug 31	200
Harris's sparrow	Nest	General development activities	May 1 – Aug 31	200
Rusty blackbird	Nest	General development activities	May 1 – Aug 31	300
Horned grebe	Edge of waterbody with a nest	General development activities	May 1 – Aug 31	300

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Appendix C - Recommended Activity Restriction Guidelines for Sensitive Wildlife Species

Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction ²	Recommended Setback Distance (m)
Other Bird Species				
Waterfowl (general)	Staging area	General development activities when large concentrations of birds are present	Spring/Fall	3,000
Swans, Loons, Cranes	Nest	General development activities	May 1 – Aug 31	800
		Pedestrians/ATVs	May 1 – Aug 31	500
Ducks	Nest	General development activities	May 1 – Aug 31	150
		Pedestrians/ATVs	May 1 – Aug 31	50
Geese	Nest	General development activities	May 1 – Aug 31	500
		Pedestrians/ATVs	May 1 – Aug 31	300
Shorebirds	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVs	May 1 – Aug 31	50
Terns, Gulls	Nest	General development activities	May 1 – Aug 31	300
		Pedestrians/ATVs	May 1 – Aug 31	200
Raptors (general)	Nest	General development activities	Mar 1 – Aug 31	1,500
	Nest	General development activities	Sep 1 – Feb 28	500

Species	Feature or Habitat	Specific Conditions	Sensitive Period / Timing Restriction ²	Recommended Setback Distance (m)
Songbirds (general)	Nest	General development activities	May 1 – Aug 31	100
		Pedestrians/ATVS	May 1 – Aug 31	30
All other birds	Nest	Varies with region and species; contact the GNWT or ECCC office	Breeding / nesting seasons	100

Notes:

- ¹ Modified from SLUPB (2013) and GNWT (2015); most conservative sensitive period and/or recommended setback distance used.
- ² Sensitive periods are a general guide and specific timing may vary. Year-round avoidance may not always be feasible, and exceptions will be discussed with the GNWT-ECC to develop appropriate mitigation.
- ³ GNWT 2022a
- ⁴ Rausch et al., 2008
- ⁵ Government of British Columbia, 2009
- ⁶ British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2014
- ⁷ Environment Yukon, 2016.

Appendix D – Standard Operating Procedures

Appendix D includes the following Standard Operating Procedures:

1. Wildlife Sightings Procedure
2. Wildlife Road Survey Procedure
3. Wildlife Surveillance Monitoring Procedure
4. Bird Nesting Activity Procedure
5. Pre-blast Surveys Procedure
6. Pre-clearing Large Mammal Survey Procedure
7. Thermal Imaging Device Pilot Study Procedure
8. Wildlife Incident Reporting Procedure
9. Bear Occurrence Procedure Manual
10. Use of Boreal Caribou Data During Project Construction

WILDLIFE SIGHTINGS PROCEDURE

PURPOSE

The purpose of this procedure is to describe the management of the Wildlife Sightings that are observed during the construction phase of the Project.

RESPONSIBILITY

All staff are responsible for reporting wildlife sightings. The Environmental Monitors are responsible for collecting the log sheets weekly, entering them into a database. Environmental Monitors are also responsible for entering wildlife observations reported by radio into the log sheets.

PROCEDURE

1. Wildlife sighting logs will be posted on various bulletin boards in camps and work areas for Project staff to record observations of wildlife.
2. Project staff will be made aware of which species are a priority to report.
3. All Project staff will be encouraged to add observations to the log, including the species, number, location, and date of the observation.
4. Environmental Monitors will check the logs weekly for evidence of problem wildlife or problem areas that may pose a risk to wildlife.
5. Observations of wildlife may be called in by radio and entered into the Wildlife Sightings Log by the Environmental Monitors.

EQUIPMENT REQUIREMENTS

None. Data sheets to be posted for all Project staff use.

REPORTING

Observations relevant to human or wildlife safety, such as observations of bears, caribou, moose, bison, species at risk or nesting birds, will be included in the Weekly Report. Copies of all Wildlife Sightings Logs will be provided in the Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

WILDLIFE ROAD SURVEY PROCEDURE

PURPOSE

The purpose of this procedure is to describe the management of the Wildlife Road Survey. This procedure will be used during the construction phase only.

RESPONSIBILITY

The Environmental Monitors are responsible for completing wildlife road surveys and entering them into a database.

PROCEDURE

1. The Wildlife Road Survey is to be completed each time Environmental Monitors drive a section of road.
2. Observations of wildlife on the roads, within the cleared right of way adjacent to the road, or within borrow pits will also be documented by Environmental Monitors. This survey may be completed as a stand-alone survey, or while driving the road for other purposes. To provide sufficient survey effort, a minimum distance of 10 km is suggested when completing a stand-alone survey and the entire drivable length of road should be covered at least twice per week.
3. At the start of a survey, the date, start time, start location and observers will be documented on the Wildlife Road Survey data sheet provided.
4. All observations of wildlife or wildlife sign along the road will be documented, including the species, number of individuals, location (UTM or kilometre) and photo if relevant.
5. Where possible, comparisons between thermal imaging device and binoculars observations should be drawn when caribou, moose or bison are observed during the road surveys. Comparisons between devices will not be made where bison are resting, grazing or travelling within the cleared RoW.
6. Speed should be limited to 50 km/h, the maximum driving speed for Project vehicles. Any notes on mitigation actions taken or suggested follow up will also be reported.
7. Observations of large mammals on the road will be reported to other drivers in the area, to reduce risk of collision.
8. At the completion of the survey, document the end time and the end location. File the original hard copy in the Environmental Office and update the Wildlife Sightings Form database.

EQUIPMENT REQUIREMENTS

- Truck
- Binoculars
- Data Sheet
- Field guide to birds
- GPS
- Project map
- Digital camera

REPORTING

Observations relevant to human or wildlife safety, such as observations of bears, caribou, species at risk or nesting birds, will be included in the Weekly Report. All information including surveys and monitoring will be also summarized in the Annual Report.

WILDLIFE SURVEILLANCE MONITORING PROCEDURE

PURPOSE

To prevent wildlife incidents through systematically documenting wildlife activity. This procedure will be used during the construction phase only.

RESPONSIBILITY

The Environmental Monitors are responsible for completing surveys of all camps and construction areas for evidence of wildlife presence and entering them into a database.

PROCEDURES

Environment Monitors will undertake systematic tours of the Project construction camps to record all wildlife observations or recent wildlife sign (e.g., tracks and scat). Surveys of will be completed at least once per week. Observers will travel to defined Project location, and record the following at each location:

1. Time upon arrival at location / monitoring site
2. Location or monitoring site
3. Presence of wildlife or wildlife sign (Yes or No)
4. Species or sign observed
5. Number of individuals
6. Wildlife Activity
7. Photo number (if photo taken)
8. Record any relevant comments about the observation, or relevant information from people working at the location.
9. Observations of any birds nesting or mammals denning adjacent to the cleared right of way, access roads or borrow sources will also be recorded.
10. Record any relevant comments about improper storage or segregation of wastes or other wildlife attractants, any evidence of wildlife gaining access to wastes or attractants, and any reports of dangerous wildlife interactions from people working at the location.
11. Report wildlife sign (such as tracks or scat) or observations of wildlife from Project staff working in the area shall be recorded on the data sheets in the additional comments section on the reverse side of the data sheet. Photos of sign and wildlife should be taken where possible to help in identification of species after completion of the survey.

12. Record the photo number on the data sheet and download and file the photos by date.

13. If no wildlife is observed, no sign seen and no reports of wildlife from staff, then an “N” should be recorded on the data sheet and in the database for that monitoring site or location.

LOCATIONS FOR SYSTEMATIC MONITORING

The following areas / sites should be visited at least once a week:

- Accommodations camps (entire perimeter)
- Waste transfer areas (entire perimeter)
- Quarries

EQUIPMENT REQUIREMENTS

- Truck
- Binoculars
- Data Sheet
- Field guide to birds
- GPS
- Project map
- Digital camera

REPORTING

Any wildlife concerns that come to light during the survey should immediately be brought to the attention of the Project Supervisor so that appropriate action can be taken. Any wildlife incidents observed or reported during this survey should be reported in the Wildlife Incident Report Form (see separate form). Observations relevant to human or wildlife safety, such as observations of bears, caribou, moose, species at risk or nesting birds, will be included in the Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

BIRD NESTING ACTIVITY PROCEDURE

PURPOSE

The purpose of this procedure is to detect and mitigate impacts to active nests and bat roosting sites. This procedure will be used during the construction phase only, except for quarries which will be monitored during operations as well.

Clearing of vegetation is scheduled to occur outside of migratory bird breeding season (1 May to 15 August). However, there may be instances where vegetation removal is required during this period due to schedule changes or unforeseen circumstances. In these cases non-intrusive pre-clearing surveys are required, to be developed on a case-by-case basis.

RESPONSIBILITY

The Environmental Monitors are responsible for completing the surveys and entering them into a database.

PROCEDURE

Environment Monitors will undertake systematic monitoring of the Project site to detect bird nesting activity, bird nests on the Project infrastructure. Environment Monitors will document all avian nests and nesting behaviour in the areas surveyed, as well as for little brown myotis maternal roosting sites. The surveillance monitoring survey will include areas of the Project where there is risk of birds or bats nesting or finding shelter. This will include buildings, stockpiles of supplies, mobile and stationary equipment.

The surveys will occur at least twice per week prior to and during the migratory bird nesting season (April to mid-July) and more frequently in particular areas if nests are found or nesting activity is observed.

LOCATIONS FOR SYSTEMATIC MONITORING

The following areas / sites should be visited at least once a week:

- Accommodations camps (entire perimeter and buildings)
- Waste transfer areas (entire perimeter and buildings)
- Heavy equipment that has been stationary for more than two days
- Waterbodies within 100 m of camps
- Stream crossing locations
- Quarries
- Borrow sources

Observers will travel to defined Project locations, and record the following at each location:

1. Time upon arrival at location / monitoring site
2. Location or monitoring site
3. Presence of bird nesting behaviour, active bird nests or bat roosting sites
4. Number of individuals
5. Photo number (if photo taken)
6. Any relevant comments about the observation, or relevant information from people working at the location.
7. Any reports of sign or observations of species from Project staff working in the area shall be recorded on the data sheets in the additional comments section on the reverse side of the data sheet.
8. If no nests, nesting behaviour or roosting sites are observed, no sign seen and no reports of wildlife from staff, then an “N” should be recorded on the data sheet and in the database for that monitoring site / location.
9. Quarries in particular should be checked for signs of swallow and nighthawk nesting. Quarry pile slopes should be less than 70 degrees to discourage swallow nesting (Refer to the ECCC pamphlet Bank Swallow in Sandpits and Quarries).
10. Monitoring will initiate in April and continue at least until mid-July (or until all identified nests are inactive), and focus on areas where scheduled construction activities are expected during the migratory bird nesting season.
11. Incidental observations of avian species at risk in particular should be documented. These include:
 - Peregrine falcon
 - Short-eared owl
 - Bank swallow
 - Barn swallow
 - Common nighthawk
 - Olive-sided flycatcher
 - Horned grebe
 - Red-necked phalarope
 - Rusty blackbird

- Yellow rail

EQUIPMENT REQUIREMENTS

- Truck
- Binoculars
- Data Sheet
- Field guide to birds
- GPS
- Project map
- Digital camera

Reporting

Any bird nesting observed during the survey should immediately be brought to the attention of the Project Supervisor. The Project Supervisor will email ECCC at cwsnorth-scfnord@ec.gc.ca and dalfnord-wednorth@ec.gc.ca to determine an appropriate course of action. Through consultation with GNWT-ECC and ECCC, bird nests will be protected by a buffer that protects the nest while allowing construction to continue, and will be monitored. Details of nests identified and the mitigation will be included in the weekly wildlife monitoring reports.

All observations of nesting activity or risk of nesting on Project infrastructure should be included in the Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

PRE-BLAST SURVEYS PROCEDURE

PURPOSE

This procedure is to search for and document large mammals (specifically caribou, moose, bison and bears) within a 500m radius (or as determined by Blast Supervisor) prior to blasts. Refer also to the relevant Blast Plan for each blasting operation for any additional site-specific procedures.

RESPONSIBILITY

The Environmental Monitors are responsible for completing the survey and entering the results into the database.

PROCEDURES

1. The Environmental Monitor will ensure that blasting does not conflict with the Operating Procedure for Use of Boreal Caribou Collar Data to Mitigate Impacts from Construction of the MVH.
2. Refer to the relevant Blast Plan for any additional blast-specific direction.
3. Two Environmental Monitors will complete a 1 hour survey, within a 500m radius of the blast zone perimeter (or as defined by the Blast Supervisor). The survey will be conducted by foot or truck, and will also include surveying within the immediate blast zone area to the extent that it is safe to do so.
4. Both binoculars and thermal imaging device will be used to survey the blast zone buffer and perimeter. The intent is to determine if the thermal imaging device improves the detectability of wildlife.
5. All large mammals observed will be documented, and it will be noted on the data sheet whether the detection was made with the thermal imaging device. Information will also include estimated distance from animal and weather conditions including air temperature.
6. If large mammals are detected in the 500m blast radius or blast zone they will be given at least 15 minutes to move away from the blast area before deterrent procedures will be considered. Deterrents will only be used if there is a risk to human or wildlife safety.
7. Once the blast zone and perimeter is cleared of large mammals, the blast should occur as soon as possible to avoid other large mammals from entering the blast zone.
8. Using the form provided, the Environmental Monitors or the Blast Supervisor will document efforts to detect wildlife, document any wildlife observed and document any deterrent actions taken.

The following will be recorded for during each survey:

- Date, time and location of blast
- Magnitude of the blast
- Time spent on wildlife survey
- Area of blast radius that cannot be surveyed due to vegetation
- Photo number (if photo taken)
- Wildlife observed and efforts to deter the wildlife

Equipment Requirements

- Truck
- Binoculars
- Thermal Imaging Device
- Data Sheet
- GPS
- Digital camera

Reporting

All relevant observations for each blast will be documented in the Weekly Report. A summary of all surveys completed will be included in the Annual Report.

PRE-CLEARING LARGE MAMMAL SURVEY PROCEDURE

PURPOSE

The purpose of this procedure is to detect large mammals ahead of the clearing activities, as well as to detect any possible denning locations. This procedure will be used during the construction phase of the Project.

RESPONSIBILITY

The Environmental Monitors are responsible for completing the surveys and entering them into a database. Surveys will be overseen by the Environmental Supervisor.

PROCEDURE

PRE-CLEARING LARGE MAMMAL SURVEY

1. Environmental Monitors will travel (by foot, ATV or snow machine) the length of the right of way that will be cleared, ahead of the clearing activities.
2. The Monitors will travel at no more than 10 km per hour along the road alignment, one person on each side of the alignment, and looking into the forest on either side of the alignment for wildlife or fresh wildlife sign.
3. Any large mammals (caribou, moose, bison, bears, wolves) or sign observed in the forest to either side of the alignment will be documented and reported to the Environmental Manager. The Environmental Monitors should aim to survey areas to be cleared no more than 48 hours prior to the vegetation clearing.
4. For each day of surveys, the following information will be recorded using the datasheet provided: the start and finish coordinates, the observer names and any observations. Communications with the Environmental Manager and any follow up actions will also be documented.
5. If a caribou is seen within 500 m ahead of clearing operations, operations will be temporarily suspended by the Project Supervisor to allow wildlife to move away from the area of their own. If they do not leave the area within 15 minutes, they will be gently encouraged to move away from construction activities, and an incident report will be completed. This will involve the slow approach of Environmental Monitors towards the caribou to encourage them to move. If a caribou is reluctant to leave the area, this could be a sign that it is a female that is hiding a calf in close proximity. If this is the case, operations will be suspended, and regional ECC biologist contacted for advice.

BEAR DEN AERIAL SURVEYS

Helicopter-based bear den surveys will be completed surveys by ECC. Detailed methods will be prepared prior to the survey, but will include the following elements:

1. The survey will be conducted by one ECC biologist and two environmental monitors in the fall, during den initiation, targeting all areas where vegetation clearing is planned for that winter season, plus an 800 m buffer around those areas.
2. Flights lines will be flown between 200-300m apart
3. A rotary wing aircraft will be used to allow for low and slow flying opportunities for the observers
4. If any wildlife dens are observed, the pilot will slow down and circle the area to obtain photographs and GPS waypoints of the den location. In some cases, where it is safe to do so, the helicopter may need to land so that observers can verify the presence of a suspected den on the ground. Surveyors will be equipped with bear deterrents and firearms in the event there is an active bear in the area.
5. Mineral licks, raptor nests and landscape features that might provide suitable habitat for bat hibernacula will also be documented.
6. Any other wildlife sightings during the survey will also be recorded.

Mitigation options in the event that a denning bear is detected:

If a bear is located in, at or near a den site that is within 800 m of an area that will be cleared of vegetation during the winter, the following mitigation options will be evaluated by ECC (in decreasing order of preference):

- If feasible, adjust the road alignment, access road alignment, borrow source boundaries or camp location to avoid the bear den by 800 m.
- Do not use all or a portion of a borrow source for that winter of construction in order to avoid the den by 800 m.
- Reduce the size of the exclusion zone and proceed but implement continual monitoring of the den to ensure the denning bear is not disturbed by activities.
- If a den is located directly on the ROW for the road, and no other mitigations can be applied, contact the Tłıchq Government to preselect a potential hunter(s) from the closest Tłıchq community to harvest the bear(s) in a den.

Mitigation options in the event that a mineral lick is detected:

If a mineral lick is documented during the aerial bear den survey that is within 250 m of an area that will be cleared of vegetation during winter, the following mitigation options will be evaluated by ECC and INF (in decreasing order of preference):

- If feasible, adjust the road alignment, access road alignment, borrow source boundaries or camp location to avoid the mineral lick by 250 m.
- Do not use all or a portion of a borrow source to avoid the mineral lick by 250 m.
- Reduce the size of the exclusion zone but maintain a vegetated buffer between the mineral lick and the cleared area, maintain connectivity of the vegetated buffer to adjacent forested areas, and avoid disruptions to drainage and groundwater near the mineral lick.

Mitigation options in the event that a raptor nest(s) is detected:

If an unoccupied raptor nest is documented during the aerial bear den survey that is within 500 m of an area that will be cleared of vegetation during winter, the following mitigation options will be evaluated by ENR and INF (in decreasing order of preference):

- If feasible, adjust the road alignment, access road alignment, borrow source boundaries or camp location to avoid the raptor nest by 500 m.
- Do not use all or a portion of a borrow source to avoid the raptor nest by 500 m.
- Reduce the size of the exclusion zone but maintain a vegetated buffer around the raptor nest. Leave the tree(s) supporting the raptor nest(s) standing if safety permits.
- If the tree(s) supporting the nest(s) is directly within an area that must be cleared, and the mitigations listed above are not feasible, obtain a permit from ECC to destroy the raptor nest.

Equipment Requirements

- Data Sheet
- GPS
- Project map
- Transect lines
- Digital camera
- Rotary Wing Aircraft

Reporting

Observations of large mammals or fresh sign will be reported immediately to the Environmental Manager. Survey effort and a summary of results will be included in the

Weekly Report. All information including surveys and monitoring will be summarized in the Annual Report.

THERMAL IMAGING DEVICE PILOT STUDY PROCEDURE

PURPOSE

This procedure will provide evidence to determine if thermal imaging devices are a useful tool for detecting wildlife. If the tests are successful, the devices may be integrated into the WMMP monitoring.

The procedure will be initiated when large mammals have been observed as part of the Pre-blast Wildlife Survey and where possible Road Surveys. Once observed, the Environmental Monitors will use both the thermal imaging device and traditional binoculars to estimate if detectability is improved.

RESPONSIBILITY

The Environmental Monitors are responsible for completing the survey. The Environmental Monitors are responsible for entering the results into the database. Guidance will be provided by the Environmental Supervisor.

PROCEDURES

1. The Environmental Monitors will initiate this survey opportunistically when a large mammal is observed, and no other immediate actions are required to manage hazards to the wildlife. Large mammals include moose, bison, caribou and wolves.
2. Upon observation of a large mammal, the data sheet will be initiated to document details of the wildlife (such as species and group size) and the environmental setting (such as daylight, season, temperature, habitat).
3. Initiate monitoring by watching the individual until it is no longer visible with either binoculars or the thermal imaging device. Do not follow the wildlife.
4. Collect photos, preferably while the large mammal is still visible.
5. When the wildlife is no longer visible with either binoculars or the thermal imaging device, complete the data sheet and continue with the original task.

The following will be recorded for during each survey:

- Date, time and location
- Large mammal details (species, group size)
- Environmental setting details (time of day, light conditions, weather, forest density)
- Time spent on the task
- Photo number
- Environmental Monitor observations on the effectiveness of the thermal imaging device for detecting and tracking large mammals

Equipment Requirements

- Binoculars
- Thermal Imaging Device
- Data Sheet
- GPS
- Digital camera

Reporting

A summary of all surveys completed will be included in the Annual Report, with a recommendation for the continued use of thermal imaging devices.

WILDLIFE INCIDENT REPORTING PROCEDURE

Purpose

The following procedure is intended as a guideline to identify wildlife that requires immediate reporting and sampling (if necessary). ECC encourages all those conducting activities on the land or residents to record and report all instances of injury or possibility of disease in wildlife. The Project will document all such incidents to prevent future incidents or escalation of problems, and report to ECC and ECCC if migratory birds are involved.

RESPONSIBILITY

All project personnel are responsibility for providing recording wildlife incident to the on the Project site.

As per Section 57 of the *Wildlife Act*, any defense of life and property kills must be reported without delay to ECC. All reasonable efforts must be made to ensure the hide and other valuable parts do not spoil and that these are turned over to an ECC Officer to avoid any wastage.

As per Section 58 of the *Wildlife Act*, and sub-section 8(1) of the Wildlife General Regulations, any person who accidentally kills or seriously wounds big game or other prescribed wildlife with a motorized vehicle on a highway must report the event to an officer within 24 hours after the incident.

PROCEDURES

Report wildlife incidents when:

- wildlife is determined to be injured.
- wildlife is suspected of being diseased.
- wildlife is found dead.
- there is the potential for human/wildlife conflict such as an occupied bird nest or wolf or bear den.
- wildlife was deterred from camp or other work area.
- there is a defensive kill.
- property is destroyed by wildlife.
- wildlife is injured or killed due to collision with a vehicle (see wildlife-vehicle collision reporting form attached).

Complete the Wildlife Incident Record Form, providing information such as:

- Behaviour and movements
- Loss of life or property
- Reason for attraction to area
- Estimation of how long the animal was dead
- Any other animals seen in the area

Collect photographs:

- Add photo name/label
- Show general area
- In case of mortality, photograph the animal (one from each side, head, and tail), including anything unusual and any obvious injuries or marks

REPORTING

Environmental Monitors should report all incidents immediately to the Environmental Manager. When the Wildlife Incident Report is complete, the Environmental Manager is to contact:

- GNWT-ECC North Slave Emergency number at (867) 873 - 7181 (24 Hours), Fax: (867) 873 - 6230.
- Environment and Climate Change Canada at cwsnorth-scfnord@ec.gc.ca and dalfnord-wednorth@ec.gc.ca.

All Incident Reports will be included in the Weekly Reports.

2014

Bear Occurrence Procedures Manual



Photo by Dean Cluff/ENR

Environment & Natural Resources

Bear Occurrence Procedures Manual

Implementation of these procedures will allow ENR a greater ability to provide advice and assistance in preventing harm to humans, bear(s) or property. In addition, it will provide guidance on safely deterring bears that find themselves in areas of development, tourism camps or cabins with the aim of preventing habituation and unnecessary destruction.

Report any incidents such as sightings, encounters, injuries and/or mortalities to the ENR. The GNWT Phone Directory can be found at <http://rdirectory.gov.nt.ca/rDirectory.aspx> Regional contacts are listed below:

North Slave Region

Wildlife Emergency (867) 873 - 9238 (24 Hours)
Yellowknife (867) 873 - 9238
Fax: (867) 873 - 6230

South Slave Region

Wildlife Emergency (867) 872 - 0400 (24 Hours)
Fort Smith (867) 872 - 6400
Fax: (867) 872 - 4250

Inuvik Region

Wildlife Emergency (867) 678 - 0289 (24 Hours)
Inuvik (867) 678 - 6650
Fax: (867) 678 - 6659

Sahtu Region

Wildlife Emergency (867) 587 - 2422 (24 Hours)
Norman Wells (867) 587 - 3500
Fax: (867) 587 - 3516

Deh Cho Region

Wildlife Emergency (867) 695 - 7433 (24 Hours)
Fort Simpson (867) 695 - 7450
Fax: (867) 695 - 2381

BEAR AWARENESS TRAINING

ENR supports the NWT Mine Health and Safety Regulations (s.15.05), which requires that all field personnel involved in mineral exploration undertake bear-safety training. However, human/wildlife incident prevention is a key component to the training.

Training of personnel in preventing and responding to wildlife incidents can reduce the likelihood of injury to personnel and wildlife. Therefore, all field personnel working on the project must receive bear awareness training, preferably from a professional trainer.

The training should include:

1. Recognizing the causes of human/wildlife conflicts;
2. How to prevent and respond to bear incidents;
3. Proper storage, transfer and disposal of camp waste; and
4. Proper use and safe application of deterrents.

INCIDENT PREVENTION

Refer to the ***Camp Waste and Wildlife Attraction Guideline***. This resource provides guidance on how to minimize or prevent attraction from bears to your camp, cabin or work site.

OCCURRENCE RESPONSE

Small scale exploration and tourism camps should develop and implement Bear Incident Standard Operating Procedures (SOPs) that can be used in the field. The SOPs will allow all members on site to have knowledge of how to minimize or prevent any loss of life or property if there is a bear within the vicinity of your camp area or work site. SOPs may include such things as:

- a) Response team
- b) Equipment
- c) Action level
- d) Emergencies
- e) Reporting Requirement

1. SIGHTING - Bear in the general vicinity (>1km)

1. If it is within sight of your camp/cabin and it is safe to do so, use a **Wildlife Sightings Log** to record and report information regarding your observations.
2. Continue to monitor, if necessary.

2. ENCOUNTER - Bear In Camp (<1km)

1. If safe to do so; take a quick note of the location, direction of travel and general behaviour of the bear(s).
2. Sound the bear alarm.
3. If necessary, phone the ENR Regional contacts listed above for guidance on necessary next steps to ensure human/wildlife safety and protection of property.
4. If necessary, stay indoors or in your vehicle. **DO NOT APPROACH THE BEAR.**
5. Keep all doors and windows closed.

6. If necessary and safe to do so; continue to monitor the behaviour and movement until either the bear leaves on its own, deterrence is successful or response personnel arrive.
7. If possible, start deterrence procedures.
8. Report status of bear encounter to the ENR Regional contacts listed above when safe to do so.

3. Injury

1. Any injuries a bear may have obtained from direct or indirect contact with the camp or persons must be reported to the appropriate ENR Regional contact listed above.

4. Mortality

1. A bear may be destroyed if human life is in danger or destruction of property is imminent.
2. Under the NWT Wildlife Act, mortalities must be reported to the appropriate ENR Regional contact listed as soon as is practicable. In some cases, the responsible party may be asked to:
 - a) Skin the bear leaving the claws and head attached.
 - b) Preserve the hide by freezing and/or salting it and store it in a cool place. Turn in the hide, the skull, evidence of sex and any other biological samples requested when filing the report to the nearest ENR Regional office or to an ENR Renewable Resource Officer.

If or when possible, the attached **Bear Occurrence Checklist** should be completed prior to calling ENR. It is critical that as much information as possible be provided in order for ENR to provide appropriate advice and guidance.

DENNING BEARS

- A. For exploration camps, if a bear is located in, at or near a den site, work in the area must halt. All employees should safely retreat from the area and report the incident to the Site Supervisor and/or Wildlife Monitor and the appropriate ENR Regional contact listed above for further advice and assistance.
- B. For cabin owners, if a bear is located in, at or near a den site, safely retreat from the area and report the incident to the appropriate ENR Regional contact listed above for further advice and assistance.
- C. Staff from ENR will be required to assess the den site and may implement measures to ensure both human safety and that the bear(s) remain undisturbed. This may include the establishment of a buffer zone of at least 300 meters around the den.
- D. Work inside the buffer zone may not be permitted until after den emergence.

OPERATING PROCEDURE

Use of Boreal Caribou Collar Data During Project Construction

Purpose

This protocol outlines the procedure for communication between the Government of Northwest Territories (GNWT), Department of Infrastructure (INF), and Department of Environment and Climate Change (ECC), regarding the location of collared boreal caribou near the proposed Mackenzie Valley Highway (MVH) Project (Project) during the construction phase.

The objective of this protocol is to alert GNWT and INF when collared caribou approach within pre-defined distances of active construction (“cautionary zones”), so that mitigation measures can be implemented to:

- Reduce sensory disturbance and unnecessary energy expenditure by caribou during the most sensitive periods — late-winter and calving
- Avoid sensory disturbance that would reduce the likelihood of calf survival during the calving period
- Avoid injury or mortality of caribou, or risk of personal injury

These protocols are to be implemented in addition to all monitoring and mitigation for boreal caribou described in the WMMP.

This protocol is intended to address the following construction activities:

- Vegetation clearing along the MVH right of way, at borrow sources, and borrow source access roads in advance of road construction and borrow source operations
- Blasting at borrow sources, quarries and, if required, along the right of way
- Other construction activities along the cleared right of way, and at borrow sources/quarries such as hauling granular materials to construct the road embankment and driving surfaces, extraction of granular materials at borrow sources/quarries, any grading, cutting or filling necessary to construct the road embankment, preparation of the driving surface, construction of watercourse crossings

Limitations of using the collar data to trigger mitigation measures:

- The GNWT-ECC will attempt to maintain a sample of 25 collared boreal caribou within the Caribou and Moose LAA (an area within 15 km of the Project), but it is recognized that only a portion of the boreal caribou population will be collared. Therefore, an absence of collar locations in proximity to MVH construction activities cannot be considered to indicate an absence of boreal caribou near construction activities. Collar data needs to be supplemented by visual surveys conducted by environmental monitors in and around active construction areas to verify that no boreal caribou are present.
- The GNWT-ECC receives updated collar data every 24 hours, and when the updated collar data is received it is already 24 hours old. If the GNWT-ECC provides the GNWT-INF with updated maps of collar locations every 48 hours during the most sensitive periods, the collar locations will already be 48-72 hours out of date. Therefore, collar data indicates where boreal caribou were 2-3 days ago, not where they are presently located. As such, the use of collar data must be supplemented by real-time visual surveys of active construction areas by environmental monitors to confirm presence or absence of boreal caribou.
- If updated maps of collar locations cannot be provided within the time intervals specified in Table 1.1, and, if one or more caribou were observed within the cautionary zone at the time the last map was provided, the associated mitigation will be observed until a new map is provided that indicates the caribou have left the cautionary zone.

Assumptions:

- Although boreal caribou occur at low densities, interactions in the Caribou and Moose LAA are possible.
- Boreal caribou are expected to avoid active construction areas during most times of the year due to the noise associated with these activities. However, exceptions may occur during times of the year where boreal caribou exhibit restricted daily movements, i.e. the late-winter period (mid-March to early April) and the calving period (early April to mid-July), and construction activities advance upon areas where boreal caribou are residing or if caribou choose to use an area where there is currently little to no construction activity and activities subsequently start up in that area.
- Boreal caribou tend to aggregate in small groups during the winter season, thus the use of location data from collared individuals to trigger mitigation measures should help to protect more than just those collared individuals.

- Prior to calving (pre-calving period), females increase their movement rates to locate suitable calving areas.
- During calving season, female boreal caribou spread out to calve individually; therefore, the use of collar data to trigger mitigation measures will only protect the collared females and their calves.
- Most vegetation clearing will take place between September and April to avoid the migratory bird nesting season, and therefore most vegetation clearing required for the project will occur outside of the calving season for boreal caribou.

Sensitive periods:

Although boreal caribou may be sensitive to disturbance from construction activities throughout the year, GNWT-ECC considers there to be two key periods when boreal caribou should receive additional protection from sensory disturbance to increase the likelihood of successful calving and thus recruitment of new individuals into the population. The following sensitive periods are based on the seasonal activity periods reported in Table 6 in the status report for boreal caribou in the NWT (Species at Risk Committee 2012), but some year-to-year variation should be expected based on snow and weather conditions:

- Late-winter (16 Mar – 4 April): Boreal caribou are exhibiting their shortest daily movements at this time of year, likely reflecting the increased energetic costs of travelling through deep snow at this time of year, or limited areas that provide easier access for foraging on ground lichens (wind swept areas and closed canopy forests with shallow snow). As boreal caribou are depleting their stores of fat throughout the winter, and movement through deep snow or displacement from good foraging habitat could have high energetic costs, disturbance events at this time of year could have negative impacts on female body condition and subsequently have negative impacts on calving and calf survival.
- Calving (05 April – 15 July): Female boreal caribou spread out during the pre-calving period (05–30 April) and increase daily movements to find suitable calving locations. Females spread out during calving as an anti-predator strategy to reduce predation risk. Once a calving location is selected, daily movement rates drop considerably during calving (30 Apr – 6 June). During the calving period, sensory disturbances that may cause energetic stress to the calving female or cause the calving female to flee and leave her calf temporarily may reduce the odds of calf survival. There are high energetic demands on females while they are lactating and raising their calves. Caribou tend to avoid suitable calving locations that are close to sensory disturbance from development, so they may avoid calving near active MVH construction areas. However, in instances where construction activities may advance upon or be near an area where a female has chosen to calve, displacement of the female from that area could have negative impacts on calf survival.

Boreal caribou are less sensitive to sensory disturbance at other times of the year, as they are moving greater distances daily and will likely avoid active construction areas or move away from them quickly if and when they encounter them.

Protocols for sharing information:

- The GNWT-INF will provide GNWT-ECC with weekly map updates of where construction activities will take place (i.e., which sections of the alignment will be active, which borrow sources/quarries will be active), and the type of activities taking place (e.g., vegetation clearing, blasting, embankment construction, etc.). Specifications about how information will flow will be determined by GNWT-INF and GNWT-ECC.
- GNWT-ECC will provide GNWT-INF with maps of collar locations according to the schedule outlined in Table 1 for different periods of the year. GNWT-INF will provide the maps to its Environmental Monitors and any other relevant designated staff and sub-contractors. GNWT-INF will inform GNWT-ECC of who the maps are being shared with.
- The maps will illustrate the location of collared caribou in proximity to the MVH alignment, borrow sources and access road and the date of the collar location information. The map will also highlight where there are construction activities taking place during that period.
- Implementation of mitigation measures will be determined by the proximity of collared caribou, the time of year, and the type of construction activity taking place as outlined in Table 1.
- GNWT-INF will provide GNWT-ECC with weekly records of the timing and location of all planned blasting events.
- The data provided by GNWT-ECC is to be used only for the purpose of assisting GNWT-INF in conducting construction work.
- Collar data should be considered sensitive information. GNWT-INF will not share the data provided by GNWT-ECC with anyone other than the Site Supervisor.
- GNWT-INF acknowledge that collared caribou represent only a portion of the caribou in the Mackenzie Valley Region. GNWT-INF recognize that the lack of collared caribou in an area does not mean that caribou are not present and will try to visually confirm that caribou are not present when undertaking construction work in a new area and will remain vigilant for the presence of caribou that choose to move into or across an active construction area.
- A project management team will host monthly and weekly meetings.
- The MVH Working Group will receive regular updates from the project management team.

Table 1.1 Cautionary Zones Applicable to Boreal Caribou – Mackenzie Valley Highway Project

Construction Activity	Season		
	Summer, Fall, Early to Mid-winter (16 July – 15 Mar)	Late-winter (16 Mar – 4 Apr)	Calving (05 April – 15 July)
Vegetation clearing of the right of way	<p>Cautionary Zone: 4 km Maps will be provided once a week to evaluate presence of collared caribou within 4 km of the MVH alignment and borrow sources.</p> <p>Mitigation:</p> <ul style="list-style-type: none"> • See WMMP Section 5.1 for recommended mitigation and monitoring. • Implement the Pre-Clearing Survey for Large Mammals and follow the additional mitigation required 	<p>Cautionary Zone: 4 km Maps will be provided every 2 days to evaluate presence of collared caribou within 4 km of the MVH alignment and borrow sources.</p> <p>Mitigation:</p> <ul style="list-style-type: none"> • See WMMP Section 5.1 for recommended mitigation monitoring. • Implement the Pre-Clearing Survey for Large Mammals and follow the additional mitigation required 	<p>Cautionary Zone: 6 km Maps will be provided every 2 days to evaluate presence of collared caribou within 6 km around the MVH alignment and borrow sources.</p> <p>Mitigation:</p> <ul style="list-style-type: none"> • See WMMP Section 5.1 for recommended mitigation monitoring. • Complete the Pre-Clearing Survey for Large Mammals and follow the additional mitigation provided. • If collared caribou are within 6 km of an area that will be cleared within the next 48 hours, suspend vegetation clearing in the active construction area. GNWT-ECC will re-evaluate the collar locations every 24 hours and will notify GNWT-INF when the collared caribou moves out of the 6 km cautionary zone. At this point, vegetation clearing can resume.

Construction Activity	Season		
	Summer, Fall, Early to Mid-winter (16 July - 15 Mar)	Late-winter (16 Mar - 4 Apr)	Calving (05 April - 15 July)
Blasting	<p>Cautionary Zone: 4 km</p> <ul style="list-style-type: none"> Collar data maps will be provided once a week to evaluate the presence of collared caribou within 4 km around areas where blasting will take place in the next week. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP 5.1.4 for mitigation measures related to blasting. Implement the Pre-Blast Survey and follow any additional mitigation measures required 	<p>Cautionary Zone: 4 km</p> <ul style="list-style-type: none"> Collar data maps will be provided every 2 days to evaluate the presence of collared caribou within 4 km around areas where blasting will take place in the next week. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP 5.1.4 for mitigation measures related to blasting. Implement the Pre-Blast Survey and follow any additional mitigation measures required 	<p>Cautionary Zone: 6 km</p> <ul style="list-style-type: none"> Collar data maps will be provided every 2 days to evaluate the presence of collared caribou within 6 km around areas where blasting will take place in the next week. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP 5.1.4 for mitigation measures related to blasting. Implement the Pre-Blast Survey and follow additional mitigation measures as may be required If collared caribou are within 6 km of the blast site, delay blasting for 24 hours. GNWT-ECC will evaluate the collar data to determine if calving is occurring (relatively stationary, e.g. hourly locations <1 km apart). If a caribou is calving within 1 km of the blast site, blasting will be suspended until a GNWT-ECC biologist indicates that calving is completed. If the caribou is calving > 1km away from the blast site, blasting can proceed. If the caribou is moving more than 1 km/day (i.e. no clear evidence that it is calving), suspend blasting and re-evaluate every 24 hours until the caribou either moves out of the 6 km cautionary zone or it is confirmed that the caribou is calving > 1 km away from the blast site.

Construction Activity	Season		
	Summer, Fall, Early to Mid-winter (16 July – 15 Mar)	Late-winter (16 Mar – 4 Apr)	Calving (05 April – 15 July)
Other construction activity along the cleared right of way and borrow sources and quarries Applies to activities taking place within areas that have already been cleared of vegetation	<p>Cautionary Zone: 4 km</p> <ul style="list-style-type: none"> Collar data maps will be provided once a week to evaluate presence of collared caribou within 4 km around the MVH alignment and borrow sources. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP Section 5.1 for general mitigation measures. Implement the Road Surveys and follow any additional mitigation measures required If collared caribou are within 4 km of sections of the road that have regular vehicle traffic (e.g. trucks travelling to and from borrow pits to lay down the road embankment), speed limits along the road within 2 km on either side of the collar locations shall be reduced to 30 km/h to reduce the likelihood of wildlife-vehicle collisions should collared caribou cross the right of way. 	<p>Cautionary Zone: 4 km</p> <ul style="list-style-type: none"> Collar data maps will be provided every 2 days to evaluate presence of collared caribou within 4 km around the MVH alignment and borrow sources. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP Section 5.11 for general mitigation measures. Implement the Road Surveys and follow any additional mitigation required. If collared caribou are within 4 km of sections of the road that have regular vehicle traffic (e.g. trucks travelling to and from borrow pits to lay down the road embankment), speed limits along the road within 2 km on either side of the collar locations shall be reduced to 30 km/h to reduce the likelihood of wildlife-vehicle collisions should collared caribou cross the right of way. 	<p>Cautionary Zone: 6 km</p> <ul style="list-style-type: none"> Collar data maps will be provided every 2 days to evaluate presence of collared caribou within 6 km around the MVH alignment and borrow sources. <p>Mitigation measures:</p> <ul style="list-style-type: none"> See WMMP Section 5.11 for general mitigation. Implement the Road Surveys and follow any additional mitigation required If a collared caribou chooses to calve within 6 km of an already active construction area, then activities other than blasting can continue as it assumed that noise from construction is not bothering them since they chose to calve there. If a situation arises where a caribou chooses to calve within 500 m of an active construction area, there may be a risk to calving success. Construction activities will be suspended, and collar locations re-evaluated every 24 hours, until the GNWT-ECC biologist confirms that the individual has moved >500 m away. If a collared caribou is calving within 6 km of a cleared construction area, that is not presently active but is planned to become active within the next 48 hours, collar locations will be re-evaluated every 24 hours, and construction in that area shall be delayed until the caribou moves out of the 6 km cautionary zone.
Aircraft	Follow GNWT “Flying low? Think Again...” guidelines.	Follow GNWT “Flying low? Think Again...” guidelines.	<p>Cautionary zone: 6 km</p> <ul style="list-style-type: none"> Collar data maps will be provided every 2 days to evaluate location of collared caribou within MVH Regional Study Area. No low-level flights (<1000 FT) within 6 km of known calving sites based on collar data.

Contacts

GNWT Environment and Climate Change contacts
To be determined prior to construction
Department of Infrastructure contacts
To be determined prior to construction
Construction Contractor
To be determined prior to construction

Appendix E – Monitoring Forms and Data Sheets

Appendix E includes the following Monitoring Forms and Data Sheets:

1. Wildlife Sightings Log
2. Wildlife Road Survey
3. Wildlife Surveillance Monitoring Form
4. Bird Nesting / Bat Roosting Activity Monitoring Form
5. Pre-blast Survey Form
6. Pre-Clearing Wildlife Survey
7. Thermal Imaging Device Pilot Study Form
8. Wildlife Incident Record

Wildlife Road Survey

Date:

Start time:

End time:

Observer(s):

Survey start at (km marker, GPS location or other landmark):

Survey completed at:

Time	Species	Number	Age/sex	Location (general feature describe)	Location	Photo ID	Notes (any behavioural response or reactions?)
					UTM or Km Marker		

Additional notes (e.g. details on wildlife interactions, behavioural responses, or response to mitigation):

Wildlife Surveillance Monitoring Form

Observers:

Date:

Page:

of:

Wildlife Observed or Wildlife Sign

Time	Location	Wildlife Present? (Y/N)	Species Or Sign	Number	Activity	Photo #	Observations from people working at the location / other comments

Record any additional comments on reverse page

Additional comments or notes:

Reviewed by:

Date:

Follow up:

Bird Nesting / Bat Roosting Activity Monitoring Form

Observers:

Date:

Page:

of:

Location:

Wildlife Observed or Wildlife Sign

Time	Location	Species Observed	Photo #	Nesting behaviour observed	Nests Roost observed (describe)

Record any additional comments on reverse page

Additional comments or notes:

Reviewed by:

Date:

Follow up:

Pre-blast Survey Form

Observer:

Date:

Page: of:

Location:

Blast Plan Reference Number:

Estimated area of blast radius:

Start and end time of Survey:

Time of blast:

Weather conditions/Air Temperature:

Wildlife Observed:

Notes on wildlife detection using binoculars versus thermal imaging device (Were any large mammals observed using one technique and not the other? Please describe including distance to animal .):

Deterrent Actions Required and Wildlife Response:

Document follow-up actions resulting from any wildlife observations

Thermal Imaging Device Pilot Study Form

Observer:

Date:

Location:

Photo numbers:

Start and end time of Survey:

Large mammal species and group size:

Sky (% overcast): Precipitation (rain or snow):

Daylight (day, night, twilight):

Binoculars make and model:

Thermal imaging device make and model:

How was the large mammal originally detected?

Approximately how far away was it when last observable?

Please check the appropriate box:

	Binoculars	Thermal Imaging Device	Naked Eye
What was the best way to first detect the large mammal?			
What was the best way to track the large mammal?			
Which were you using when you last saw it?			
Overall, what was the best way to observe the large mammal?			

Please record any other useful information, and your suggestions for use of the thermal imaging device:

NWT Wildlife Collision Report Form

Occurrence #: _____ RCMP File #: _____

Date of Collision: _____ Time of Collision (if known): _____ Location of Incident - Hwy #: _____

Officer: _____ Complainant: _____

Latitude/Longitude (Use GPS on scene): _____

Location (km marker, general location, which highway): _____

Wildlife

Wildlife Species:
 Bison Moose White-tailed Deer Black Bear
 Caribou, boreal Caribou, barren-ground Caribou, mountain Other (specify): _____

Total Number of Animals Involved:
 Males: ___ Calf / cub ___ Yearling ___ Sub-Adult ___ Adult ___ Unknown
 Females: ___ Calf / cub ___ Yearling ___ Sub-Adult ___ Adult ___ Unknown

Number Killed On Impact: _____ Number Destroyed by Officer: _____ Photos of Wildlife: Yes / No

Describe injuries to wildlife:

Sample ID#: _____
 Samples collected:
 Blood Lymph Nodes Middle Incisors Feces Ear Tail

Hide Salvaged: Yes / No Meat Salvaged: Yes / No Skull Salvaged: Yes / No

Method of Carcass Disposal: _____

Weather & Road Conditions

Light Conditions:
 Daylight Dawn Dusk Night Unknown

Weather Conditions:
 Raining Cloudy Clear Snowing Fog
 Windy Freezing Rain Unknown Other: _____

Road Surface Type:
 Asphalt Gravel Dirt

Road Description:
 Turn Dip Rise Straight & Level

Surface Conditions:
 Dry Wet Icy Loose Snow Packed Snow

Vehicle

Passenger Car Van/SUV Pickup Truck Heavy Truck/Semi-Trailer
 Bus/RV Unknown Other: _____

Estimate of Damage: Minimal Extensive Totalled Unknown

Photos of Vehicle Taken? Yes / No

Comments (continue comments on back of this form):



Environment & Natural Resources (ENR)

Bear Occurrence Checklist

- Fill out or check all that apply

1. Complainant Details:				
Name, job title and affiliation:				
Contact information:				
Location of complainant: <i>(coordinates, lake or property name)</i>				
Other on-site contact information: <i>(wildlife monitors/site supervisors)</i>				
2. Bear Occurrence Details:				
Date/Time:			Location: <i>(coordinates, lake or property name)</i>	
Type of bear occurrence:	<input type="checkbox"/> sighting	<input type="checkbox"/> encounter	<input type="checkbox"/> injury	<input type="checkbox"/> mortality <i>Ear tag/tattoo #</i>
	<input type="checkbox"/> Other, explain:			
Number of bears:			# of cubs	
Type:	<input type="checkbox"/> black	<input type="checkbox"/> grizzly	<input type="checkbox"/> unknown	
Sex :	<input type="checkbox"/> male	<input type="checkbox"/> female	<input type="checkbox"/> unknown	
Age Class:	<input type="checkbox"/> cub (<1)	<input type="checkbox"/> juvenile	<input type="checkbox"/> adult	<input type="checkbox"/> unknown
Behaviour:	<input type="checkbox"/> fearful	<input type="checkbox"/> not fearful	<input type="checkbox"/> aggressive	<input type="checkbox"/> other
General Observations	<input type="checkbox"/> moving toward site	<input type="checkbox"/> moving away from site	<input type="checkbox"/> at site	
Other observations: <i>(i.e. walking, resting, eating, mortality, injury, den site, number of cubs, etc.)</i>				
Has bear(s) been involved in a previous incident:	<input type="checkbox"/> No <input type="checkbox"/> Yes	If yes, explain:		
Did the bear obtain a reward	<input type="checkbox"/> No <input type="checkbox"/> Yes	If yes, explain:		
Any property damage or loss of life:	<input type="checkbox"/> No <input type="checkbox"/> Yes	If yes, explain:		

Appendix F – Reporting Form Templates

[to be developed prior to construction]

Appendix G – WMMP Revisions Tracking Table

Table G.1 Wildlife Management and Monitoring Plan Tracking Table

Reviewer	Comment	Section	INF Response