Screening Report and Recommendation

Project Assessment 2008-0304

Mactung Mine Project

YESAB
Yukon Environmental and Socio-economic Assessment Board

March 10, 2014

Prepared by
Executive Committee
Yukon Environmental and Socio-economic Assessment Board

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PREFACE

North American Tungsten Corporation Limited (NTC) is proposing the construction, operation, closure and reclamation of an underground tungsten mine in east-central Yukon, approximately 250 km east of Ross River and 8 km northeast of Macmillan Pass in the Mount Allan area. The Mactung site contains an indicated current mineral resource of 33 million tonnes of ore and is expected to generate 207 000 m^3 of waste rock. The Project will also establish a camp for about 250 personnel during construction and 150 during operation.

The Project includes a construction stage of two years, an operational stage (mining operations) of 11 years and a reclamation and closure stage of two years.

NTC submitted their project proposal to the Executive Committee on December 24, 2008. After issuing adequacy review reports, holding working group meetings, and considering the responses from the Proponent, the Executive Committee determined that the project proposal was adequate to commence the screening.

On November 9, 2009, the Executive Committee held the first of three public meetings in Ross River. From that meeting it became clear to the Executive Committee that:

- The Ross River Dena felt that they had not been meaningfully engaged by NTC decision makers.
- The proposed new access road through Yukon was totally unacceptable;
- The Ross River Dena were determined that the ongoing metal leaching/acid rock drainage challenges at the Faro Mine site could not occur at the Mactung Mine.

The Executive Committee issued its Draft Screening Report on October 12, 2012 and subsequently held public meetings in Watson Lake and Ross River. During the two-day public meeting in Ross River (November 8 and 9, 2012), Ross River Dena again highlighted that the major issues raised at our first meeting had still not been addressed.

An important change to the project proposal occurred when NTC announced on February 26, 2013 that the proposed Yukon access road would be removed from the scope of the Project. NTC indicated that the existing spur road in the NWT would be utilized.

NTC decision makers joined the Executive Committee at its third public meeting in Ross River on October 29, 2013, resulting in continuing formalized dialogue between the Proponent and the Ross River Dena.

The Executive Committee would like to thank the Ross River Dena and the entire community of Ross River for the exceptional hospitality shown to us during our three extended visits to the community and recognize the extremely important role Ross River Dena Council played in this assessment.

The Executive Committee also recognizes the technical support provided by EcoMetrix Incorporated, Terraprobe, Hemmera Envirochem Inc., Westrek Geotechnical Services Ltd., and Stantec Inc. in preparing this Screening Report.

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EXECUTIVE SUMMARY

This Screening Report is the outcome of the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee's assessment of the Mactung Mine Project proposed by North American Tungsten Corporation Ltd. (NTC). The purpose of the proposed project is the construction, operation, closure and reclamation of an underground tungsten mine in east-central Yukon, approximately 250 km east of Ross River and 8 km northeast of Macmillan Pass in the Mount Allan area. The Mactung site contains an indicated current mineral resource of 33 million tonnes of ore and is expected to generate 207 000 m^3 of waste rock. The Project will also establish a camp for about 250 personnel during construction and 150 during operation.

Pursuant to s. 50(3) of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA), before submitting a project proposal to the Executive Committee, a proponent is required to consult any First Nation in whose traditional territory the project will be located or might have significant environmental or socio-economic effects, as well as the residents of a community in which the project will be located or might have significant environmental or socio-economic effects. After considering the project proposal and the information provided by the Proponent, the Executive Committee determined that, in its opinion, the Proponent consulted with Ross River Dena Council, Liard First Nation, the First Nation of Na-Cho Nyak Dun and residents of Ross River in accordance with s. 50(3) of YESAA.

YESAA directs the Executive Committee to examine the potential environmental and socio-economic effects of a project and provide a recommendation to Decision Bodies on whether or not a project should be allowed to proceed or, in certain circumstances, refer the project for review by a panel of the Yukon Environmental and Socio-economic Assessment Board. YESAA requires that Decision Bodies consider the recommendation, and issue a Decision Document, prior to taking any action that would enable a project to be undertaken. The purpose of the Screening Report is to provide the Decision Bodies with a recommendation arising from the screening, and the rationale for that recommendation.

This Screening Report:

- describes the Project and the screening approach;
- summarizes the matters considered during the screening;
- identifies potential effects of the Project and outlines terms and conditions that mitigate significant adverse environmental and socio-economic effects of the Project; and
- considers the public comments received on the project proposal.

The Executive Committee has employed a "valued component" assessment methodology to assess the environmental and socio-economic effects of the Mactung Mine Project. The Executive Committee has identified the environmental and socio-economic valued components for the Project to be water resources, aquatic resources, wildlife, health and

safety, environmental quality, heritage resources and traditional land use, land and resource use, and cultural and community well-being.

This report addresses Project and cumulative effects on these valued components. Potential effects are subsequently characterized and their significance is discussed. For each valued component, mitigative measures that address significant adverse effects are presented and a final determination is made. The Executive Committee has identified mitigation for all significant adverse effects identified in this report.

Underground Disposal in Mined Out Stopes

The Executive Committee determined that many of the significant adverse effects of the Project are related to effects on water resources. The Executive Committee has concluded that tailings and waste rock shall be either disposed of underground in mined out stopes below the natural water table or within the DSTF. The Executive Committee is not confident that backfilled stopes above the water table with bulkheads is an effective disposal method to manage ARD/ML issues. Before using backfilled stopes above the water table as a disposal method, conclusive evidence must demonstrate containment and geochemical stability based on the in-situ monitoring program. There are no such assurances at this time.

Proposed Access Road

NTC was proposing to construct a new access route to the mine site rather than upgrading and utilizing the existing access route. The new access route would be located entirely in Yukon and would require construction of approximately 31 km of new road, as well as substantive upgrades and re-alignment to 19 km of an existing road.

In its Draft Screening Report, the Executive Committee set out its view that the Proponent had not demonstrated adequate consideration of the existing access route and found that it was completely unacceptable to construct a new 31 km access road through remote undeveloped valleys to access the mine site if it is feasible to upgrade the existing route. Many of the concerns raised in the DSR and from comments received on the DSR were related to the effects of the development and use of the proposed access road.

On February 26, 2013, NTC indicated that they were withdrawing the proposed access road from the project proposal and would pursue upgrading the existing road located in the NWT.

Recommendation

As a result of this assessment, the Executive Committee recommends to the Decision Bodies that the Mactung Mine Project be allowed to proceed without a review, subject to terms and conditions identified in this Screening Report. The Executive Committee has determined that this Project will have significant adverse environmental and/or socio-economic effects in Yukon that can be mitigated by these terms and conditions.

The Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB) has assessed the environmental and socio-economic effects of the proposed project pursuant to the *Yukon Environmental and Socio-economic Assessment Act* (YESAA),

The Screening Report is available on the YESAB Online Registry (www.yesab.ca/registry, YESAB Project No. 2008-0304) or copies can be obtained from:

- YESAB Head Office
- YESAB Mayo Designated Office
- YESAB Watson Lake Designated Office

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ACRONYMS AND ABBREVIATIONS

>	greater than
<	less than
ABA	acid base accounting
Activity Regulations	Assessable Activities, Exceptions and Executive Committee Projects Regulations
ANFO	ammonium nitrate fuel oil
ARD	acid rock drainage
ASL	above sea level
BC	British Columbia
BGS	below ground surface
° C	degrees Celsius
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
cm	centimetre
COPC	constituents of potential concerns
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRL	Colorado Resources Ltd.
DFO	Department of Fisheries and Oceans Canada
DSO	Deuling Stone Outfitters
DSR	Draft Screening Report
DSTF	Dry-stacked tailings facility
EBA	EBA Engineering Consultants Ltd.
EcoMetrix	EcoMetrix Incorporated

ELC	Ecosystem Land Classification
Executive Committee	Executive Committee of the Board
GMS	Game Management Subzone
GNWT	Government of the Northwest Territories
h	hour
ha	Hectares
hm	hoary marmot
ICP-MS	Inductively Coupled Plasma Mass Spectometry
IDF	inflow design flood
kg	kilogram
km	kilometre
km^2	square kilometre
L	litre
L/s	litre per second
LHB	long-hole blasting
LSA	local study area
LTF	Land Treatment Facility
m	metre
m^3	cubic metre
MA	million years
MAP	mean annual precipitation
MASL	meters above sea level
MBG	metres below ground
mg/kg	milligram per kilogram

ML	metal leaching
mm	milimetres
MMER	Mining Metal Effluent Regulations
ms^{-1}	metre per second
m^3/s	cubic metres per second
mw	megawatt
NTC	North American Tungsten Corporation Limited (Proponent)
NAG	non-potentially acid generating
NP	neutralization potential
NPR	neutralization potential ratio
NTU	nephelometric turbidity units
NWT	Northwest Territories
ORV	off-road vehicle
PAG	potentially acid generating
Project	Mactung Mine Project
Proponent	North American Tungsten Corporation Ltd.
PWH	Points West Heritage Ltd.
RRDC	Ross River Dena Council
RTC	registered trapping concession
TK	traditional knowledge
t	tonnes (metric)
tpd	tonnes (metric) per day
USGS	United States Geological Survey
VESECs	valued environmental and socio-economic components

WRSA	waste rock storage area
WTP	water treatment plant
YESAA	*Yukon Environmental and Socio-economic Assessment Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOR	YESAB Online Registry
XRD	Rietveld X-Ray Diffraction

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PART I BACKGROUND

1.0 INTRODUCTION

The *Yukon Environmental and Socio-economic Assessment Act* (YESAA) requires that Decision Bodies consider the recommendation arising from a screening conducted under YESAA, and issue a Decision Document, prior to taking any action that would enable a project to be undertaken.

The purposes of this report are to provide the Decision Bodies with a recommendation arising out of the screening and to provide the reasons for that recommendation.

This report:

- describes the Project and the screening approach;
- summarizes the matters considered during the screening;
- identifies potential effects of the Project and outlines terms and conditions that mitigate potentially significant adverse environmental and/or socio-economic effects of the Project;
- considers comments received from the public and other parties regarding the project proposal; and
- makes a recommendation.

2.0 ASSESSMENT PROCESS

This section sets out the legislation context, assessment chronology and assessment approach for the Executive Committee's screening of the Project.

2.1 LEGISLATIVE CONTEXT FOR THE SCREENING OF THE MACTUNG MINE

YESAA sets out a process to assess the environmental and socio-economic effects of projects and other activities in Yukon, or that might have an effect in Yukon. The Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB) is responsible for assessing large, complex projects identified under the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (Activity Regulations). A screening by the Executive Committee is required for the Mactung Mine Project because:

- North American Tungsten Corporation Ltd. (the Proponent/NTC) proposes to undertake activities listed in Schedule 3 of the Activity Regulations which require a screening by the Executive Committee, specifically:

  > *"3. Construction, decommissioning or abandonment of*
  >
  > *(a) a metal mine, other than a gold mine, with an ore production capacity of 1500 t/day or more";*

- the Project is being undertaken in Yukon; and

- an authorization or the grant of an interest in land by a government agency, independent regulatory agency, municipal government or First Nation is required for the activity to be undertaken.

Potential Decision Bodies and authorizations were identified based on information in the project proposal and information submitted to the Executive Committee. Transport Canada, Natural Resources Canada, Fisheries and Oceans Canada, and Government of Yukon are identified as Decision Bodies for this Project. The Decision Bodies and authorizations required for the Project are listed in Table 1 and Table 2. The Executive Committee notes that not all of the authorizations listed in Table 1 may be required for the Project to proceed.

Table 1 Government of Canada Decision Bodies and Authorizations Required

Decision Body and Legislation	Regulation	Authorization(s) Required
Transport Canada		
Navigable Waters Protection Act		Approval under *Navigable Water Protection Act*
Aeronautics Act	*Canadian Aviation Regulations*	MOU for the expansion of an aerodrome
Transportation of Dangerous Goods Act	*Transportation of Dangerous Goods Regulations*	Waste Manifest
Natural Resources Canada		
Explosives Act	*Explosives Regulations*	Explosives Factory License Explosives Magazine License
Fisheries and Oceans Canada		
Fisheries Act	*Metal Mining Effluent Regulations*	Listing under Schedule 2 of the *Metal Mining Effluent Regulations* Authorization for Works or Undertakings Affecting Fish Habitats

Table 2 Government of Yukon and Authorizations Required

Decision Body and Legislation	Regulation	Authorization(s) Required
Department of Energy, Mines and Resources		
Quartz Mining Act		Quartz Mining License
Territorial Lands (Yukon) Act	*Land Use Regulation* *Quarry Regulations*	Land Use Permit Quarry Permit Land Lease
Forest Resources Act	*Forest Resources Regulation* *Forest Protection Regulation*	Cutting Permit
Department of Highways and Public Works		
Highways Act	*Highways Regulations* *Bulk Commodity Haul Regulations*	Over Dimensional Weight Permit Access Permit Permit to work within the highway's right-of-way
Building Standards Act		Building Permit
Electrical Protection Act		Electrical Permit
Department of Environment		
Environment Act		
Department of Community Services		
Environment Act	*Air Emissions Regulations* *Contaminated Sites Regulation* *Solid Waste Regulations* *Special Waste Regulations* *Spills Regulation* *Storage Tanks Regulation*	Air Emissions Permit Solid Waste Permit Special Waste Permit Relocation Permit, Land Treatment Facility Permit Storage Tank Permit

Decision Body and Legislation	Regulation	Authorization(s) Required
Department of Health and Social Services		
Public Health and Safety Act	*Eating and Drinking Places Regulations* *Drinking Water Regulation* *Sewage Disposal Systems Regulations*	Sewage Disposal System Permit
Department of Tourism and Culture		
Historic Resources Act	*Archaeological Sites Regulation*	Archaeological Sites Permit
Yukon Water Board		
Waters Act	*Waters Regulation*	Type A Water License Type B Water License

2.2 MACTUNG MINE SCREENING CHRONOLOGY

Timelines for screenings are set out in the *Rules for Screenings Conducted by the Executive Committee*. An overview of the Executive Committee screening process is illustrated in Figure 1. All tasks required of the Executive Committee during this screening have been completed within the timelines and process prescribed under the *Screening Rules*.

The chronology of the Mactung Mine screening outlined in Table 3 provides a brief outline of key assessment dates and stages. For more detailed assessment information please see the YESAB Online Registry (YOR) at www.yesab.ca/registry or the YESAB Document Registry located at the YESAB Head Office in Whitehorse.

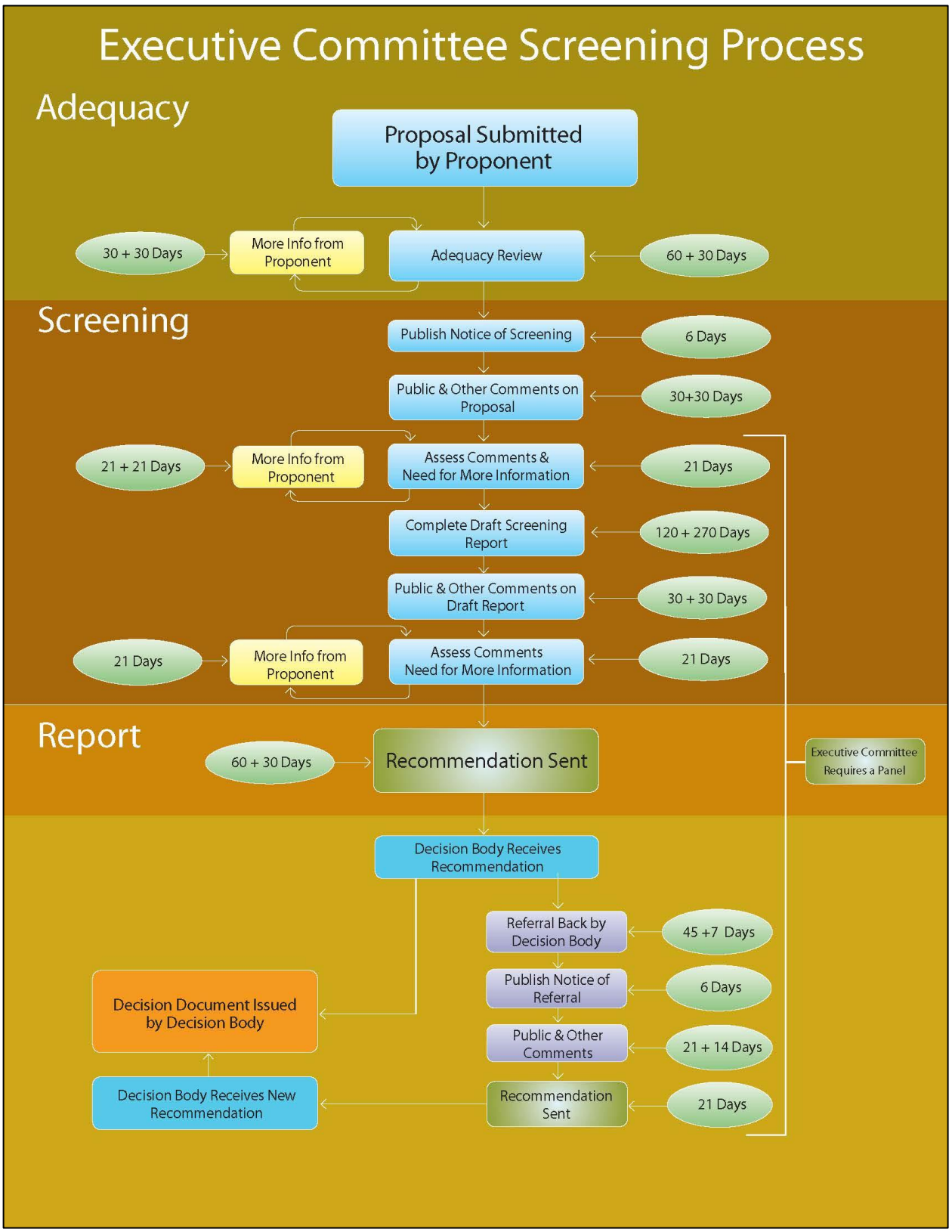

Figure 1 Executive Committee screening process

Table 3 Chronology of Mactung Mine Screening

Adequacy Review Period	
December 24, 2008	NTC submits project proposal to the Executive Committee.
February 12, 2009	Executive Committee holds working group meeting to consider issues related to water balance, water quality and characterization of rock geochemistry.
February 26, 2009	Executive Committee extends the Adequacy Review Period.
March 30, 2009	Executive Committee issues Adequacy Review Report.
July 31, 2009	NTC submits response to Adequacy Review Report.
August 26, 2009	Executive Committee holds working group meeting to consider issues related to water balance, water quality and characterization of rock geochemistry.
September 1, 2009	Executive Committee issues Supplementary Information Request.
September 22, 2009	NTC submits response to Supplementary Information Request.
October 16, 2009	Executive Committee determines that the Project proposal is adequate to commence the screening.
Screening	
October 22, 2009	Executive Committee issues Preliminary Statement of Scope of Project.
October 23, 2009	Executive Committee commences Public Comment Period (October 23 to November 23, 2009).
November 9, 2009	Executive Committee holds a public meeting in Ross River.
November 19, 2009	Executive Committee extends Public Comment Period to December 7, 2009.
December 7, 2009	Public Comment Period ends.
January 13, 2010	Executive Committee issues a Supplementary Information Request.

July 14, 2010	NTC submits response to Supplementary Information Request.
August 4, 2010	Executive Committee issues a Supplementary Information Request.
July 18, 2011	NTC submits response to Supplementary Information Request.
August 5, 2011	Executive Committee issues a Supplementary Information Request.
October 25, 2011	NTC submits response to Supplementary Information Request.
November 15, 2011	Executive Committee determines that Supplementary Information is satisfactory.
November 28, 2011	Executive Committee commences preparation of Draft Screening Report.
March 2, 2012	Executive Committee issues a Notice of Extension of Time Period to Complete the DSR.
March 22, 2012	Technical Working Group Meeting considers water quality predictions and mine closure.
April 16, 2012	NTC submits response to Technical Working Group Meeting.
May 8, 2012	NTC submits summary of Mactung Road Option and Decision.
June 28, 2012	Executive Committee issues a Notice of Extension of Time Period to Complete the Draft Screening Report to October 12, 2012.
October 12, 2012	Executive Committee issues Draft Screening Report.
November 7 & 8, 2012	Executive Committee holds a public meeting in Ross River
November 13, 2012	Executive Committee holds a public meeting in Watson Lake
December 13, 2012	Public Comment Period to review Draft Screening Report ends.
January 4, 2013	Executive Committee issues a Supplementary Information Request.
February 26, 2013	NTC withdraws the new access road in Yukon from the scope of the project indicating that the existing spur road in the Northwest

	Territories will be utilized.
October 15, 2013	NTC submits response to the January 4, 2013 Executive Committee information request
October 29, 2013	Executive Committee holds a public meeting in Ross River
November 8, 2013	Executive Committee agrees to conclude the review of the NTC response to December 1, 2013
December 2, 2013	Executive Committee issues a supplementary information request
December 9, 2013	NTC submits response to the December 2, 2013 Executive Committee information request
January 9, 2014	Executive Committee determines that supplementary information is satisfactory
March 10, 2014	Executive Committee issues the Screening Report with recommendations.

2.3 PROGRESSION OF PROJECT PROPOSAL

Sections 24 and 66 of the *Executive Committee Screening Rules* state that supplementary information provided by the Proponent shall be appended to and form part of the Proponent's proposal. During the course of the screening, NTC provided addendums to its project proposal in response to information requests and new information becoming available. Table 4 identifies key addendums to the proposal that will be referred to throughout this report. This summary is not a comprehensive list of all correspondence from the Proponent. The YOR provides a full record of the supplementary information provided by the Proponent.

Table 4 Summary Table of Progression of Project Submission

Project Proposal, December 24, 2008		
[OBSOLETE] Mactung Mine Project Proposal YESAB – Executive Committee Submission	2008-0304-002-1 to 2008-0304-023-1	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
[OBSOLETE] Appendices A1 to	2008-0304-024-1 to	These documents were updated on October 15, 2009 after Addendum II

M2 of Project Proposal	2008-0304-070-1	was submitted. The updated documents include references to sections with updated information.
Addendum I, July 10, 2009		
[OBSOLETE] Response to YESAB's Adequacy Review Report for the Proposed Mactung Mine, Macmillan Pass, Yukon, Addendum 1 of the Mactung Project Proposal	2008-0304-082-1 to 2008-0304-086-1	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
[OBSOLETE] Appendix A to D of Addendum I	2008-0304-087-1 to 2008-0304-090-1	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
Addendum II, September 22, 2009		
YESAA Project Proposal Organization and Layout	2008-0304-103-1	This memo explains how the December, 2008 proposal, July 2009 Addendum I, and September 2009 Addendum II information form a part of the proposal. A Table of Clarification is provided.
[REVISED] Mactung Mine Project Proposal YESAB – Executive Committee Submission	2008-0304-002-2 to 2008-0304-023-2	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
[REVISED] Appendices A1 to M2 of Project Proposal	2008-0304-024-2 to 2008-0304-070-2	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
[REVISED] Response to YESAB's Adequacy Review Report for the Proposed Mactung Mine, Macmillan Pass, Yukon,	2008-0304-082-2 to 2008-0304-086-2	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to

Addendum 1 of the Mactung Project Proposal		sections with updated information.
[Revised] Appendix A to D of Addendum I	2008-0304-087-2 to 2008-0304-090-2	These documents were updated on October 15, 2009 after Addendum II was submitted. The updated documents include references to sections with updated information.
Response to YESAB's Adequacy Review Report of Supplementary Information Response for the Proposed Mactung Mine, Macmillan Pass, Yukon, Addendum 2 Of The Mactung Project Proposal	2008-0304-099-2	
Consideration of Access Road Alternatives	2008-0304-099-2	
EBA Engineering Consultants Ltd. clarifications to questions raised by the Executive Committee during the adequacy review of supplementary information.	2008-0304-099-2	
Supplementary Geochemical Information For Waste And Mineralized Rocks, Mactung Deposit, Yukon Territory	2008-0304-095-2	
Addendum III, July 13, 2010		
Response to YESAB's Request for Supplementary Information for the Proposed Mactung Mine, Macmillan Pass, Yukon	2008-0304-164-1	
Addendum IV, July 18, 2011		
Response to YESAB's Information Request Dated August 4, 2010 for Mactung (2008-0304)	2008-0304-175-1	

Response to Request for Supplementary Information for the Mactung Project Proposal	2008-0304-176-1	
[Obsolete] Appendix B: Mactung Geochemical Characterization and Predictive Water Quality Modeling Report	2008-0304-0177-1	The Mactung Geochemical Characterization and Predictive Water Quality Modeling Report was replaced with and updated report 2008-0304-0177-2
Water Balance Tables	2008-0304-0178-1	
Addendum V, October 25, 2011		
[Revised] Appendix B: Mactung Geochemical Characterization and Predictive Water Quality Modeling Report	2008-0304-0177-2	This document replaced the water quality prediction model presented in Appendix B of Addendum IV.
NTC Supplementary Information Response	2008-0304-174-1	
Addendum VI, April 16, 2012		
Response to YESAB following a review of the EcoMetrix report and attendance at the Technical Working Group meeting held on March 22, 2012 regarding the Mactung project	2008-0304-219-1	
Addendum VII, May 8,2012		
Summary of NTC Examination of Mactung Spur Road Option and Decision	2008-0304-224-1	
Addendum VIII, September 6, 2012		
Photos of Fish Barriers on Tributary C	2008-0304-238-1 2008-0304-239-1	
Addendum IX, October 18, 2013		

NTC Supplementary Information response to the January 4, 2013 Information Request	2008-0304-298-1 2008-0304-299-1 2008-0304-300-1	
Appendices to the October 18, supplemental information request	2008-0304-301-1 2008-0304-302-1 2008-0304-303-1 2008-0304-304-1 2008-0304-305-1 2008-0304-306-1 2008-0304-307-4	
Addendum X December 9-23, 2013		
NTC Supplementary Information response to the December 2, 2013 information request	2008-0304-322-1 2008-0304-323-1 2008-0304-324-1 2008-0304-325-1 2008-0304-326-1 2008-0304-326-1 2008-0304-336-1 2008-0304-337-1 2008-0304-338-1 2008-0304-340-1	
Appendices to the December 9, 2013 supplemental information response	2008-0304-327-1 2008-0304-328-1 2008-0304-329-1 2008-0304-330-1 2008-0304-331-1 2008-0304-332-1 2008-0304-333-1 2008-0304-334-1	

	2008-0304-335-1	

2.4 NTC CONSULTATION REQUIREMENTS UNDER YESAA

Pursuant to s. 50(3) of YESAA, before submitting a project proposal to the Executive Committee, a proponent is required to consult any First Nation in whose traditional territory the project will be located or might have significant environmental or socio-economic effects, as well as the residents of a community in which the project will be located or might have significant environmental or socio-economic effects. This duty to consult is to be exercised in the manner described in s. 3 of YESAA.

Before commencing its screening of a project, the Executive Committee must determine whether, in its opinion, a proponent has consulted First Nations and the residents of communities in accordance with s. 50(3).

Based on the information provided in the project proposal, the Executive Committee determined that for the purposes of s. 50(3), NTC was required to consult:

- the Ross River Dena Council, the Liard First Nation, and the First Nation of Na-Cho Nyak Dun, being the First Nations in whose territories the project "will be located or might have significant environmental or socio-economic effects," and
- the residents of the community of Ross River, being the community in which the Project "will be located or might have significant environmental or socio-economic effects."

After considering the project proposal and the information provided by the Proponent, the Executive Committee determined that, in its opinion, with respect to the Mactung Mine, NTC consulted with the above-noted First Nations and community residents of Ross River in accordance with s. 50(3) of YESAA.

The Executive Committee notified the Proponent in writing of its determination on March 30, 2009.

2.5 ACCESS TO ASSESSMENT DOCUMENTATION

As required by s. 118 of YESAA, YESAB maintains a register that contains all documents produced, collected or received by the Executive Committee in relation to this screening. The register can be accessed electronically through the YESAB Online Registry (YOR) www.yesab.ca/registry, or in person at the YESAB Head Office in Whitehorse.

2.6 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT METHODOLOGY

The Executive Committee has employed a valued component based assessment methodology to assess the environmental and socio-economic effects of the Mactung Mine Project. The assessment methodology is outlined below.

- Determine project scope that accounts for all proposed activities through all stages of the Project (i.e. construction, operation, reclamation, closure and post-closure).

- Include activities identified in the proposal and any other activity that it considers so likely to be undertaken in relation to an activity so identified and sufficiently related to it to be included in the project.
- Give full and fair consideration to scientific information, traditional knowledge and other information provided during the assessment (s. 39 of YESAA).
- Determine the scope of assessment based on:
    - Matters to be considered (as described further in 2.6.1)
    - Views and information provided during the assessment.
    - Key issues identified.
    - Valued Environmental and Socio-economic Components (VESECs).
- Consider baseline information.
- Evaluate the Proponent's approach to modelling and predicting changes from baseline caused by project activities.
- Determine spatial and temporal overlap between project activities and values. For example, the use of heavy machinery may occur spatially within wildlife habitat and temporally when wildlife is known to be using that habitat (e.g. summer habitat).
- Characterize potential project effects.
- Consider the consequence of overlap between an activity and a value is an effect, which can be either positive (i.e. beneficial) or negative (i.e. adverse).
- Consider the Proponent's assessment of adverse effects and their conclusions.
- Evaluate the effectiveness of mitigation measures proposed by the Proponent and non-discretionary legislation that may mitigate these effects.
- Determine the significance of adverse project effects. (as described further in 2.6.2)
- Specify terms and conditions to mitigate significant adverse project effects so that they are no longer significant. Terms and conditions may include:
    - alternatives to the project or alternative ways of undertaking or operating it;
    - mitigative measures; and
    - measures to compensate.
- Characterize the residual effects of project activities, and how they interact.
- Determine whether there are residual significant adverse effects that require additional terms and conditions.
- Identify the spatial and temporal boundaries for cumulative effects to particular VESECs.
- Identify projects for which proposals have been submitted to YESAB and other existing or proposed activities occurring within these boundaries.

- Determine the spatial and temporal overlap between all activities and VESECs.
- Conduct a cumulative effects assessment.
- Consider the Proponent's assessment of adverse cumulative effects and their conclusions.
- Evaluate the effectiveness of mitigation measures proposed by the Proponent and non-discretionary legislation that may mitigate these effects.
- Specify terms and conditions to mitigate significant adverse cumulative effects.
- Determine whether there are residual significant adverse cumulative effects that require additional terms and conditions.

2.6.1 Matters to be Considered

The scope of the assessment encompasses the matters considered in the screening. Consistent with s. 42 of YESAA, the Executive Committee considers:

- the purpose of the project;
- all stages of the project;
- the significance of any environmental or socio-economic effects of the project that have occurred or might occur in or outside Yukon, including the effects of malfunctions or accidents;
- the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project in combination with the effects of:
    - other projects for which proposals have been submitted under s. 50 (1); or
    - other existing or proposed activities in or outside Yukon that are known to the Executive Committee from information provided to it or obtained by it under YESAA.
- alternatives to the project, or alternative ways of undertaking or operating it, that would avoid or minimize any significant adverse environmental or socio-economic effects;
- mitigative measures and measures to compensate for any significant adverse environmental or socio-economic effects;
- the need to protect the rights of Yukon Indian persons under final agreements, the special relationship between Yukon Indian persons and the wilderness environment of Yukon, and the cultures, traditions, health and lifestyles of Yukon Indian persons and other residents of Yukon;
- the interests of residents of Yukon and of Canadian residents outside Yukon;
- the need for effects monitoring; and
- the capacity of any renewable resources likely to be significantly affected by the project to meet present and future needs.

2.6.2 Determining the Significance of Adverse Effects

To determine if a particular effect is significant, the Executive Committee examines the characteristics of the effect as well as the context, or circumstances, within which the effect would occur. Criteria for determining what may constitute a significant effect include the following factors:

- Magnitude: This refers to the magnitude of the effect. Low magnitude effects may have no impact, while high magnitude effects do have an impact.
- Probability: This refers to the likelihood that an adverse effect will occur.
- Geographic Extent: This refers to the extent of change over the geographic area of the project. The geographic extent of effects can be local or regional. Local effects may have a lower impact than regional effects.
- Duration and Frequency: This refers to the length of time the effect lasts and how often the effect occurs. The duration of an effect can be short-term or long-term. The frequency of an effect can be frequent or infrequent. Short- term and/or infrequent effects may have a lower impact than long-term and/or frequent effects.
- Reversibility: This refers to the degree to which the effect is reversible. Effects can be reversible or permanent. Reversible effects may have a lower impact than irreversible or permanent effects.
- Context: This refers to the ability of the environment to accept change. For example, the effects of a project may have an impact if they occur in areas that are ecologically sensitive with little resilience to imposed stresses.

YESAA requires that the Executive Committee recommend mitigations for those project and cumulative effects that it determines are adverse and significant in order to recommend that a project proceed. This screening report contains the Executive Committee's recommended mitigations for all significant adverse effects of the proposed project.

3.0 PROJECT OVERVIEW

3.1 PROPONENT INFORMATION

North American Tungsten Corporation Ltd. (NTC) is the Proponent for the proposed Mactung Mine Project. The company is a publicly listed Tier 1 Junior Resource Company engaged primarily in the operation, development, and acquisition of tungsten mineral properties in Canada. NTC has been identified as the largest producer of tungsten concentrate in the western world. The company is managed by its executives and Board of Directors in the head office located in Vancouver, British Columbia.

Contact Person:

Allan Krasnick

Barrister & Solicitor,

Director, North American Tungsten Corporation Ltd.

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NTC will also be referred to as the Proponent in this report. It is recognized that EBA Engineering Consultants (EBA) provided many of the responses on NTC's behalf.

3.2 MACTUNG MINE PURPOSE AND OBJECTIVES

NTC is proposing to design, construct, operate, maintain, and decommission a tungsten extraction and concentrating mine in east-central Yukon. The principal objectives of the Project are to:

- extract tungsten-bearing ore from Mount Allan by underground Long-Hole Blasting (LHB), stoping and cut-and-fill mining;
- concentrate the tungsten mineral at a milling rate of 2 000 tonnes-per-day (tpd) using a scheelite gravity and flotation process; and
- transport the tungsten concentrate to market by way of Edmonton, AB and Vancouver, BC.

3.3 MACTUNG MINE LOCATION

The Mactung Mine is located in Yukon in the Selwyn Mountain Range. The site is approximately 8 km northwest of Macmillan Pass on the edge of Mount Allan. The mine site is located on 1:50 k Index map sheet 105O08 and 1:250 k Index map sheet 105O. Table 5 provides project location coordinates.

Table 5 Project Location Coordinates

UTM Zone: 9 V	Degrees, Minutes, Seconds	Decimal Degrees
7017669.54 m N	63° 16' 59.575" N	63.283215231
441933.03 m E	130° 9' 27.556" W	-130.157654427

Project infrastructure at the proposed Mactung Mine site will include underground adits, mine camp, waste rock disposal facilities, dry-stacked tailings facility (DSTF), an in-valley reservoir, dam, seepage pond, diesel generators, fuel storage facilities, and water related infrastructure (Figure 2).

The regional area around the mine site will also include mine-related infrastructure and activities such as access roads, the Macmillan Pass Aerodrome, water intake infrastructure on the Hess River South Tributary, and borrow sites for road construction and maintenance.

Additional mine infrastructure and activities will be located along the North Canol Road. Staging areas will be developed to support the movement of construction materials to the mine site. Project-related activities along the road will consist primarily of the movement of materials, personnel and concentrate to and from the project site.

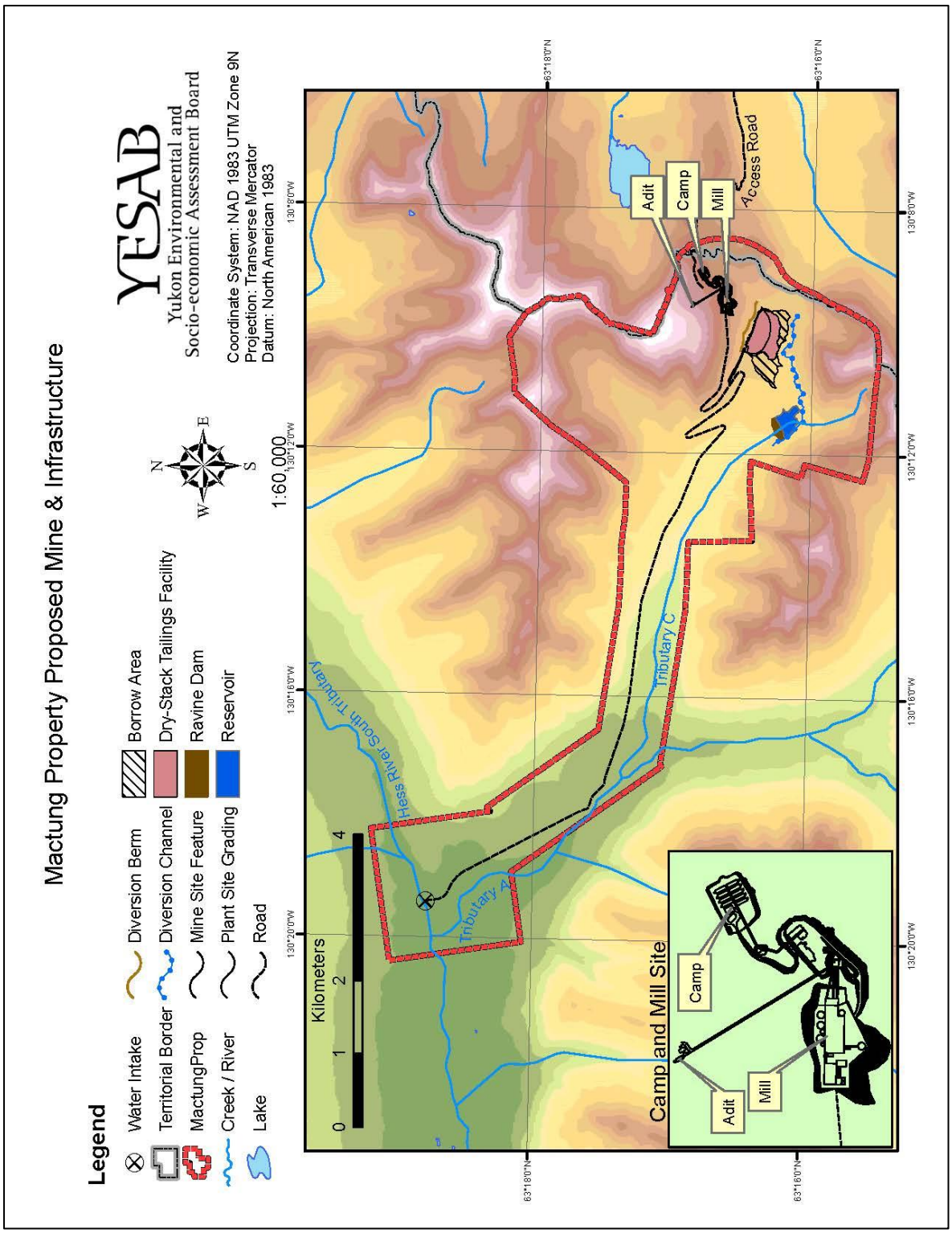

Figure 2 Mactung mine and infrastructure

3.4 SCOPE OF THE MACTUNG PROJECT

This section addresses the scope of the proposed project to be assessed by the Executive Committee. Material changes to the scope of the Project made since the proposal was originally submitted in December 2008 are also discussed.

Project scoping is conducted in accordance with s. 51 of YESAA and Part 4 of the *Rules for Screenings Conducted by the Executive Committee*. Section 51 of YESAA states, in part:

> *… the executive committee shall determine the scope of a project to be assessed by it, and shall include within the scope of the project, in addition to any activity identified in the proposal, any other activity that it considers likely to be undertaken in relation to an activity so identified and sufficiently related to it to be included in the project.*

The *Screening Rules* provide additional guidance to the Executive Committee in making its scoping determination.

A complete description of the Project is included as part of the proposal. The purpose of this section is to summarize the description provided.

Table 6 Scope of the Project

Project Component	Activities
General Project	• The construction, operation, decommissioning and closure of an underground tungsten mine in east-central Yukon. The Mactung site contains an indicated current mineral resource of 33 million tonnes of ore and is expected to be in operation for 11 years.

Water Management	• Construction of reservoir dam and reservoir required to store between 120 000 to 540 000 m³ of water.
	  ○ The reservoir dam will be approximately 315 m long and 35 m high at its highest point with a crest width of 25 m.
	  ○ Construction will require stripping overburden to the surface of bedrock and excavating highly weathered/fractured bedrock (using machinery and hand scaling) to a more competent bedrock surface.
	• Construction of a seepage collection dam and pond with a capacity of 5 250 m^3 to collect reservoir seepage and any groundwater underflow.
	  ○ The seepage water dam will be approximately 8 m high and 60 m wide with a capacity of 5 250 m^3.
	• Construction of mine site water diversion structures.

Waste Rock Storage	• Construction of dry-stacked tailings facility (DSTF) on an area approximately

Project Component	Activities
Areas	25 ha. ○ Clearing and grubbing of vegetation as well as the stripping and stockpiling of organics. • Two temporary waste rock stockpiles of approximately 92 000 m³ and 32 000 m³ will be established near the existing adit portal and conveyor entrances respectively. • The Project will generate approximately and 207 000 m^3 total waste rock during all development phases (including 124 000 m^3 during the pre-production phase). • Disposal of approximately 50 percent (approximately 2 130 500 m³) of the dewatered tailings comingled with waste rock, backfilled, and encapsulated within mined out stopes. • Disposal of approximately 50 percent (approximately 2 130 500 m³) of dewatered and filtered mill tailings in the dry-stacked tailings facility.
Mine Site Construction and Maintenance	• Construction of six infrastructure pads to provide level areas for infrastructure buildings. • Construction of site haul roads to connect mine site infrastructure and access roads. • Construction of seasonal 13 km pipeline road from the mine site to the Hess River South Tributary. • General road construction design includes a 5 m road bed, 3 m wide ditches, and a minimum 5 m clearing on either side. • Construction, operation and closure of pipeline and power line bench adjacent to 13 km pipeline road. The bench surface will be a maximum of 2 m in width and a maximum of 1.5 m above the pipeline road. • Development of three borrow areas, two borrow pits and one quarry, at the mine site for construction. ○ Clearing and grubbing of vegetation as well as the stripping and stockpiling of organics. ○ Development of borrow pits/excavated areas to produce approximately 500 000 m³ of fill. ○ Development of quarry to produce approximately 50 000 m³ of high quality aggregate through blasting bedrock and processing.

Project Component	Activities
Process Plant	• Construction of a process plant to house heavy, vibratory equipment such as rock mills and crushers and lighter static equipment such as the floatation system. The process plant will be located on the 1 808 m infrastructure pad.
Power	• Construction and use of a powerhouse containing five 2.5 MW diesel generators and heat recovery system as well as power distribution system constructed on the 1 808 m infrastructure pad.
ANFO Emulsion Plant	• Construction and use of an ammonium nitrate fuel oil (ANFO) emulsion plant located on the west side of Mount Allen • The plant will produce 1000 kg of ANFO a day in a package type explosive.
Construction, Maintenance and Operation of Associated Facilities	• Construction, operation and decommissioning of a land treatment facility with a capacity to treat up to 900 m^3 of soil at any one time or temporarily store up to 2 800 m^3 from a single spill event. The facility is based on an estimated annual generation of 100 to 300 m^3 of soil per year. • Construction, operation and decommissioning of a landfill facility adjacent to the land treatment facility. • Construction, operation, decommissioning and closure of three staging areas approximately 20 ha each to facilitate the movement of materials to and from the mine site. The three proposed locations are: the south side of the North Canol Road opposite the Macmillan Pass Aerodrome; the North Canol Road approximately 5.3 km northeast of Ross River; and the south end of Ross River opposite the airport. o Each staging area will require clearing and grubbing of vegetation, leveling the ground surface, and surfacing with gravel. o Staging areas will be securely fenced. o The two staging areas near Ross River will be used until the end of the reclamation phase of the proposed project. o The staging area near the Macmillan Pass Aerodrome will be decommissioned and reclaimed after the construction phase of the proposed project is complete. • Use of either a temporary stationary concrete batch plant or a mobile concrete mixer for construction.
Use, Upgrades and	• Upgrade and expansion of the Macmillan Pass Aerodrome to approximately

Project Component	Activities

Maintenance of Existing Infrastructure	1 375 m long and 30 m wide (from 460 m long and 15 m wide), and construct a 90 m by 60 m apron. Stabilize the western end of the airstrip to repair existing erosion and prevent further erosion.
	• The use of the Macmillan Pass Aerodrome:
	  ○ Workers will be flown into the Macmillan Pass Aerodrome and then bused to the mine site or transported by ground from nearby communities.
	  ○ There will be approximately six flights a week into the Macmillan Pass Aerodrome using 19-passenger Beechcraft-sized aircraft or equivalent.
	• The use of the North Canol Road, roads within the community of Ross River, the Pelly River barge, and territorial highways for the transportation to and from the mine site.
	  ○ The Pelly River will be crossed by barge during the summer and by ice-bridge during the winter.
	  ○ During construction and operation, there will be approximately two to four loads per day with a peak of 10 trucks per day using standard five-axle or six-axle, 40-tonne trucks and 1-tonne “hot-shot” trucks.

Mine Site Operation	• Extraction of tungsten bearing ore through underground long-hole blasting, stoping, and cut and fill mining techniques. • Milling of tungsten ore at a rate of 2 000 tonnes per day using the scheelite gravity flotation process. • Transport of the tungsten concentrate to market by way of Edmonton, AB and Vancouver, BC.

Camps and Mine Site Administration	• Construction and operation of a mine site camp and accommodations complex to accommodate approximately 250 people during construction and up to 150 people during operation which includes:
	  ○ Installation and use of modular units including kitchen, dining room, dorms, washrooms, sewage treatment plant, potable water treatment facility and distribution system, and recreation complex.
	  ○ Installation and use of propane furnaces and propane fired solid waste incinerator.
	  ○ Disposal of treated effluent into septic field/rock drain until the reservoir is operational, at which point treated effluent will be discharged into the

Project Component	Activities
	reservoir. • Construction of infrastructure and administration buildings including: o Process building and plant to process ore into tungsten concentrate. o Equipment maintenance facility/warehouse and administration/shifter building constructed on the 1 836 m elevation infrastructure pad. o Warehouse, workshop and laboratory facility. o Administration office and communication system. o Wastewater treatment facility. o Waste oil burner for building heating. • Construction, operation, decommissioning and closure a temporary construction camp for approximately 49 people located at the Macmillan Pass Aerodrome staging area. o Installation and use of modular trailers including kitchen/dinner module, seven sleeper modules, wash car module, a sewage treatment module, and water supply module. o Installation and use of a diesel generator, propane furnaces, and propane fired solid waste incinerator. o Disposal of treated effluent into septic field/rock drain.
Equipment	• Construction and operation phase activities will require the use of heavy equipment such as jumbo drills, rock bolters, jackleg units, stopper units, exploration drills, load-haul-dump scoop trams, haul trucks, graders, loaders, service trucks, scissor lifts and cassette carriers, bulldozers, excavators, soil compactors, tool carriers, hydraulic reed drills, freshwater tank truck, sewage tank truck, and fuel/lube service trucks.
Fresh Water Distribution System	• Construction of freshwater intake facility on the Hess River South Tributary and water distribution system to supply water for domestic use and for use in processing ore. o Rip and excavate or drill and blast bedrock to install intake pipe. o Construction and installation of pumphouse, two submersible pumps, and intake structure. o Construction of 100 mm to 250 mm diameter insulated and heat-traced steel and/or high density polyethylene pipeline 13 km in length on

Project Component	Activities
	pipeline bench. ○ Construction of freshwater and firewater storage tank with a capacity of 810 m³ at mine site. • Use of up to 768 m³ of water per day (withdrawal rate of 8.9 L/s or 0.0089 m³/s) from the Hess River South Tributary.
Mine Water Treatment Plant	• Installation of a water treatment plant prior to operation to manage water quality that is discharged from the reservoir.
Reclamation and Closure	• Decommissioning and reclamation of the camp site, access road, Hess River South Tributary pumping station, and borrow areas that support the mine site. • Removal of the explosives storage facility and process plant. • Installation of a cover for the DSTF. ○ Install an artificial liner on the surface of the DSTF. ○ Construct a 0.8 m thick protective cover overtop the liner. ○ Revegetate the final cover surface. • Progressive closure mined out stopes underground. Plug the conveyer decline and ventilation adit to restrict movement of surface runoff into underground workings. • Termination of pumping of mine water to the surface to allow groundwater levels to recover toward pre-mining conditions. • Phased decommissioning and reclamation of the reservoir dam. • Pump down the reservoir prior to breaching the dam. • Breach the dam. • Fine sediments within the reservoir will be transported to DSTF facility for final disposal. • Re-establish the natural drainage pattern.

Project Sequencing

The Project will occur over a 16-year period in three phases: construction phase, operation phase, and decommissioning and closure phase. Some decommissioning and closure activities will occur concurrently during operations phase.

The construction phase is expected to commence in the spring and be completed in two to three years. This phase includes the construction of infrastructure as well as the development of underground mine structures and components.

The operation phase is expected to commence in late fall and be completed by the end of eleven years. This phase includes the extraction of tungsten bearing ore, milling and production of tungsten concentrate, and transportation of the tungsten concentrate to market as well as the use and maintenance of associated infrastructure.

The decommissioning and closure phase is expected to occur progressively. Reclamation will be conducted on areas that are no longer operationally required during the production phase. Decommissioning and closure of operation phase infrastructure will commence at the end of the operation phase and will take approximately two years.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

4.1 GENERAL PHYSIOGRAPHY/GEOMORPHOLOGY

The Project is located in the Selwyn Mountain Ecoregion of the Taiga Cordillera Ecozone (Smith, Meikle and Roots 2004). The landscape is characterized by rugged, steep-sided mountainous terrain divided by narrow glaciated valleys. These steep mountain slopes are typically blanketed in colluvium deposits (i.e. loose sediments transported by gravity and generated by erosion process and mass movements such as landslides and rockfalls). On the upper slopes and peaks, bedrock is exposed. Valley bottoms generally contain significant deposits of glacial till or colluvium (Figure 3).

The mountainous area was shaped by the Selwyn Lobe of the Cordilleran ice sheet during the late Wisconsin McConnell glaciation. More recently active geomorphic processes such as gully erosion, debris slides, debris flows, rockfall, avalanches and permafrost processes have shaped the landscape. Alpine glaciers also have modified the terrain.

Figure 3 Terrain of proposed mine site area. (YOR 2008-0304-031-2)

4.2 SURFICIAL GEOLOGY AND SOILS

EBA Engineering Consultants (EBA) conducted terrain mapping in the vicinity of the proposed mine (YOR 2008-0304-031-1, 2008-0304-032-1 and 2008-0304-099-2). The hazard mapping provides details

on terrain stability, potential for soil erosion, slope, drainage capacity and geomorphologic processes. The terrain mapping identified areas expected to be initiation zones for rock and snow avalanches.

The terrain classification inventory for the proposed footprint of the approximate 40 km^2 mine site area identified till covering 41 percent, colluvium covering 30 percent and exposed bedrock covering 28 percent of the area. Fluvial deposits were identified covering approximately one percent of the total footprint area.

Materials and landscape identified in the EBA reports are typical of northern alpine and sub-alpine glaciated environments. The till material is composed of varying amounts of gravel, silt and sand and consist of basal deposits, lateral and terminal moraines. The colluvium material generally changes from coarse, blocky clasts on the upper slopes to sandy gravel with some silt on the lower valley slopes. Typically bedrock is exposed on the upper slopes of the valley walls, ridges and in cirques. The deposits of colluvium typically occur on moderately to lower gradient portions of the valley sides and lower valley. There is a decrease in grain size of materials from coarse blocky talus below exposed bedrock to finer, more weathered clasts towards the valley bottom. Colluvium on the lower reaches of the valleys is frequently covered by thin soils. The fluvial material is located in areas of the valley floor and is typically composed of silt and sand.

Typical of arctic alpine environments, soil formation is controlled by low temperatures, slow plant growth rates, accumulation and decomposition of organics. Soils in the region are typical poorly developed soils such as regosols and brunisols. EBA notes that regosols generally occur at high elevations in association with till deposits and brunisols generally occur at lower elevations in well drained locations. Also observed in the mine site area were some organisols which occurred in flat, poorly drained areas on the valley floor and crysosols noted in areas where organic layers provide sufficient insulation to allow frozen soil horizons to develop.

4.3 BEDROCK GEOLOGY

The Macmillan Pass area is at the boundary between the Mackenzie Platform and Selwyn Basin. In general terms, the regional bedrock geology is described as laminated shales (fine-grained sedimentary rock) and phyllites (shale which has undergone metamorphic processes) intruded by granitic rocks. The date range of the sedimentary rocks ranges from the late Proterozoic (542 Ma) to the Triassic (201 Ma). These sedimentary rocks were intruded by granitic stocks and batholiths during the Cretaceous (65.5 to 145.5 Ma).

A more detailed description of the bedrock geology provided in the project proposal describes the geology as follows:

> *Major rock types present are quartz monzonite, argillite, shale, hornfels, chert and limestone. Quartz monzonite is typically light grey, medium grained, vaguely porphyritic biotite quartz monzonite grading to light grey to buff, equigranular, medium-grained biotite near the contacts with the country rock.Two thin, probably discontinuous limestone layers are interstratified with shales and cherts, which are underlain by well foliated limy phyllites and quartz mica schists. The lower limestone bed is approximately 12 m to 15 m thick and interstratified with limy and siliceous shales and argillites. It is converted to a garnetepidote-diopside skarn adjacent to the*

> *quartz monzonite stock, with fine-grained scheelite disseminated throughout the skarn. The upper limestone bed is over 30 m thick and is mostly barren, with skarn mineralogy limited to faults near the quartz monzonite contact. Mineralogy has differentiated pyroxene skarn, pyrrhotite skarn, pyroxene marble skarn, light green cherty skarn and chlorite skarn (NTC, YOR 2008-0304-007-2).*

4.3.1 Description of Mineral Resource

The style of the deposit at Mactung is described by North American Tungsten Corporation Ltd. (NTC) as a tungsten skarn. A skarn deposit develops when igneous rock and the associated hydrothermal fluids are intruded into a carbonate sedimentary parent-rock creating a chemical altered zone in the contact area. Geo-environmental models describe a typical skarn deposit as:

> *coarsely-crystalline metamorphic rocks composed of calcium-iron-magnesium manganese-aluminum silicate minerals (calc-silicate minerals) that form by replacement mainly of carbonate-bearing rocks during contact or regional metamorphism and metasomatism. Skarns are relatively high-temperature mineral deposits resulting from magmatic-hydrothermal activity associated with granitoid plutons in orogenic tectonic settings. Skarns generally form where a granitoid pluton has intruded sedimentary strata that include limestone or other carbonate-rich rocks. (Hammarstrom 2004)*

At Mactung, the skarn developed at the contact between previously described Cretaceous quartz monzonite stock and Lower Paleozoic calcareous sedimentary rocks. The Proponent has estimated a mineral resource of approximately 33 million tonnes of tungsten tri-oxide (WO_3) ore at 0.88 percent grade. In this deposit the tungsten occurs predominantly in the mineral scheelite ($CaWO_4$) with minor amounts of the mineral ferberite ($FeWO_4$).

Rock types identified within the area where proposed project activities will primarily disturb have been classified by NTC into three units, with one unit, Unit 3, having several subdivisions (Figure 4).

In order of ascending sequence the geologic units are:

Unit 1 - Phyllite (mica schist)
Unit 2B - Limestone slump breccias, skarn [ore]
Unit 3C - Hornfelsed black shale with interbeds of limestone
Unit 3D - Interbedded shale and limestone slump breccia (partially skarnified)
Unit 3E - Pellitic interbedded black shale and grey to black limestone (partially skarnified)
Unit 3F - Interbedded black shale and grey to black limestone (partially skarnified)
Unit 3H - Hornfelsed black carbonaceous pyritic shale

Projected volumes of disturbed material by rock unit type during each stage of the Project (development and stoping) are indicated in Table 7 showing the summary of primary and secondary rock types which account for the majority of the three rock units affected by the proposed underground development (YOR 2008-0304-082-2).

Table 7 Proposed Mactung Development Volume and Tonnage by Rock Unit (adapted from NTC YOR 2008-0304-082-2)

Unit	Development Volume (m^3)	Stoping Volume (m^3)	Total Volume (m^3)	Specific Gravity	Development Tonnage (tonnes)	Stoping Tonnage (tonnes)	Total Tonnage (tonnes)
1	22 959	43 162	66 121	2.70	61 989	116 537	178 526
2B	30 964	2 100 345	2 131 309	3.14	97 227	6 595 083	6 692 312
3C	183 837	460 080	643 917	2.99	549 673	1 375 639	1 925 310

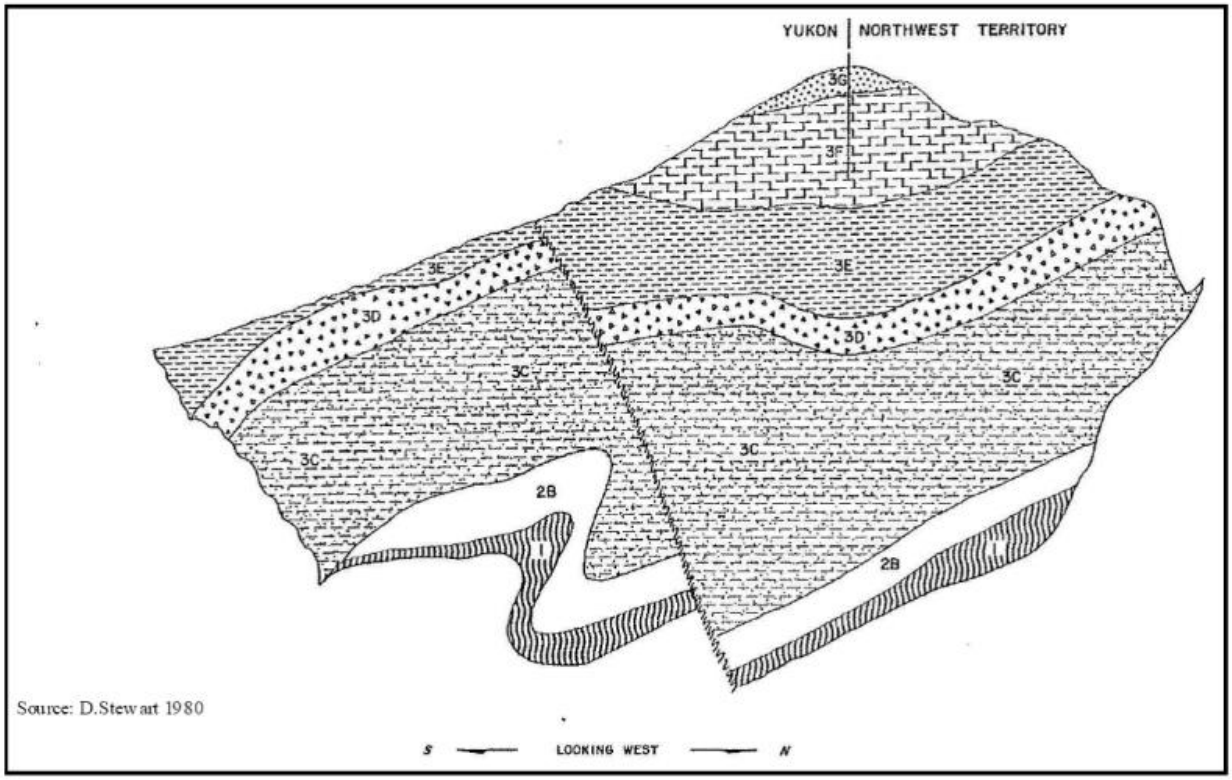

Figure 4 Schematic of geological cross-section. Indicates geological units. (Wardrop 2009)

4.3.2 Construction Materials

Material for the construction of the reservoir dam has been identified at the reservoir site and DSTF location. Proposed borrow material consists of till. Results of geotechnical investigations estimate the volume of the potential borrow material as 81 000 m^3 at the reservoir dam location and 448 000 m^3 at the DSTF borrow site (YOR 2008-0304-099-2).

4.4 CLIMATE

An on-site weather station was installed in July 2005 and is located approximately 150 m north of the proposed camp area (63° 17' 22.6", 130° 8' 50.3") at an elevation of approximately 1 860 m above sea level (ASL). This meteorological station collects temperature, wind speed, relative humidity, and incident solar radiation data. There is no rain gauge installed at the on-site weather station or elsewhere on-site. Data between July 2005 and September 2008 were presented in the project proposal and are summarized in this section. Raw data as well as details on instrumentation employed to collect climate data can be found in the project proposal (YOR 2008-0304-007-2, 2008-0304-036-2, 2008-0304-037-2 and 2008-0304-038-2). Climate variables relative humidity and incident solar radiation (YOR 2008-0304-007-2) are not summarized in the screening report. For detailed reporting on these data refer to the project proposal.

4.4.1 Temperature

Elevation of project area ranges from approximately 2 170 m ASL at the top of Mount Allan to 1 160 m ASL at the intersection of the proposed access road and North Canol Road. The DSTF is located at the mill site, approximately 1 650 m ASL. The camp and portal are located at approximately 1 840 m ASL. Climatic conditions will vary across this elevation and spatial range.

The on-site meteorological station recorded mean summer air temperature between 5 and 10 °C, with maximum temperature of 20 °C. The minimum winter air temperature recorded was -37 °C, with typical mean air temperature of -10 to -20 °C.

ClimateWNA is a program to "generate climate normal data for genecology and climate change studies in western North America." The program is available at ClimateWNA and methodologies are described in Wang et al. (2012) and Wang et al. (2006). ClimateWNA was used to compare the on-site data with data for a longer period of record. The above temperature data is consistent with ClimateWNA data for period of 1971 to 2000, at 63.2847°N, 130.1528°W (63°16'50.5'', -130°8'58.6"); elevation: 1 860 m ASL.

Temperature ranges from mean July temperature of 8 °C to mean January temperature of -23.7 °C. Mean annual temperature is -8.7 °C.

4.4.2 Rainfall

A meteorological station was installed on August 12, 2013, which will be used to validate precipitation estimates used in the water balance and water quality predictions.

The precipitation estimates in this report are based on a regional analysis as provided by NTC in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1)

4.4.3 Snowfall

A snow survey was conducted in mid-April 2009 to determine snow depth and density (YOR 2008-0304-082-2). As indicated by the Proponent, the water content of the snowpack in Yukon generally increases until mid-April, then reduces after this date as the snow begins to melt. The average snow depth at the 127 sample locations across the mine site area was 131 cm. The average water content of the snow was determined to be 10.5 percent of depth (i.e. snow column of 52 cm contained 5 cm of water).

4.4.4 Wind Speed and Direction

Winds at the site were observed predominantly from the W/SW and from the NE/NNE. Recorded wind speeds were greater than 6 m/s less than ten percent of the time. Winter months typically experienced the higher wind gust speeds. Detailed records of wind speed and direction are provided in the project proposal.

4.4.5 Climate Trends

The project proposal provides some analysis of the 1998 to 2007 data record for the Macmillan Pass meteorological station. The period of record is too short to provide meaningful analysis of climate trends. It has been generally predicted that Yukon will experience increased precipitation and increased temperatures resulting in shorter and milder winters. For snowmelt driven watersheds, annual peak flows are anticipated to experience increased magnitudes of peak flows and less frequent low flow events (Government of Yukon 2011).

4.5 PERMAFROST

The proposed project is located in a zone classified as extensive discontinuous permafrost which classifies the distribution of land area which is underlain by permafrost as between 50 to 90 percent (Heginbottom 1984). At lower elevations, widespread establishment of permafrost may be limited by the insulating value provided by significant snowfall accumulations the region typically experiences (Smith et al. 2004).

Frozen bedrock was identified at observation well MW-MT-08-01, located at the mine site. Although the drilling program did not identify ground ice, ground temperature is monitored through the instruments installed at this location (i.e. a vibrating wire piezometer). Ground temperature monitoring at 20 and 144 mbg has recorded temperatures of -1.5 ^{o}C or colder. Temperature measured at about 340 mbg was noted to be consistently at +1.2 ^{o}C. At this location EBA inferred the transition of rock at temperatures below freezing to above freezing to occur between 200 and 250 mbg based on linear interpolation. Observations during exploration activities at the site have not indicated the presence of ice-rich bedrock. Due to the lack of significant ice within the frozen bedrock, it is anticipated by the Proponent that there will be minimal water produced during active mining operations when underground rock temperatures may periodically increase above 0 ^{o}C.

Ground ice was observed from depth of 1.5 to 2 mbg in a test pit next to observation well MW-MT-08-08 located in the area of the proposed mine site. Field investigation by EBA suggests that the active layer

extends through the upper two to four metres in the vicinity of the underground workings. Investigations as part of site assessment south of Mount Allan did not identify the presence of permafrost in the southern portion of the project area.

4.6 HYDROLOGY

4.6.1 Surface Water Flows

The border between Yukon and NWT in the vicinity of the project area coincides with the continental divide. The proposed mine footprint is located within the Yukon River drainage area which drains to the Pacific Ocean. Flow on the NWT side, outside of proposed mine footprint, drains into the Mackenzie River watershed and discharges into the Arctic Ocean. More specifically the mine site is located within the Hess River watershed that drains into the Stewart River which flows into the Yukon River. The project proposal contains additional baseline data on Dale Creek located in NWT. Flow characteristics of Dale Creek may be substantially different from rivers on the Yukon side because of the changes in precipitation on the leeward side of the Selwyn Mountains.

The project proposal refers to the local watercourses in the immediate mine area as Tributaries A, B, C and Hess River South Tributary.

In the October 13, 2013 Information Response (YOR 2008-0304-300-1) NTC provides a summary of manual and continuous water flow measurements from the Tributary C and Hess River South Tributary. The average monthly averages from the Hess River South Tributary and Tributary C are provided in Table 8.

Table 8 Average Monthly Discharge of Hess River South Tributary and Tributary C

Year	Average Monthly Discharge (m^3/s)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Tributary C - Basin Area = 24.2 km^2												
2006							0.97	0.82	0.62			
2007							0.95	0.54	0.36			
2008					0.11*	1.52	1.03	0.81	0.73			
2009				0.03*	0.97*	0.89	0.67	0.85	0.68	0.24*	0.08*	0.10*
2010					1.71*	1.00	0.50	0.35	0.19	0.13	0.09*	0.05*
2011	0.08*			0.03*	0.42	1.22	0.58	0.52	0.35	0.21	0.12	0.08
2012	0.05	0.03	0.02	0.01	0.15	1.36	0.72	0.47	0.36	0.25	0.20	0.06
Average	0.06	0.03	0.02	0.02	0.67	1.20	0.77	0.62	0.47	0.21	0.12	0.07
Hess River South Tributary - Basin Area = 340 km^2												
2008						16.59	14.96	12.81	6.11			
2008			0.14*			15.48	14.22	12.84	7.89			
2009		0.27*		0.26*	10.23*	11.31	8.86	11.28	11.09		0.54*	1.43*
2010						16.63	12.35	9.95	3.75	1.74*		1.43*

2011	0.54*			0.24*	13.65	14.76	11.39	9.80	5.51	3.02		
2012	0.45*				11.95	20.92	14.87	11.12	7.81	5.98	0.46*	
Average	0.50	0.27	0.14	0.25	11.94	15.82	12.34	11.00	7.21	3.58	0.50	1.43

Notes: Cells with an asterisk (*) indicate only a manual measurement was recorded

4.6.2 Water Quality

NTC provided water quality results from samples taken at 15 locations on tributaries in the mine site area (Figure 5):

- nine stations on Tributary C (WQ-C0, WQ-C1, WQ-Ravine dam, WQ-C2, WQ-C3, WQ-C4, Warm Spring, WQ-1A and WQ-1);
- three stations on Tributary A (WQ-2A, WQ-Trib A Flow Stations, and WQ-2); and
- three stations on Hess River South Tributary (WQ-3, WQ-Trib H Flow Station, WQ-4).

Some stations were sampled multiple times and year round, while others only once.

The location of WQ-3, which is located upstream of the confluence of the Hess River South Tributary and Tributary A, would allow this station to provide water quality samples undisturbed by project activities. The upstream location on Tributary A, WQ-2A, is also located to provide relatively undisturbed water quality data prior to disturbance by mining and exploration activities.

Additional surface water quality samples were collected as part of the aquatics study. These water quality samples included characterization of temperature, pH, dissolved oxygen, turbidity and conductivity.

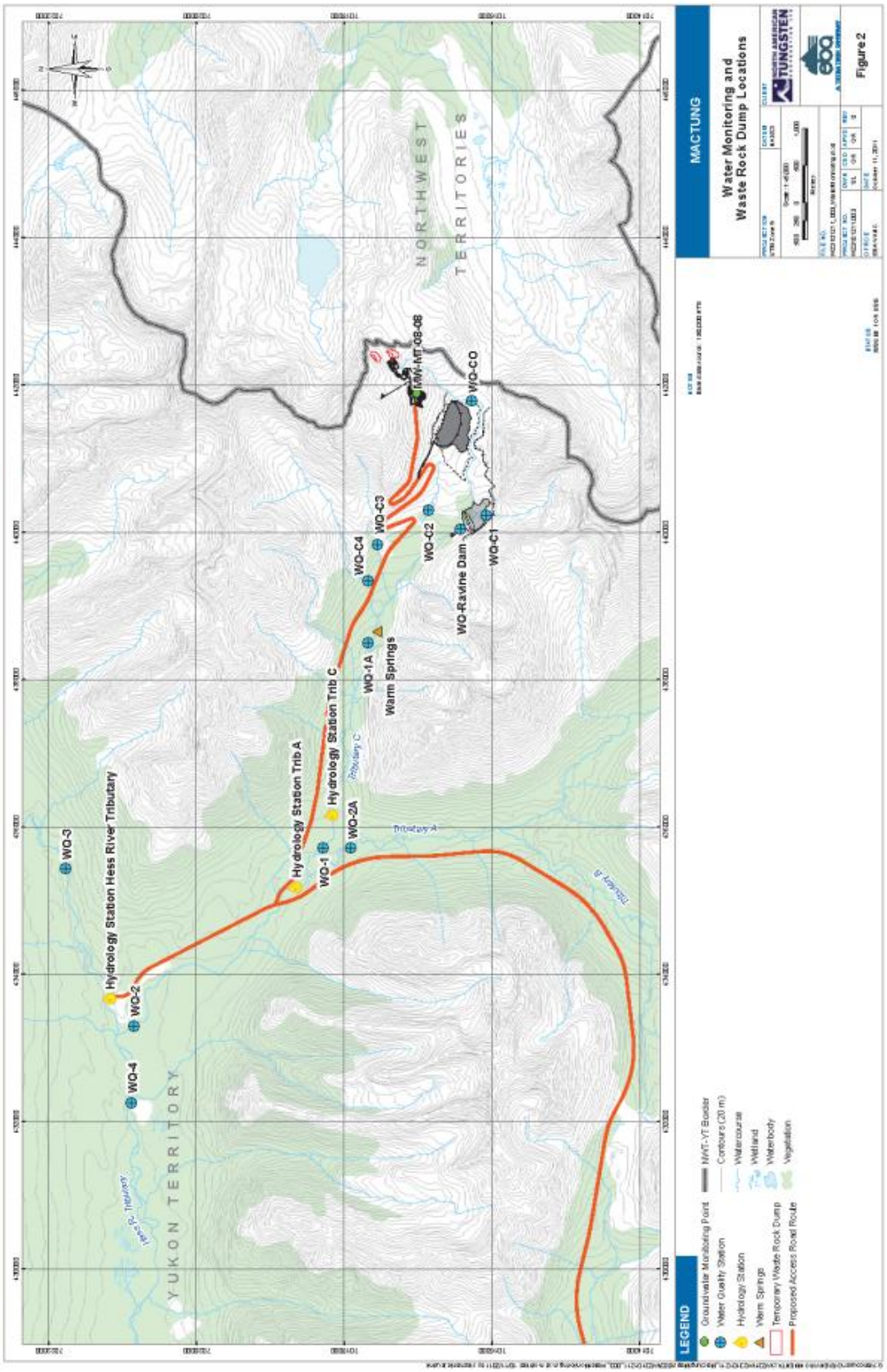

Figure 5 Water monitoring locations. (YOR 2008-0304-177-2)

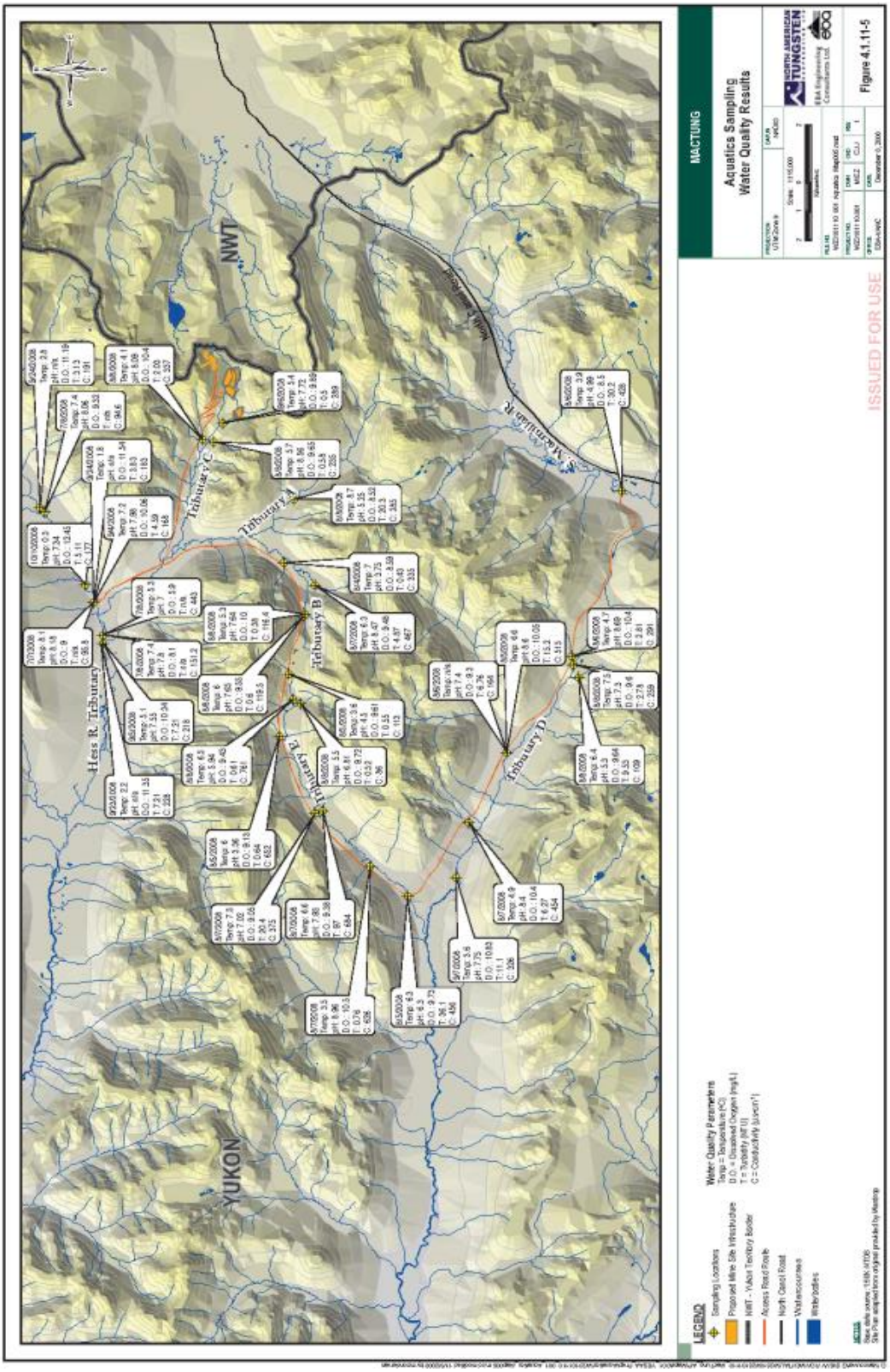

Figure 6 Aquatics sampling water quality results. (YOR 2008-304-012-2)

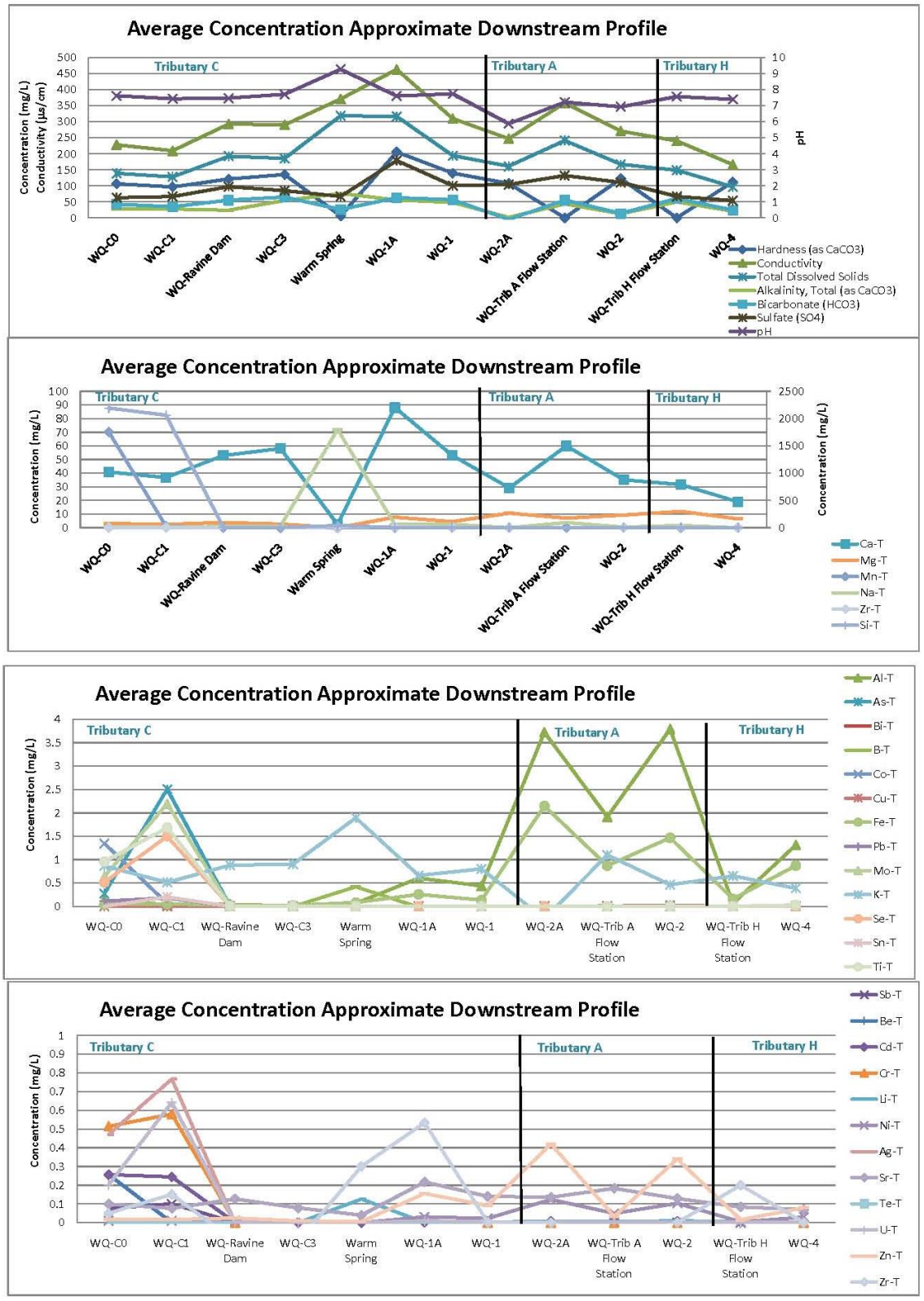

Figure 7 Average downstream water quality profile. Tributaries A, C, and H, at identified monitoring stations.

The charts above summarize the water quality profile of the creek systems based on the water quality measurements taken (Figure 6 and Figure 7). NTC also made some prediction of fish suitability based on the measured water quality characteristics.

Tributary C (WQ-1 and WQ-1A, Warm springs, reservoir dam, DSTF)

The water quality in this tributary was found to be conducive to supporting fish. The pH ranges from 7.7 to 8.6, dissolved oxygen around 10 mg/L, turbidity <2 NTU, and conductivity around 300 µs cm-1 or lower.

Tributary A (WQ-2 and WQ-2A)

Water quality appeared generally suitable to support fish (pH of 6.7, turbidity of 8.8 NTU, 9.7 mg/l of dissolved oxygen). However, both the suspended precipitate and benthic deposits/staining are suggestive of upstream ARD and elevated metals levels (confirmed at a pH of 5.25 in upstream areas). As noted earlier, EBA's baseline water quality data for this tributary has shown a trend of increasing metals concentrations with the progression of the summer season.

Hess River South Tributary (WQ-3 and WQ-4)

The water quality samples characterize this section of the river as having pH of between 7 and 8.18, turbidity being less than 10 NTU and dissolved oxygen of between 5.9 and 12.45 mg/L. Conductivity is generally less than or approximately equal to 200 µs cm-1, except for one location. The Hess River South Tributary is a productive river system that has been known to support populations of Chinook salmon, Dolly Varden, and Arctic grayling.

4.7 HYDROGEOLOGY

Hydrogeological investigations at the Mactung site have consisted of eight drill holes and installing deep (30 to 340 mbg) and shallow (4 to 5 mbg) piezometers (Figure 8). NTC provided a detailed hydrogeological assessment as part of the project proposal. An updated conceptual model describing the groundwater system was also presented (YOR 2008-0304-082-2).

A shallow unconfined aquifer in the overburden sediments overlying bedrock was identified within the active zone (seasonally thawed zone) in areas where permafrost exists. The underlying metamorphic and sedimentary bedrock hosts a deep aquifer or aquifers. Groundwater flow is expected to mainly occur along fractures and other rock discontinuities.

Figure 8 Approximate well locations. (YOR 2008-0304-011-2).

4.7.1 Overburden Aquifer

In the upland area around Mount Allan, overburden sediments have been estimated by NTC to be between approximately one and three metres thick. In the valley bottom the thickness is estimated to be between approximately five and 10 metres thick. The groundwater elevation in the shallow monitoring wells has been observed to seasonally change by a few meters. Hydraulic conductivity estimates have been made based on grain size and range from 2x10-7 to 3x10-3 m/s (Table 9). As indicated by EBA,

> *the main groundwater flow with the highest groundwater levels is anticipated to occur during the snowmelt in late spring after thawing of the shallow sediments. Along the southern slope of Mount Allan, EBA considers the shallow groundwater as temporary or seasonal subsurface runoff (ephemeral through flow) rather than permanent groundwater in a strict sense.*
>
> (YOR 2008-0304-011-2)

Table 9 Hydraulic Conductivity of Shallow Aquifer (YOR 2008-0304-011-2)

Hydraulic Conductivities of the Shallow Aquifer (Overburden)			
Location	Hydraulic Conductivity		
	Min	Max	Geomean
	m/s		
All	1.7E-07	2.5E-03	9.7E-06
Mount Allan (incl. Mill, Camp)	1.7E-07	2.5E-03	3.1E-05
Dry-Stacked Tailings Facility	1.5E-06	9.2E-06	4.7E-06
Reservoir Dam	1.3E-06	1.7E-05	4.2E-06

4.7.2 Bedrock Aquifers

Groundwater flow in bedrock is largely controlled by a few conductive fractures or other rock mass discontinuities. Three constant rate pumping tests were conducted to provide information on the hydraulic conductivity of the bedrock: one at each of MW-MT-08-01 (downgradient of the DSTF), MW-MT-08-02 (downgradient of the reservoir dam), MW-MT-08-08 (mill site), and MW-MT-09-10 (underground workings). The MW-MT-09-10 borehole test was conducted in August 2009 to further characterize the underground workings. The pumping tests provide a range of estimated bulk hydraulic conductivity between approximately $1x10^{-6}$ to $2x10^{-7}$ m/s. These three wells were completed in metapelite and test the bedrock in within approximately 100 m below ground surface (bgs) or shallower.

Packer testing to estimate hydraulic conductivity for all boreholes was also completed. The determined bedrock hydraulic conductivity values are summarized in the project proposal and ranged from less than 1×10^{-8} to 5×10^{-6} m/s.

Downgradient of MW-MT-08-08 groundwater has been depicted to flow roughly west with similar expression as the topography. The hydraulic gradient in this section is indicated to be approximately 10 percent, with groundwater elevation change of 260 m over approximately 2.5 km.

Several analytical models were used to estimate groundwater inflow in the underground workings. NTC predicted inflow rates to range from approximately 1 m^3/day to 1000 m^3/day with an overall mean inflow rate of 75 m^3/day (YOR 2008-0304-082-2).

NTC updated the estimated inflow rates to 4 m^3/day to 19 m^3/day using the 90 percent probability level inflow rates. NTC used a Monte Carlo simulation that uses a stochastic approach to develop a probability distribution of possible outcomes. (YOR 2008-0304-299-1)

In the upland areas of Mount Allan, the data available, from a single nested installation (VWP at MW-MT-08-01), suggests that groundwater within the bedrock aquifer is beneath permafrost which extends to depths of up to about 250 m below ground surface. There is no indication of direct contact between permafrost and the underlying groundwater. The information suggests that the lower and westernmost

portion of the underground workings will have groundwater inflow, and require dewatering during mining of these parts of the site.

4.7.3 Hydro-geochemistry

NTC provided hydro-geochemistry results of groundwater data from seven samples, of which five are from deep wells and two are intended to represent shallow groundwater conditions (a spring and sump dug for drilling).

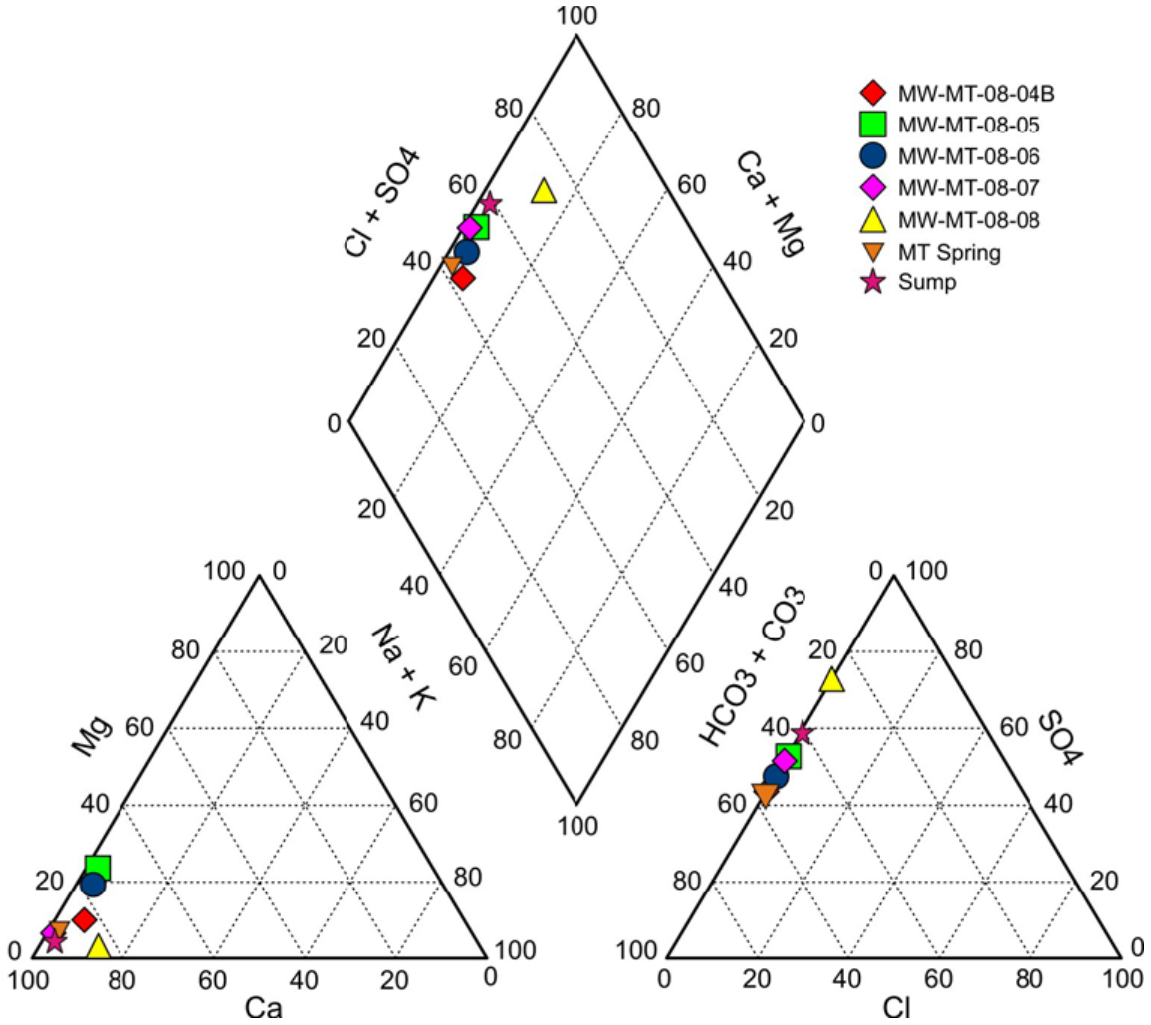

Figure 9 Major ion composition of the groundwater samples. Piper diagram (YOR 2008-0304-012-2)

The drill site MW-MT-08-08, located at the proposed camp area, is the closest sample location to underground workings. The geochemical signature of groundwater sourced from this location plots on the piper diagram distinctly from all other samples (Figure 9).

Additional groundwater samples and piezometric head measurements were taken in late November 2008, middle of April 2009, and late May 2009 (Figure 10).

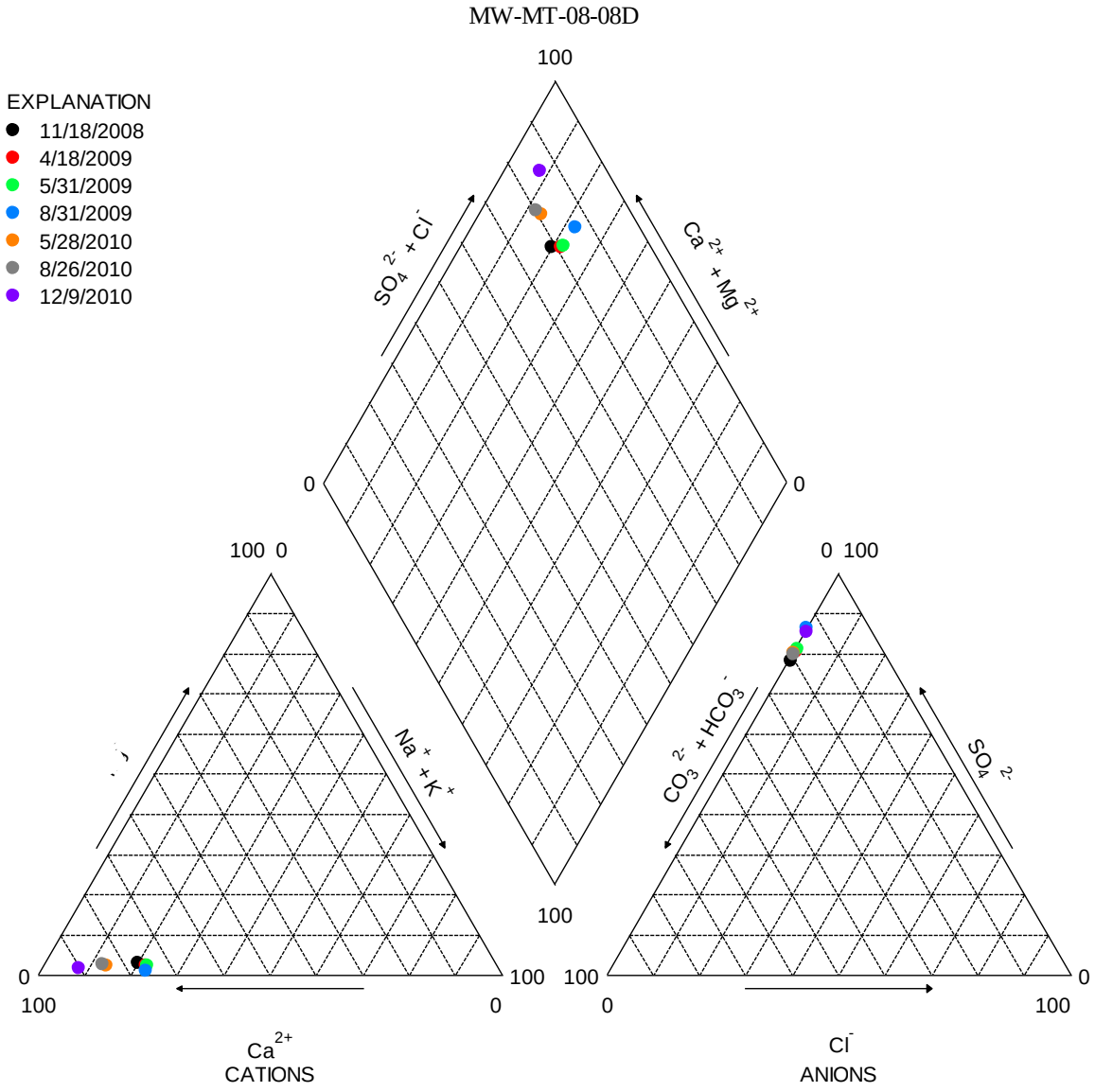

Figure 10 Distribution of MW-MT08-08D samples from 2008 to 2010. Piper diagram.

Comparison of the samples collected over the course of one year does not reveal any obvious major seasonal changes. The major ion composition determining the water type was very consistent throughout the seasons for all samples analyzed, except for an increase in magnesium concentration in MW-MT-08-06 and an increase in sodium concentration in MW-MT-08-08.

4.8 WILDLIFE

The Selwyn Mountain ecoregion displays the highest diversity of mammals in the Taiga Cordillera of Yukon and encompasses habitat for the following species: woodland caribou, black and grizzly bears, moose, mountain goats, Dall sheep, shrews, bats, snowshoe hares, collared pika, voles, lemmings, muskrats, woodrats, beavers, deer mice, porcupines, squirrels, hoary marmots, chipmunks, wolves, foxes, lynx, otter, wolverines, martens, weasels, minks, and numerous rodent species (Smith, Meikle and Roots 2004). Several species of special conservation status under Committee on the Status of Endangered Wildlife in Canada (COSEWIC), *Species at Risk Act* (SARA), and/or Yukon and NWT government programs are potentially present near the project area including: woodland caribou, grizzly bears, wolverines, peregrine falcon, and short-eared owl.

EBA conducted wildlife studies over a three-year period from 2005 to 2008 to support NTC's project submission. Table 10 provides a summary of the wildlife baseline studies provided as part of the project proposal.

Table 10 Summary of Wildlife Baseline Studies

Title	Summary	Targeted Species
Appendix G1 (YOR 2008-0304-044-2) Environmental Baseline Studies 2005 Preliminary Wildlife Survey Mactung Project Area, Yukon February 2006	Aerial Wildlife Survey October 6, 2005	moose, woodland caribou, Dall sheep and grizzly bear
Appendix G2 (YOR 2008-0304-045-2) 2006 Environmental Baseline Studies Wildlife Report May 2007	Aerial and ground-based surveys June, July, August and September, 2006	moose, woodland caribou, Dall sheep, breeding birds, raptors and waterfowl
Appendix G3 (YOR 2008-0304-046-2) 2007 Environmental Baseline Studies Wildlife Report March 2008	Aerial and ground-based surveys June, July, August and September, 2007	moose, woodland caribou, Dall sheep, breeding birds, raptors, and waterfowl
Appendix G4 (YOR 2008-0304-047-2) Summary of Late Winter Aerial Ungulate Survey May 26, 2008	Late winter aerial ungulate survey March 26, 2008	moose, woodland caribou, Dall sheep

Title	Summary	Targeted Species
Appendix G5 (YOR 2008-0304-048-2) 2008 Environmental Baseline Studies Wildlife Report December 2008	Aerial and ground based surveys July and October 2008 Expanded study area including proposed access road	woodland caribou, moose, Dall sheep, grizzly bear, raptors, and wetland birds
Addendum I Appendix C (YOR 2008-0304-089-2) Mactung Property - Summary of Late Winter Sheep Surveys May 29, 2009	Late winter aerial sheep survey April 7 and 13, 2009	Dall Sheep

The wildlife studies made reference to earlier wildlife studies conducted by or for AMAX Northwest Mining Company Ltd. during the late 1970s and early 1980s:

- AMAX Northwest Mining Company Limited. 1983. Initial Environmental Evaluation – MacTung Project Yukon and Northwest Territories.
- AMAX Northwest Mining Company Limited. NDb. Winter Wildlife Survey 1975-1976 at the MacMillan Tungsten Property (MacTung). Prepared with cooperation of AMAX Inc. Environmental Services Group (AMAX).
- AMAX Environmental Services Inc. 1982. Avifauna of the MacTung Project Area. Prepared for AMAX Northwest Mining Company, Limited. Golden, Colorado. 64 pp. + maps
- Gill, D. 1978. Large Mammals of the MacMillan Pass Area, Northwest Territories and Yukon. AMAX Northwest Mining Company, Ltd. Vancouver, British Columbia. 59 pp.
- Kershaw, G.P., and L.J. Kershaw. 1983. 1981-1982 MacTung Wildlife Studies, Yukon/NWT. Prepared for AMAX Northwest Mining Company Limited. 134 pp.

However, these reports were not included as part of the project proposal.

The following sections provide a brief summary of each key species that will be considered in the effects assessment.

4.8.1 Moose

Moose are recognized as an important ungulate species, particularly because they are harvested as a primary source of meat by First Nations and others. In 2005, Government of Yukon estimated the moose density of the greater region encompassing the proposed project to average approximately 285 moose/1000 km^2. Moose are generalist herbivores that feed on grasses, herbaceous plants and new growth shrubs and trees. Required habitat characteristics include adequate browse, protective cover, and mineral licks to support life requisites. The valleys within the project area provide these important year-round habitat characteristics. However, the mountainous terrain and significant alpine areas of the surrounding area provide unsuitable habitat; thus, there are likely fewer moose in the immediate project area than the surrounding area. Figure 11 shows key moose habitat (shaded brown polygons) near the mine site and along the North Canol Road. Figure 12, Figure 13 and Figure 14 show seasonal moose distribution in the project area.

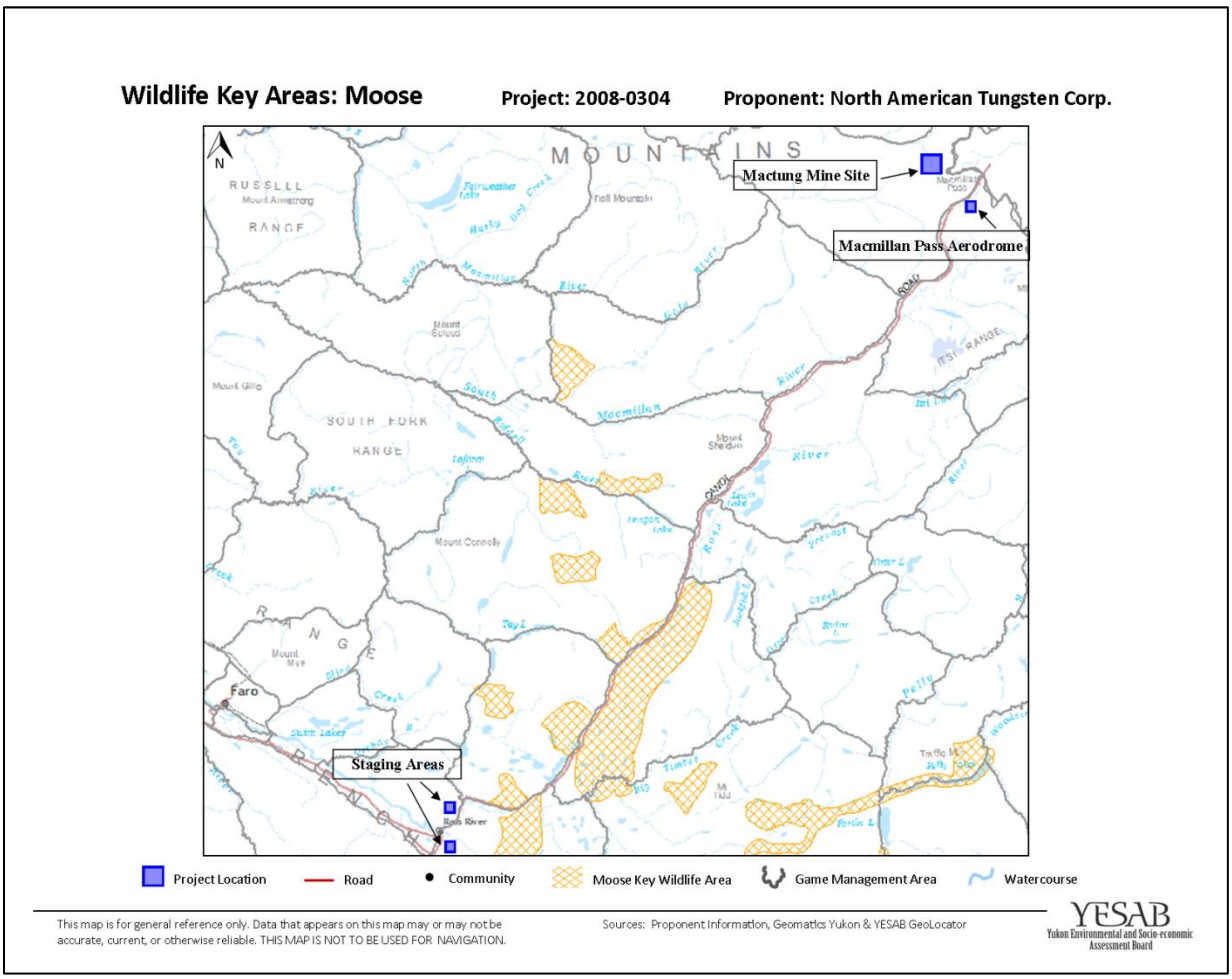

Figure 11 Moose late winter wildlife key areas and game management sub-zones.

Twelve systematic ungulate surveys were flown from 2005 to 2008 in preparation of a project proposal submission by NTC. The surveys were conducted in March, June, July, August, September and October.

Table 11 summarizes key findings of those surveys.

Table 11 Key Findings of Moose Surveys

Title	Observations	Notes
Appendix G1 October 6, 2005 Aerial survey	17 moose (eight bulls and nine cows). Moose were sighted in riparian willow, scrub birch, and open spruce communities in river and tributary valleys.	Due to weather conditions, the 2005 aerial survey was reduced to flying valleys open from cloud cover. A documented mineral lick was observed during the 2005 aerial survey; the mineral lick remains open throughout the winter.
Appendix G2 Aerial survey June 14, 2006 Aerial survey July 7, 2006 Aerial survey August 5, 2006 Aerial survey September 19, 2006 Aerial survey	33 moose observed, 25 were observed on transects (2 in June, 6 in July, 4 in August, and 13 in September). Most moose were observed in wooded upland, wooded lowland riparian, shrub-upland and shrub-lowland riparian.	Heavy moose use of the documented mineral lick in August with 12 antler sheds in the grass.
Appendix G3 June 16, 2007 Aerial survey July 11, 2007 Aerial survey August 15, 2007 Aerial survey September 4, 2007 Aerial survey	34 moose observed, 11 were recorded on transects (3 in June, 0 in July, 1 in August, and 7 in September) Most moose observations were at low elevations, particularly in the Hess River South Tributary valley bottom in scrub birch – lichen and willow – Sedge habitats	During the surveys a total of 55 percent of the study area was surveyed except for the June event where only 25 percent was surveyed. Relative abundance was low possibly due to straight line transect protocol to document moose presence in a mountainous terrain.

Title	Observations	Notes
Appendix G4 March 26, 2008 Late winter aerial survey	7 moose observed. Moose were observed primarily in riparian valleys vegetated by sparse conifer or willow.	Relative low density of 6.36 moose /1000 km^2. Survey results suggest that winter habitat use in the study area is generally low. Mineral lick previously noted on Hess River South Tributary was actively being used at the time of survey, and an open water spring was observed at the same location.
Appendix G5 July 14, 2008 Aerial survey October 6, 2008 Aerial survey	33 moose observed throughout season, 8 were recorded on transects (0 in July and 8 in October). Moose observations in a mixture of habitat types including vegetated subalpine-willow slopes and in scrub birch – lichen willow – sedge habitats located in the subalpine valleys.	Moose density for the rut/post rut survey was 1.66 moose/hour or 0.021 moose per km. It should be noted that the ungulate aerial surveys were not a structured compositional survey for moose.

Moose abundance in the baseline study area is generally low, with the highest abundance in September and the lowest in August. As mentioned, EBA stated the low abundance is partly due to the mountainous terrain limiting the availability of suitable moose habitats to support moose browsing, calving, and over-wintering within the study area. Transect surveys also may result in low population abundance estimates in mountainous terrain as a result of large areas of high elevation being surveyed where moose habitat is not present.

Within the baseline study area, moose habitat is primarily in valleys, particularly the Hess River South Tributary and South Macmillan River valleys and their tributaries. Suitable moose habitat types include vegetated subalpine-willow slopes and in scrub birch, lichen willow, sedge habitats located in the subalpine valleys.

Mineral licks are another important component of moose habitat. An identified mineral lick along the Tributary A near the Project was confirmed to be heavily utilized, including for over-wintering.

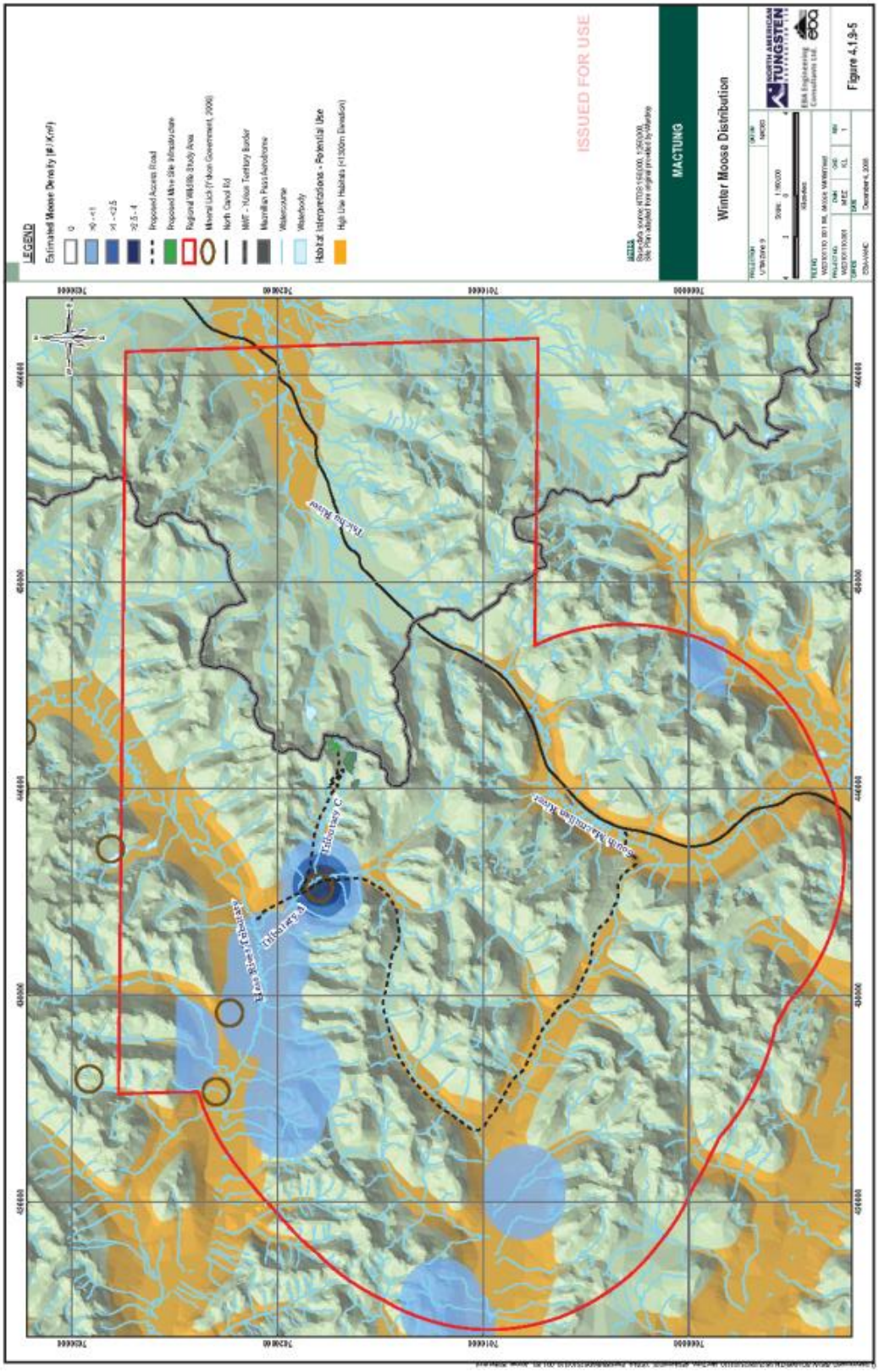

Figure 12 Winter moose distribution. (YOR 2008-0304-010-2)

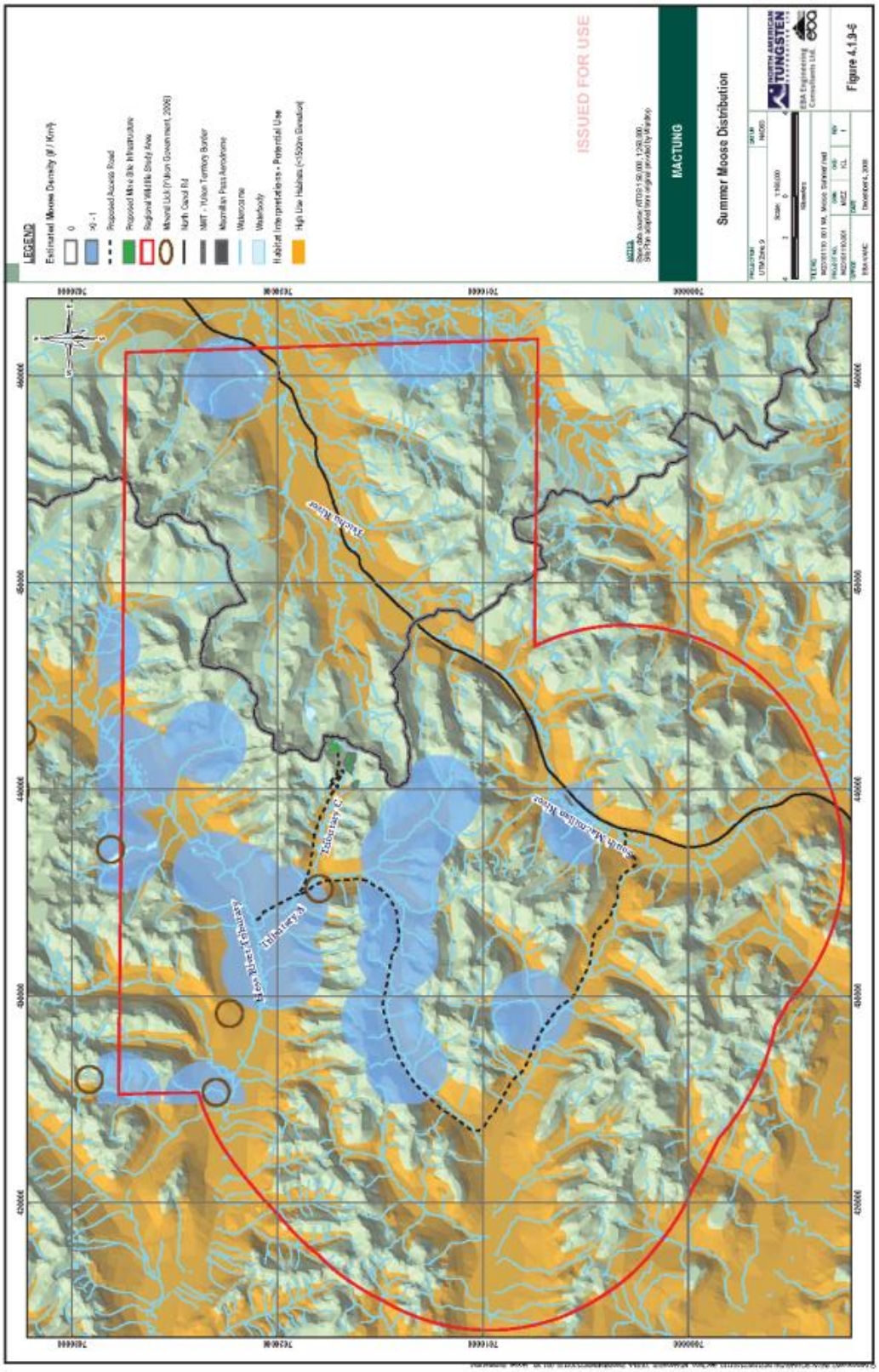

Figure 13 Summer moose distribution. (YOR 2008-0304-010-2)

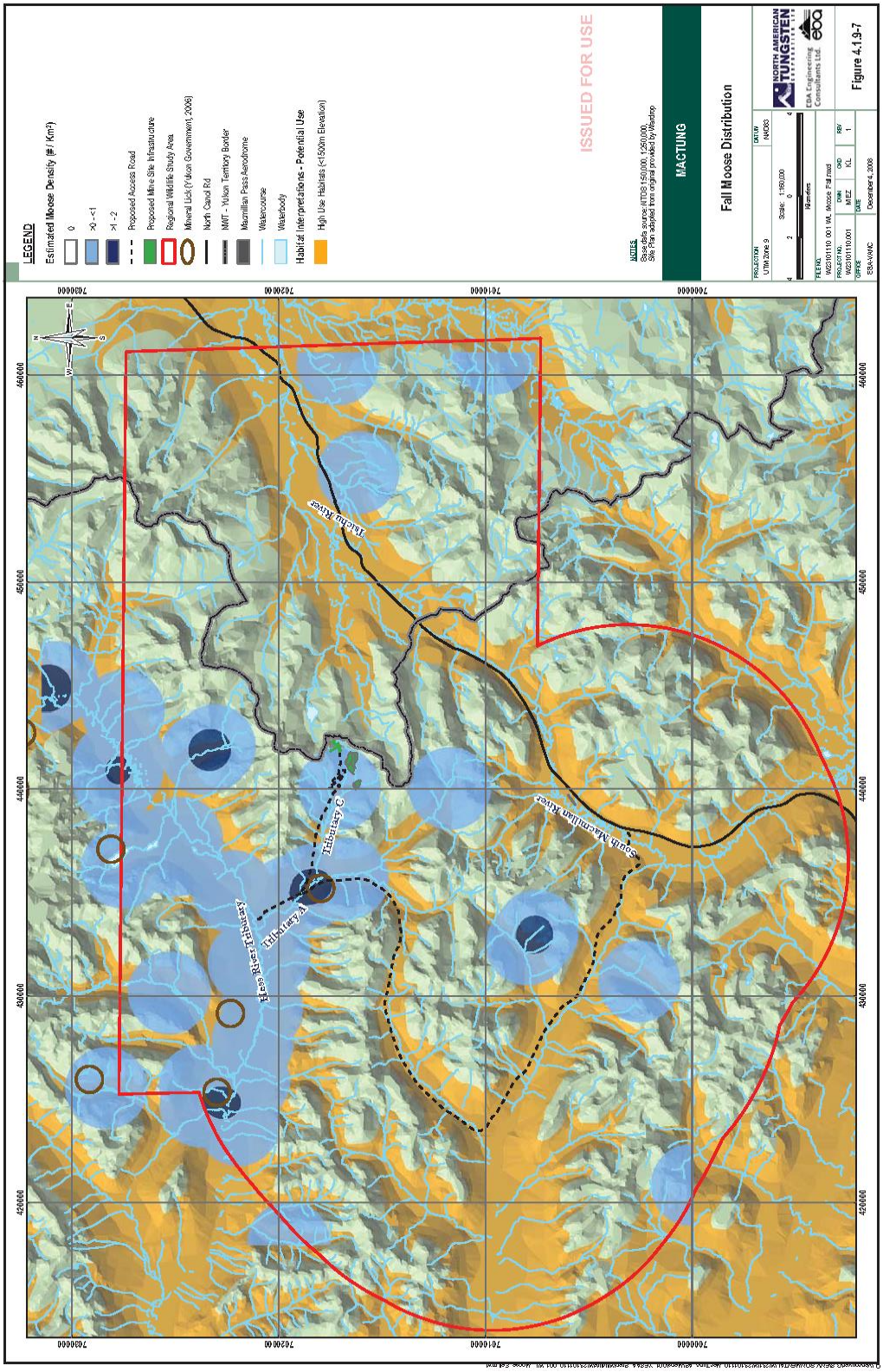

Figure 14 Fall moose distribution. (YOR 2008-0304-010-2)

4.8.2 Woodland Caribou

According to Yukon Environment maps, three woodland caribou herds use the project area and areas along the North Canol Road between the Yukon–NWT border and the community of Ross River (Figure 15). Ross River Dena Council (RRDC) comments indicate that two other herds, the Bonnet Plume and Keele River herds, are known to use the area as well (YOR 2008-0304-271-1). The Tay River and Bonnet Plume herd ranges are on the north side of the North Canol Road, the Finlayson herd range is on the south side of the North Canol Road and the Redstone herd range is along the Yukon–NWT border mainly on the NWT side. The Keele River herd is not identified on Yukon Environment maps but is considered a sub-herd of the Redstone Caribou herd and as such, overlaps in range. Individuals or groups from these herds are known to migrate through any of these ranges.

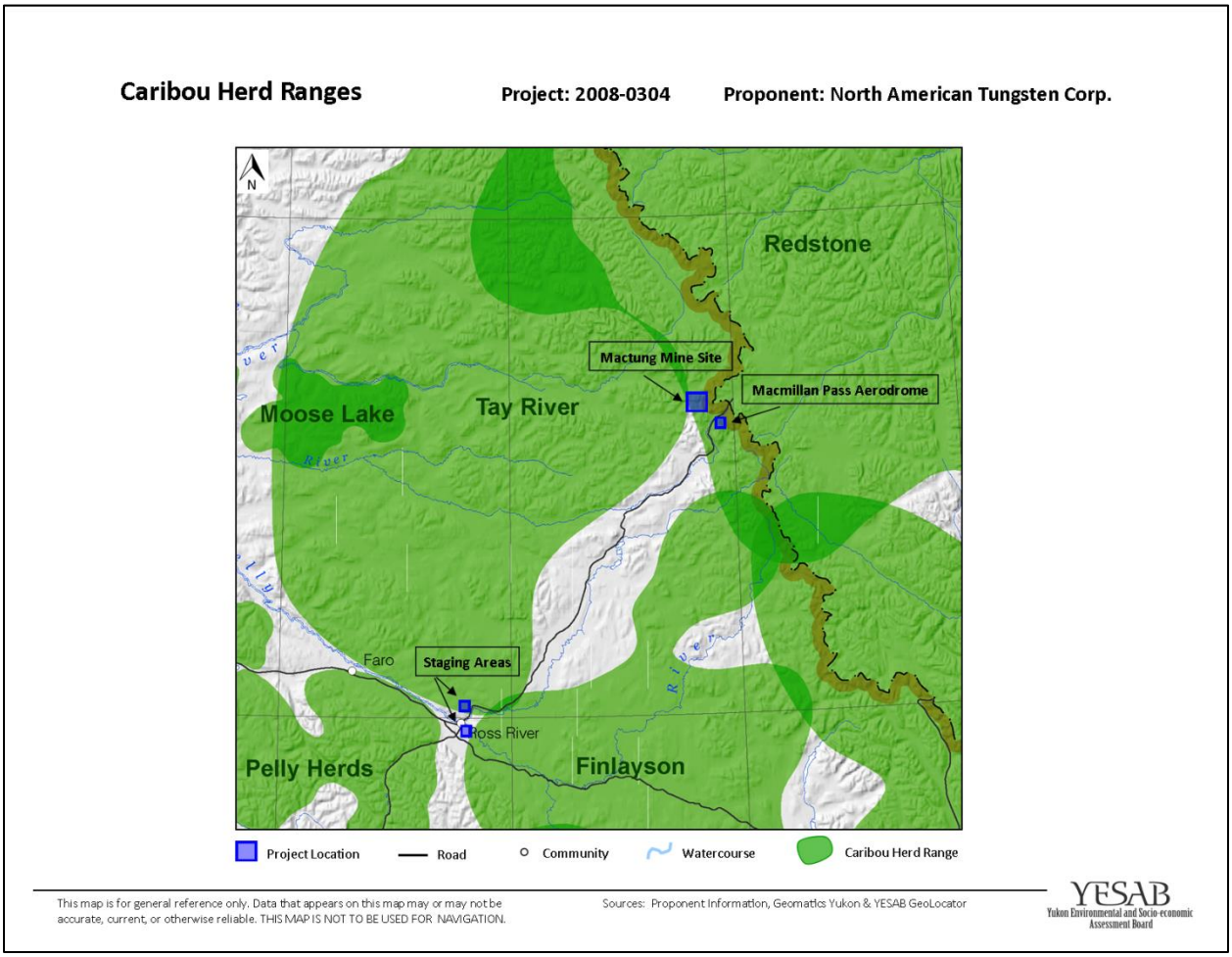

Figure 15 Caribou herd ranges.

The range of the woodland Redstone Caribou herd overlaps with the project area. Both COSEWIC and SARA list woodland caribou as a species of special concern. In addition, local First Nations and others rely on the Redstone herd as a food source.

Twelve systematic ungulate surveys were flown from 2005 to 2008 in preparation for NTC's project proposal submission. The surveys were conducted in March, June, July, August, September and October. Table 12 summarizes some of the key findings of those surveys.

Table 12 Key Findings of Caribou Surveys

Title	Observations	Notes
Appendix G1 October 6, 2005 Aerial survey	No caribou were observed, however fresh tracks and trails were observed within the study area.	Due to weather conditions, the 2005 aerial survey was reduced to flying valleys open from cloud cover. Historical studies indicate caribou frequently visit a mineral lick in the Hess valley within the study area.
Appendix G2 Aerial survey June 14, 2006 Aerial survey July 7, 2006 Aerial survey August 5, 2006 Aerial survey September 19, 2006 Aerial survey	571 caribou were observed, 204 were observed on transects (45 in June, 45 in July, 57 in August and 57 in September). 7 calves were observed (one in June and 6 in July).	The study area may not be a critical post calving area. Reconnaissance flights over the Mackenzie Mountain Barrenlands: Aug 4, 2006, 266 caribou and 49 calves; Sept 20, 2006, 48 caribou and 4 calves.
Appendix G3 June 16, 2007 Aerial survey July 11, 2007 Aerial survey August 15, 2007 Aerial survey September 4, 2007 Aerial survey	524 caribou were observed, 431 observed on transects (60 in June, 128 in July, 63 in August, and 180 in September). During the June ungulate survey, a total of eight calves were observed on high alpine meadows. All but one of these eight calves were observed in the Yukon Territory. A total of 22 calves were documented within the study area during the July survey.	These observations indicated that the study area is occasionally used for calving and post calving, although is not likely a critical calving area for this herd. The Mackenzie Mountain Barrens, located approximately 24 km northeast of Mactung camp (outside the study area), has been documented as the principal calving and post-calving area for the Redstone caribou herd (Collin 1983).
Appendix G4 March 26, 2008 Late winter	No sign of caribou or caribou activity.	Corroborate both recent and historical evidence that caribou

Title	Observations	Notes
aerial survey		make an annual fall-winter migration eastward from the project area to the Mackenzie barren-lands region of the Northwest Territories.
Appendix G5 July 14, 2008 Aerial survey October 6, 2008 Aerial survey	321 caribou were observed (307 in July and 14 in October). 79 calves observed in July. No calves were observed in October.	Low numbers of rut observations (October) suggest the fall migration out of the area has already begun. Low number of rut observations of calves indicates that the majority of the Redstone herd breeds outside of the project area.

Based on these studies EBA concluded the Redstone Caribou Herd uses areas near the Project during spring, summer and fall seasons. Figure 16 and Figure 17 show the seasonal distribution of woodland caribou in the project area.

During the spring and fall migration, woodland caribou tend to migrate along large river valleys including the Tsichu, Hess Tributary, and South Macmillan rivers. The mid-elevation ranges between approximately 1 300 m to 1 650 m along the valleys are utilized for migration from late May to early June and in late September although the specific period of migration may vary (YOR 2008-0304-010-2).

Between the last week of May and first week of June spring calving occurs in plateaus and upland sites within the study area. Additional calving areas for this herd have been documented approximately 25 km northeast of the Project in the Mackenzie Mountain barren lands. The Mackenzie Mountain barren lands are considered as the principal calving and post-calving area for the Redstone Caribou Herd. Some females with calves used the study area as a post-calving area, including areas with alpine tundra and open meadows. These areas are most sensitive to disturbance.

The summer range of the Redstone Caribou Herd includes subalpine and alpine habitats that occur throughout the baseline study area. The habitat types that caribou appeared to prefer include sedge–bluebell, sedge–cinquefoil, fescue–willow, fescue–sedge and heath–lichen.

Caribou do not occupy habitat within the study area during winter months. Caribou migrate eastward out of baseline study area, likely migrating to the Mackenzie barren lands region of the NWT.

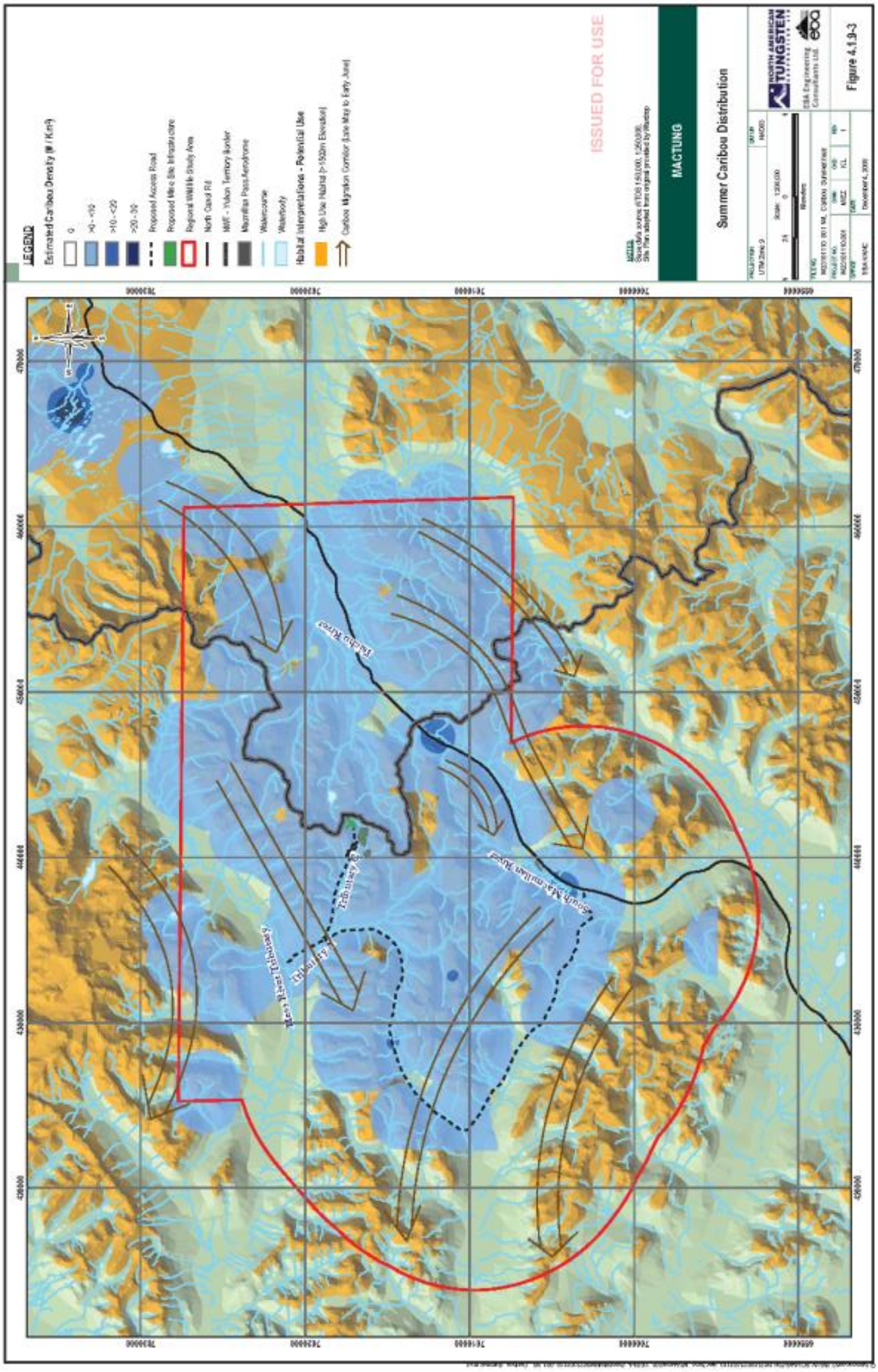

Figure 16 Summer caribou distribution. (YOR 2008-0304-007-2)

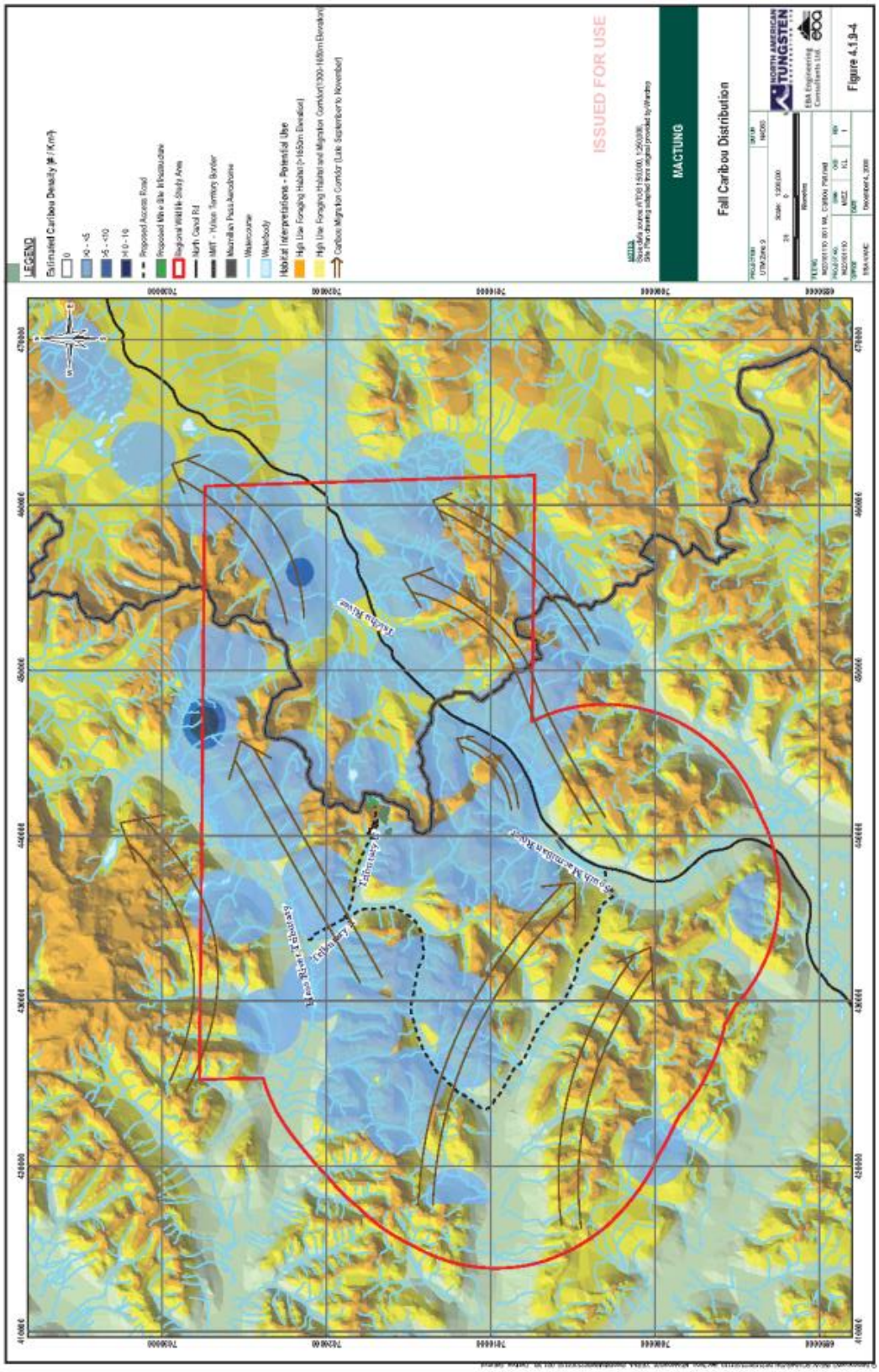

Figure 17 Fall caribou distribution. (YOR 2008-0304-007-2)

4.8.3 Dall Sheep

Dall sheep are present within the study area. Dall sheep require three critical habitats: wintering areas, lambing areas and mineral licks. All three habitat types exist within the study area. Government of Yukon and traditional knowledge identified key winter habitat adjacent to the proposed site as well as on several other mountains in the area (Figure 18). The closest lambing areas for Dall sheep overlap with the project site. Government of Yukon and RRDC identified several mineral licks in the area, including an important lick that is located in close proximity to components of the Project (YOR 2008-0304-271-1, 2008-0304-278-1).

The Proponent has indicated that very few Dall sheep were identified within the project area during the 12 aerial surveys conducted during the 2005-2008 baseline studies done by NTC and EBA. Based on a review of historical studies overlapping the study area, EBA concluded that while the project area supports Dall sheep, suitable habitat is limited by the harsh environmental conditions. Conditions that may result in low Dall sheep densities include high winter snowfall, high winds as a result of east-west oriented mountain blocks, and isolated areas of suitable habitat.

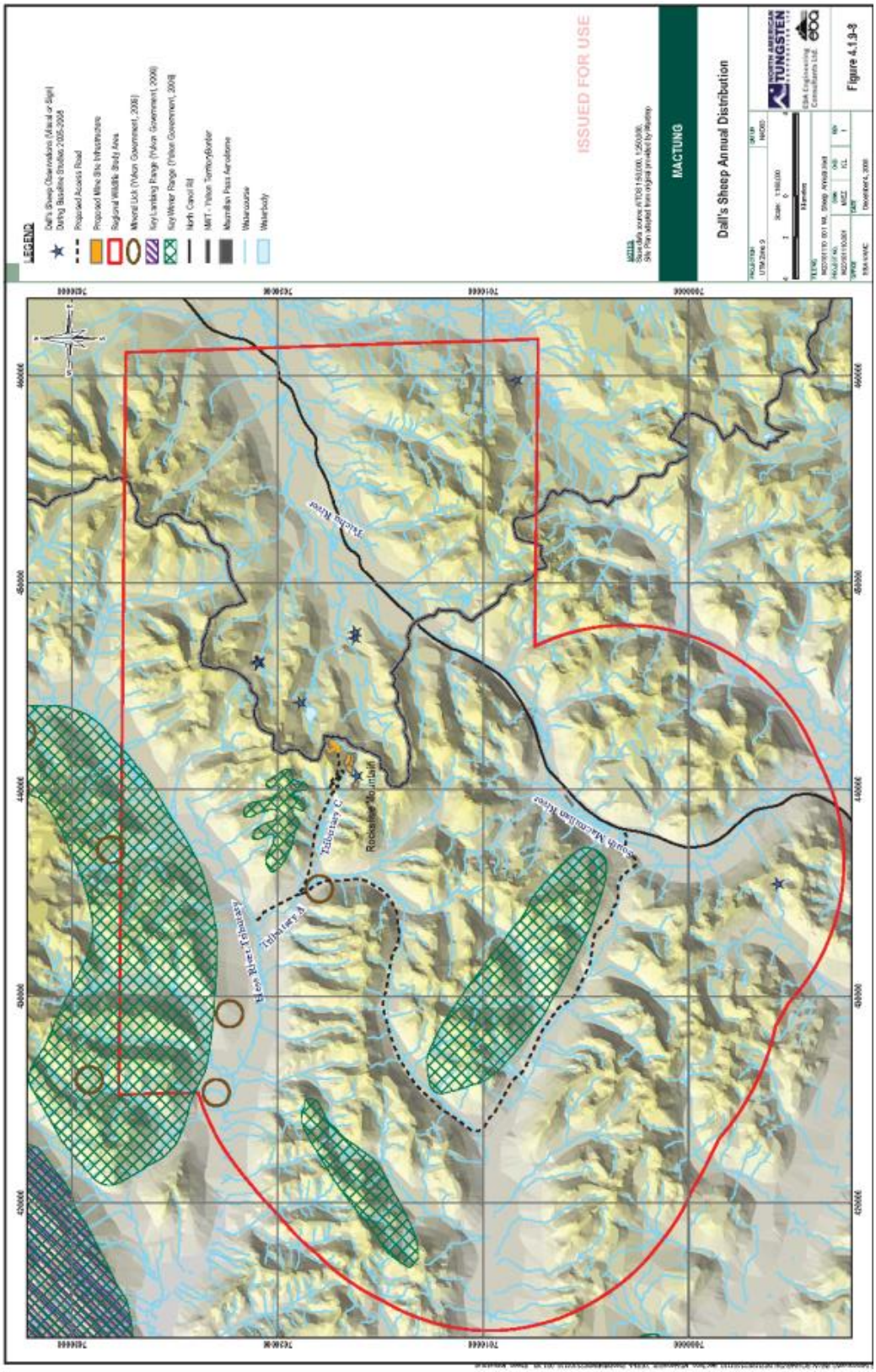

Figure 18 Dall sheep annual distribution. (YOR 2008-0304-010-2)

4.8.4 Grizzly Bears

Grizzly bear habitat overlaps with the Project and the study area identified in the baseline studies COSEWIC and SARA list the grizzly bear as a species of special concern. Government of Yukon estimates grizzly bear populations in Yukon to be about 6 000 to 7 000 animals. The Northwest Territories is estimated to have approximately 3 500 to 4 000 grizzly bears. The Mackenzie Mountains are considered to support the highest concentrations of grizzly bears in the NWT (Figure 20). Grizzly bears have large home ranges that on average can range over 2 000 km^2 for a male and half that for a female (GNWT 2011).

In 2006-2008 wildlife baseline studies, EBA identified 67 grizzly bear observations including visuals, dens, tracks, and digs, within the study area (Figure 19). Fourteen grizzly bears were observed in 2006, seven in 2007 and 13 in 2008. Several of these observations included sow with cubs with repeated observations in 2006 and 2007 near the mine site. It is assumed the observations of the same sow indicate a productive territory near the Mactung mine.

Seventeen den sites were recorded during the EBA wildlife baseline studies, eight of which are within a 10 km radius of the mine site. Grizzly dens were mostly situated on south facing steep slopes between 1 400 to 1 800 m in elevation. Some of the dens observed were located on east or west facing slopes.

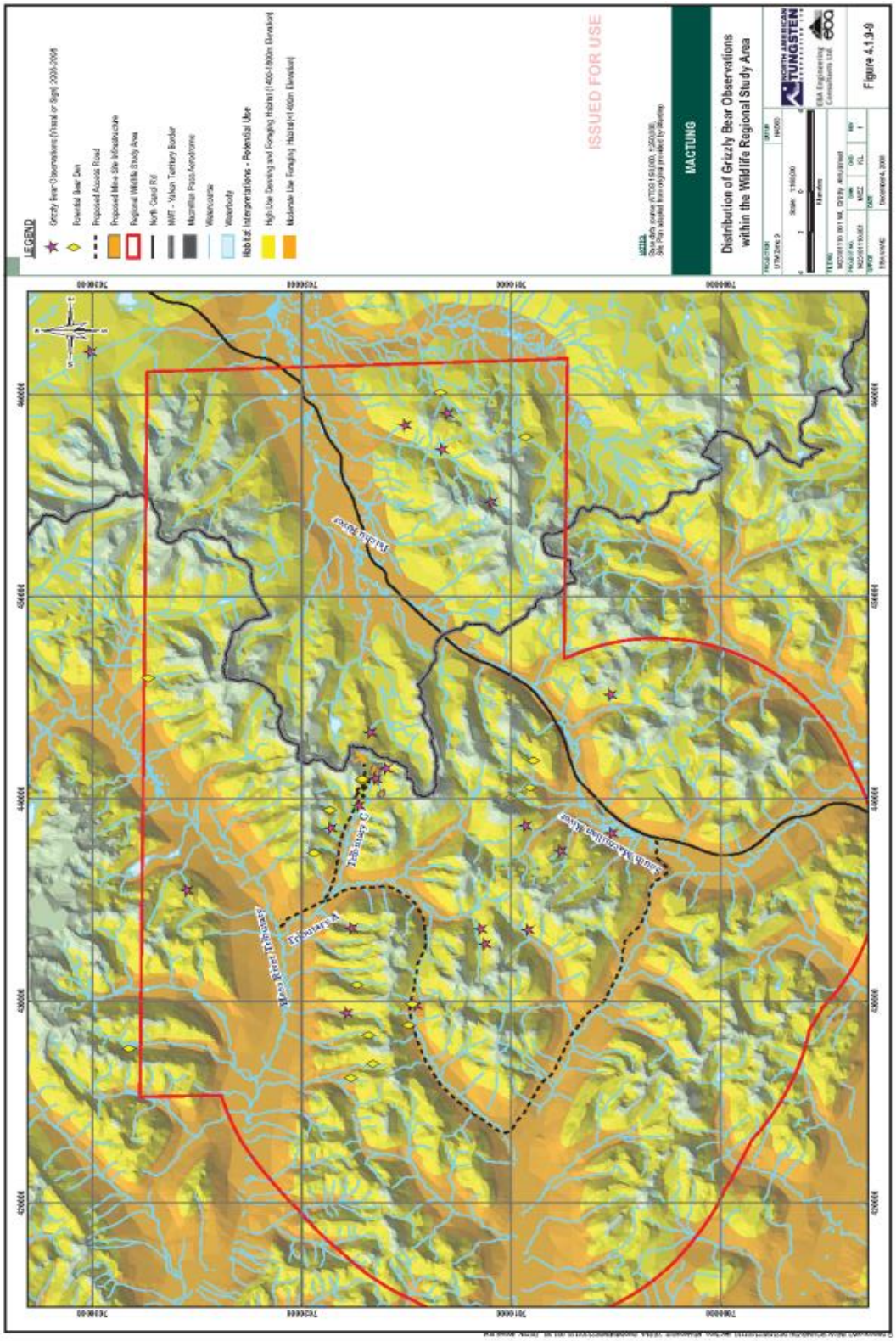

Figure 19 Grizzly bear observations. Observations occur within the wildlife regional study area. (YOR 2008-0304-010-2)

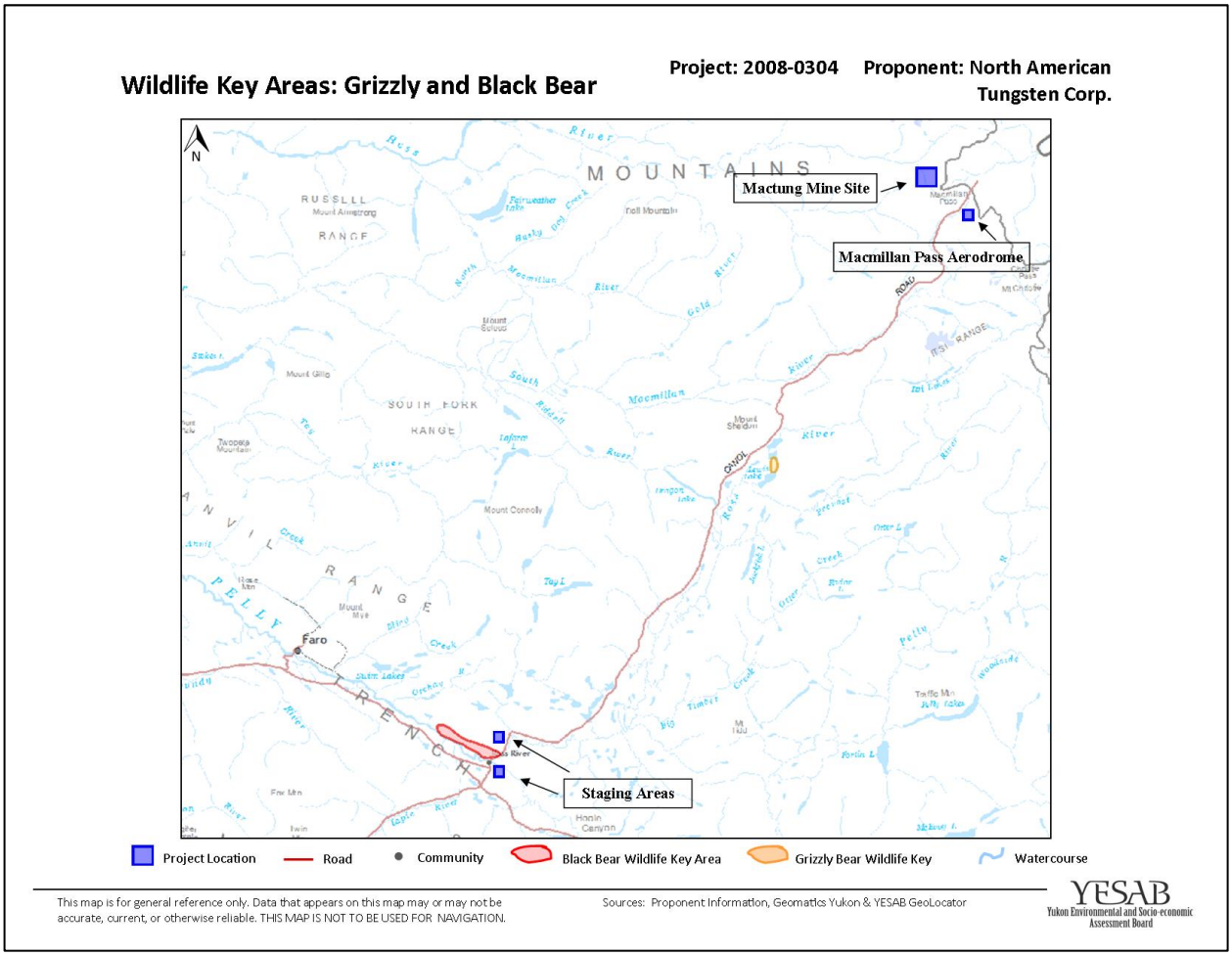

Figure 20 Grizzly and black bear wildlife key areas

4.8.5 Small Mammals

The study area is suitable habitat for a variety of fur bearing animals including commercial species such as the beaver, wolverine, muskrat, fox and marten. The wolverine is listed as a Species of Special Concern by COSEWIC, but is not listed under the federal SARA legislation. Wolverines are distributed throughout all habitat types in Yukon. Hoary marmots have been identified as having cultural significance to the Ross River Dena (YOR 2008-0304-019-2).

Small mammals as a species category are a large and diverse group of species, with varying life histories and habitat requirements making generalization difficult. No wildlife specific studies were conducted on small mammals in particular; however, based on incidental observation and ecosystems present within the study area, species listed in Table 13 are assumed present.

Table 13 Smalls Mammals Potentially Present Near Mine Site

Common Name	Scientific Name	Conservation Status (SARA/COSEWIC)
American marten	*Martes americana*	Not Assessed
American mink	*Mustela vison*	Not Assessed
American porcupine	*Erethizon dorsatum*	Not Assessed
Arctic ground squirrel*	*Spermophilus parryii*	Not Assessed
Arctic shrew	*Sorex arcticus tundrensis*	Not Assessed
Beaver*	*Castor canadensis*	Not Assessed
Brown lemming*	*Lemmus trimucronatus*	Not Assessed
Bushy-tailed woodrat	*Neotoma cinerea*	Not Assessed
Canada lynx	*Lynx Canadensis*	Not At Risk
Collared pika*	*Ochotona collaris*	Special concern COSEWIC
Deer mouse	*Peromyscus maniculatus*	Not Assessed
Dusky shrew	*Sorex obscurus*	Not Assessed
Ermine	*Mustela erminea*	Not Assessed
Fisher	*Martes pennanti*	Not Assessed
Hoary marmot*	*Marmota caligata*	Not Assessed
Least chipmunk*	*Eutamias minimus*	Not Assessed
Least weasel	*Mustela nivalis*	Not Assessed
Little brown myotis	*Myotis lucifugus*	Endangered COSEWIC
Long-tailed vole	*Microtus longicaudus*	Not Assessed
Masked shrew	*Sorex cinereus*	Not Assessed
Meadow jumping mouse	*Zapus hudsonius*	Not Assessed

Common Name	Scientific Name	Conservation Status (SARA/COSEWIC)
Meadow vole	*Microtus pennsylvanicus*	Not Assessed
Muskrat	*Ondatra zibethicus*	Not Assessed
Northern bog lemming	*Synaptomys borealis*	Not Assessed
Northern flying squirrel	*Glaucomys sabrinus*	Not Assessed
Northern red-backed vole*	*Clethrionomys rutilus*	Not Assessed
Pygmy shrew	*Microsorex hoyi*	Not Assessed
Red fox*	*Vulpes vulpes*	Not Assessed
Red squirrel	*Tamiasciurus hudsonicus*	Not Assessed
River otter	*Lutra canadensis yukonensis*	Not Assessed
Singing vole	*Microtus miurus*	Not Assessed
Snowshoe hare*	*Lepus americanus*	Not Assessed
Taiga vole	*Microtus xanthognathus*	Not Assessed
Tundra vole	*Microtus oeconomus*	Not Assessed
Water shrew	*Sorex palustris*	Not Assessed
Wolf*	*Canis Lupus*	Not Assessed
Wolverine*	*Gulo Gulo*	Species of Special Concern COSEWIC
Woodchuck	*Marmota monax*	Not Assessed

*Observed during the 2005-2008 wildlife surveys

4.8.6 Birds

NTC reported results of avian surveys in three sections: raptors, breeding birds, and waterfowl. The following is a summary of NTC's findings.

To document raptor presence and breeding territories, aerial raptor surveys were conducted on June 14, 2006; June 18, July 11, August 17, 2007; and July 8, 2008. Raptors observed outside these aerial surveys were also documented. Nine raptor species were recorded within the study area including:

golden eagle, bald eagle, peregrine falcon, gyrfalcon, northern harrier, rough-legged hawk, merlin, northern hawk owl, and short-eared owl. Golden eagles were the most common raptor species observed followed by northern harriers. Figure 21 shows the raptor and raptor nest distribution of the project area.

Breeding bird and waterfowl studies were also carried out during the 2006, 2007 and 2008 wildlife surveys. A total of 112 bird species may nest within the project study area. Of these, seven species have special conservation status designations (Table 14).

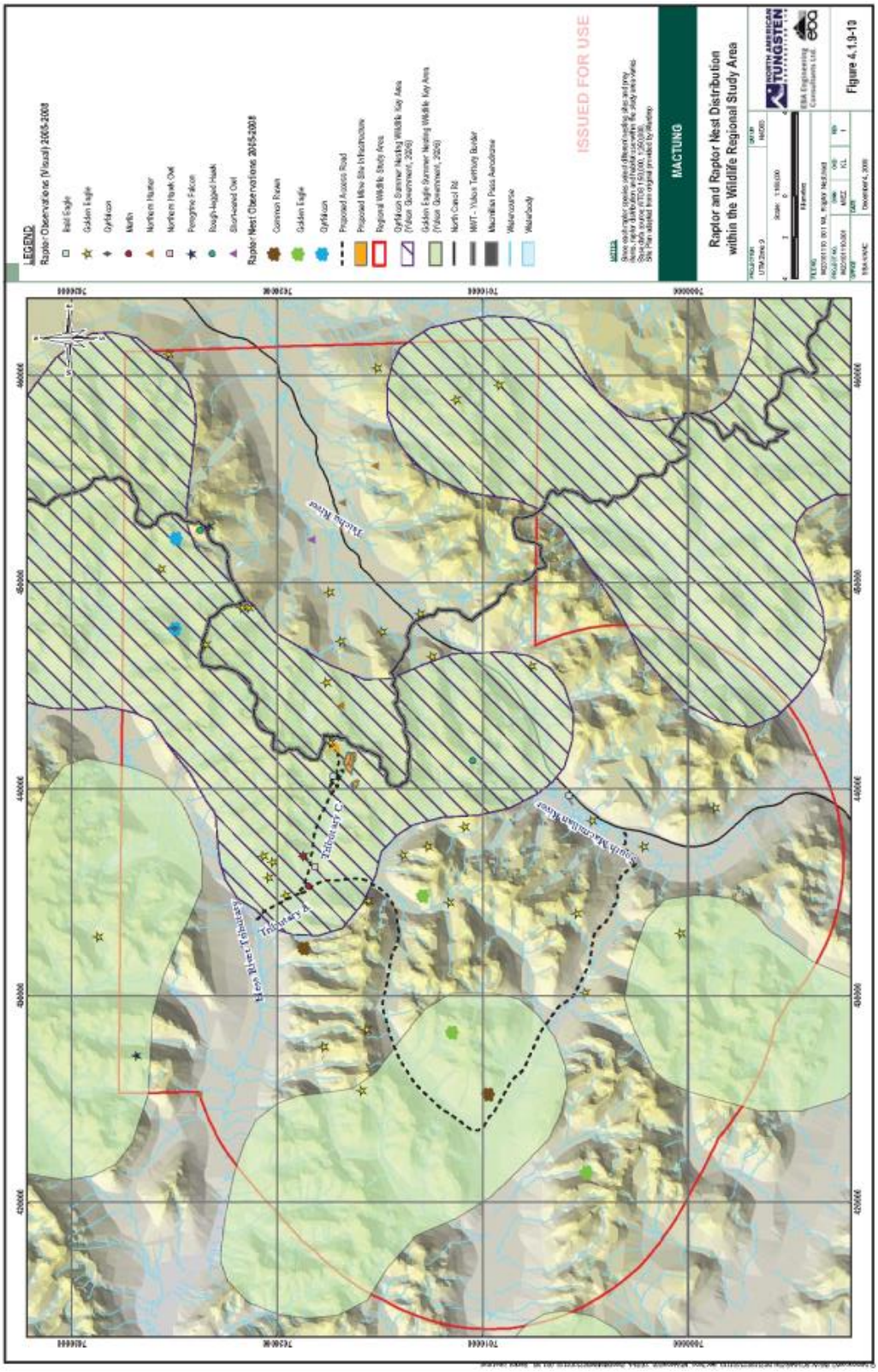

Figure 21 Raptor and raptor nest distribution within the wildlife regional study area

Table 14 Species Distribution, Designation, and Nesting Habitat

Species	Conservation Status	Favoured Nesting Habitat	Nesting Habitat within the Local Study Area
Common nighthawk (not observed)	Threatened (COSEWIC)	Nest on the ground in bare soil, sand, gravel or rock in open habitats such as recently burned or harvested forests, open forests, wetlands, rocky barrens and wetlands as well as mine tailings, quarries, railways and gravel roads.	Aerodrome, Canol Road and existing staging areas, valley wetlands and rocky barrens in subalpine and alpine.
Olive-sided flycatcher	Threatened (COSEWIC)	Nest in conifer trees (including dead trees and snags) in open and edge habitats, including burn areas and wetlands. Often associated with young forests (0-30 years) or old mixed wood forests (>125 years).	Valley wetlands and may occur in forests to the treeline.
Rusty blackbird	Special Concern (COSEWIC)	Nests in various tree species (both living and dead coniferous and deciduous), shrubs or on top of stumps over or near wetlands, beaver ponds and streams.	Low valleys, including those along the proposed access road and aerodrome.
Short-billed dowitcher	May Be At Risk in Yukon (CESCC 2006)	Nests on the ground in marshy wetlands with scattered trees and shrubs.	Low valley wetlands.
Short-eared owl	Special Concern (COSEWIC)	Nests on the ground in open wetlands at low elevations, low shrub habitats and in wet sedge meadows.	Birch – lichen habitats, particularly along the Tsichu River, valley wetlands.

Species	Conservation Status	Favoured Nesting Habitat	Nesting Habitat within the Local Study Area
American kestrel	May Be At Risk in Yukon (CESCC 2006)	Nests in cavities in mature spruce (usually dead trees) in open forests.	Spruce – moss habitat types in low valleys, including the Hess River South Tributary and along the proposed access road.
Gyrfalcon	Specially Protected in Yukon	Nests in stick nests constructed by common ravens or golden eagles on cliff ledges, or scrapes in the substrate of a cliff ledge.	Subalpine and alpine precipitous terrain.
Species	**Conservation Status**	**Favoured Nesting Habitat**	**Nesting Habitat within the Local Study Area**
Common nighthawk (not observed)	Threatened (COSEWIC)	Nest on the ground in bare soil, sand, gravel or rock in open habitats such as recently burned or harvested forests, open forests, wetlands, rocky barrens and wetlands as well as mine tailings, quarries, railways and gravel roads.	Aerodrome, Canol Road and existing staging areas, valley wetlands and rocky barrens in subalpine and alpine.
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Gyrfalcon	Specially Protected in Yukon	Nests in stick nests constructed by common ravens or golden eagles on cliff ledges, or scrapes in the substrate of a cliff ledge.	Subalpine and alpine precipitous terrain.

4.9 FISHERIES

EBA conducted fisheries baseline studies (Figure 22) during 2006-2008 on the three tributaries that comprise the Project receiving environment:

- Hess River South Tributary that flows into the Hess River
- Tributary A that flows into the Hess River South Tributary

- Tributary C that flows into Tributary A

In 2008 EBA also conducted baseline studies of the tributary group that will be affected by the proposed access road:

- Tributary B that flows into Tributary A
- Tributary E that flows into Tributary D
- Tributary D that flows into the Hess River
- South Macmillan River and tributaries

Based on these studies NTC characterized fish presence and fish habitat availability for these reaches. Due to the removal of the proposed access road in the Yukon from the project scope, the Executive Committee recognizes that Tributary B, E, D and the South Macmillan River and tributaries will not be directly affected by the Project. However the description of these tributaries was kept in the Screening Report as baseline information provided during the course of the assessment.

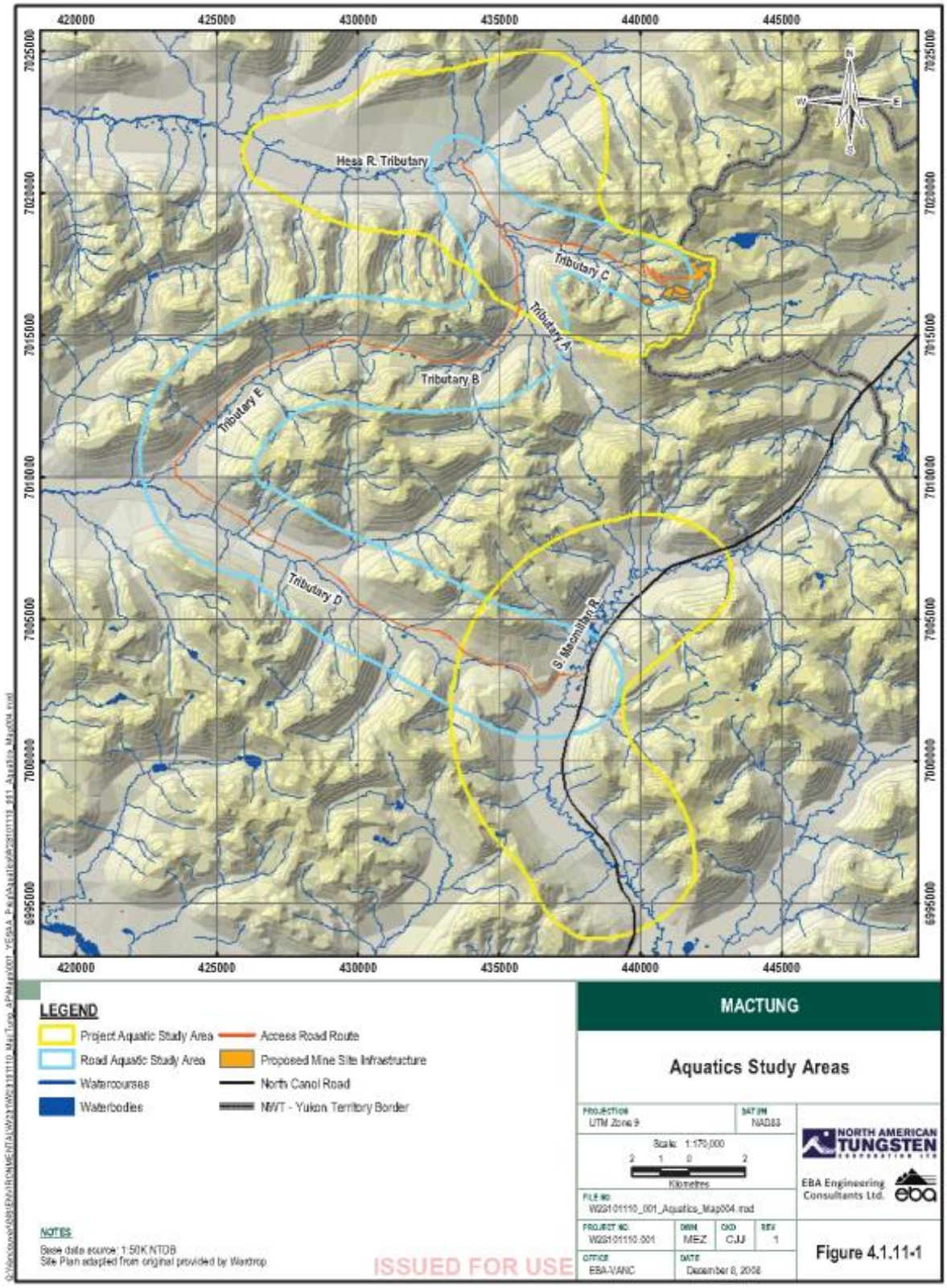

Figure 22 Aquatics study areas. (YOR 2008-0304-012-2)

Department of Fisheries and Oceans Canada (DFO) provided an updated characterization of these reaches during Seeking Views and Information based on the EBA 2006-2008 studies and the existing knowledge of these watersheds (YOR 2008-0304-144-1). The Executive Committee description of the reaches set out below is adopted directly from the summary provided by DFO.

Hess River: The Hess River is a productive river system known to support populations of Chinook salmon, Dolly Varden, and Arctic grayling. As well, other fish species such as lake trout, slimy sculpin, least cisco and whitefish have been observed in the Hess River. This river system provides suitable habitat for all life history stages.

Hess River South Tributary: Recent studies have shown that the Hess River South Tributary contains Dolly Varden, Arctic grayling and slimy sculpin. This river system likely supports suitable juvenile nursery habitat as well as suitable spawning habitat.

Tributary A: This watercourse feeds directly into the Hess River South Tributary, which contains a variety of fish species. The fisheries assessment undertaken on behalf of the Proponent, during August 2006 and 2007, indicated that no fish species were captured; however, given the proximity of Tributary A to downstream and upstream fish bearing waters, this tributary could support a population or act as a migration corridor between the Hess River South Tributary and Tributary C.

Tributary B: This tributary feeds into Tributary A and was designated as non-fish bearing in the Mactung Mine Project report. Although there are portions of Tributary B that are dominated by a cobble substrate and a riffle-pool pattern there appears to be no over-wintering habitat. DFO is hesitant to classify this tributary as non-fish bearing due to its connection to the Hess River South Tributary through Tributary A. As well, it was deemed as non-fish bearing based solely on the results of a single point in time fisheries assessment. In order to adequately assess the fish presence/absence of Tributary B, a multi-year and multi-season survey using a variety of methodologies would need to be conducted.

Tributary C: This watercourse also feeds into Tributary A and provides suitable fish habitat that includes overwintering areas and supports Dolly Varden year round.

Tributary D: This water body feeds directly into the Hess River and can support populations of Dolly Varden. The direct connection to the Hess River indicates that Tributary D may contain populations of a variety of fish species such as Arctic grayling, slimy sculpin, whitefish, lake trout and possibly Chinook salmon. It is likely that this tributary can support rearing, spawning and overwintering habitat.

Again, in order to understand the complex fishery that exists in Tributary D a multi-year assessment using a variety of techniques throughout various times of the year would need to be conducted. The assessment conducted in 2008 provides useful information into the type of habitat and confirms the presence of Dolly Varden but cannot be used to describe the fish population in detail.

Tributary E: This tributary flows into Tributary D which is known to contain populations of Dolly Varden and most likely supports other fish species as well. The water crossing assessment study conducted on behalf of the Proponent in 2008 indicated that Tributary E provided low fisheries habitat value and no fish species were captured. As mentioned earlier, a single fisheries assessment will not be adequate to determine the productivity of this tributary. Due to the proximity to fish bearing waters, it is possible that

fish are utilizing Tributary E. A more extensive study would be required to determine fish species presence/absence.

South Macmillan River: The study conducted in 2008 on the South Macmillan River suggest that the portion of the river studied supports little quality fish habitat and has been degraded by geological features and past mining activities. DFO records indicate that several fish species have been captured downstream of the study area. Arctic grayling and northern pike have been observed just below the study area. Similarly, the South Macmillan River supports slimy sculpin, round whitefish, longnose sucker, burbot and quite possibly Chinook salmon. Although the area sampled may be impacted from past mining practices, the South MacMillan River is still classed as a fish bearing system (YOR 2008-0304-144-1).

4.10 VEGETATION

Due to the removal of the proposed access road in the Yukon from the project scope, the Executive Committee recognizes that much of the study area included within the scope of the vegetation studies will not be directly affected by the Project. However the summary of the baseline studies was maintained in the Screening Report as baseline information provided during the course of the assessment.

EBA conducted three vegetation baseline studies during the years 2006-2008 within the local study area (LSA) that includes the entire mine site and proposed access road. The studies included ecosystem land classification (ELC) surveys, rare plant surveys and trace element concentration surveys.

EBA reported an initial reconnaissance of rare plant species and mapping of a bioclimate zone and vegetation mapping as part of the ELC in the 2006 vegetation study. The 2006 study focused on the mine site and the immediate surroundings. Twenty-six rare species were identified as potentially within the LSA.

EBA updated the ELC maps based on in-field quality assurance in the 2007 vegetation study. The 2007 vegetation study also included a baseline assessment of trace element concentration in plant tissue. The study found that one site had relatively high values for most metals in willow composite samples.

EBA expanded the LSA of the 2008 vegetation study to include the proposed road access corridor (which has since been removed from the Project). Figure 23, Figure 24 and Figure 25 show the results of the studies.

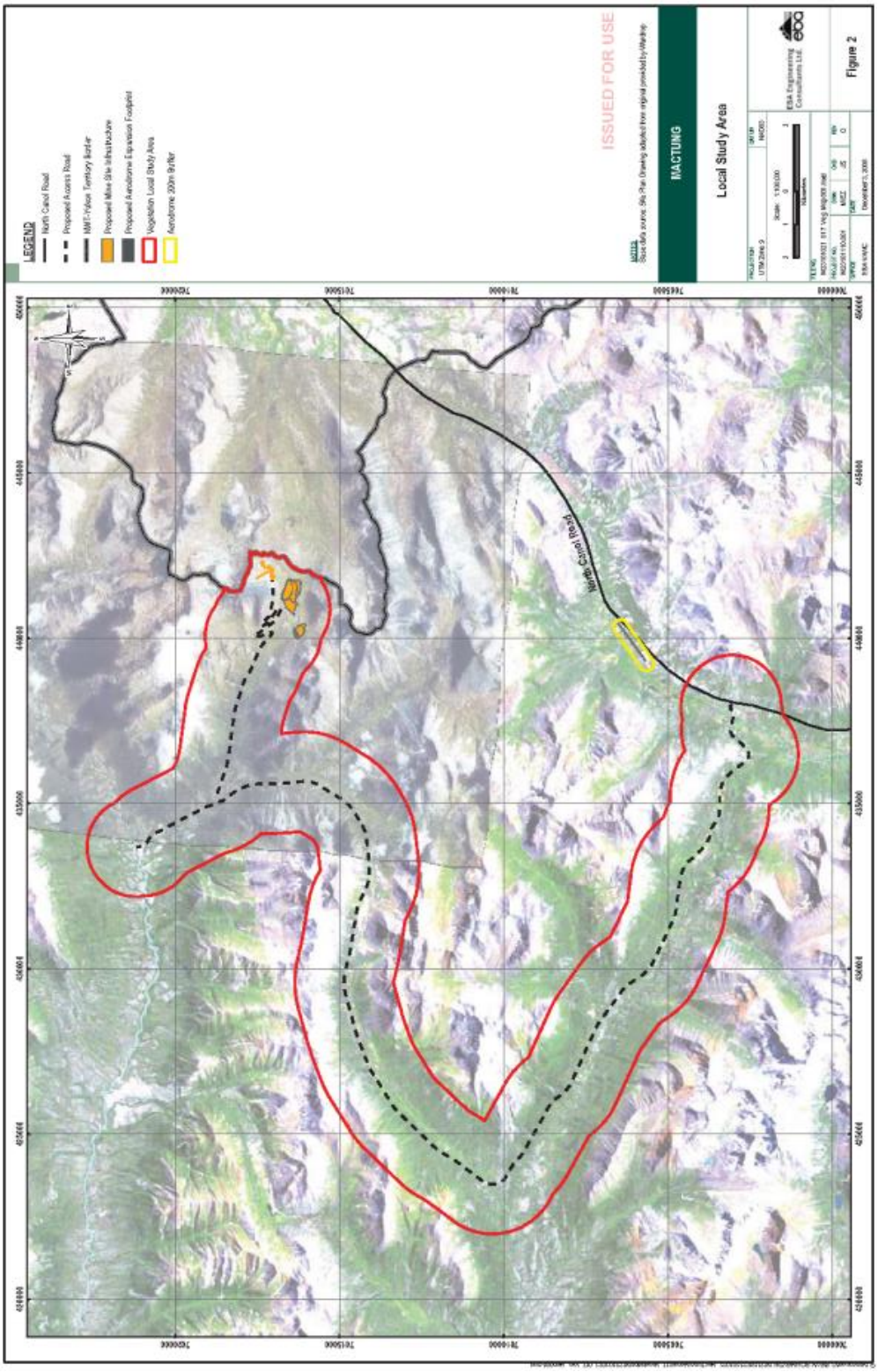

Figure 23 Vegetation baseline study: local study area. (YOR 2008-0304-042-2)

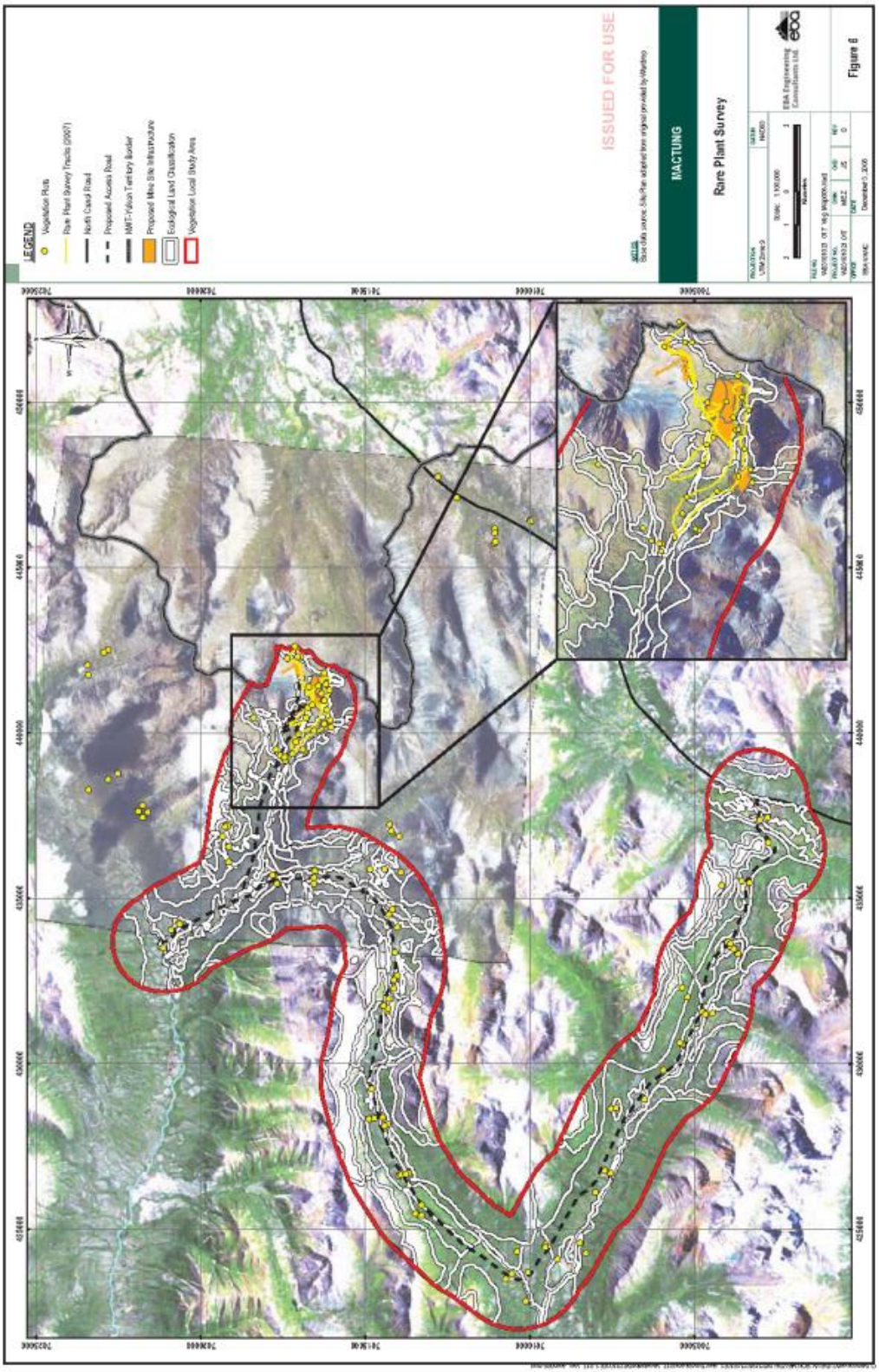

Figure 24 2008 vegetation study: rare plant survey (YOR 2008-0304-043-2).

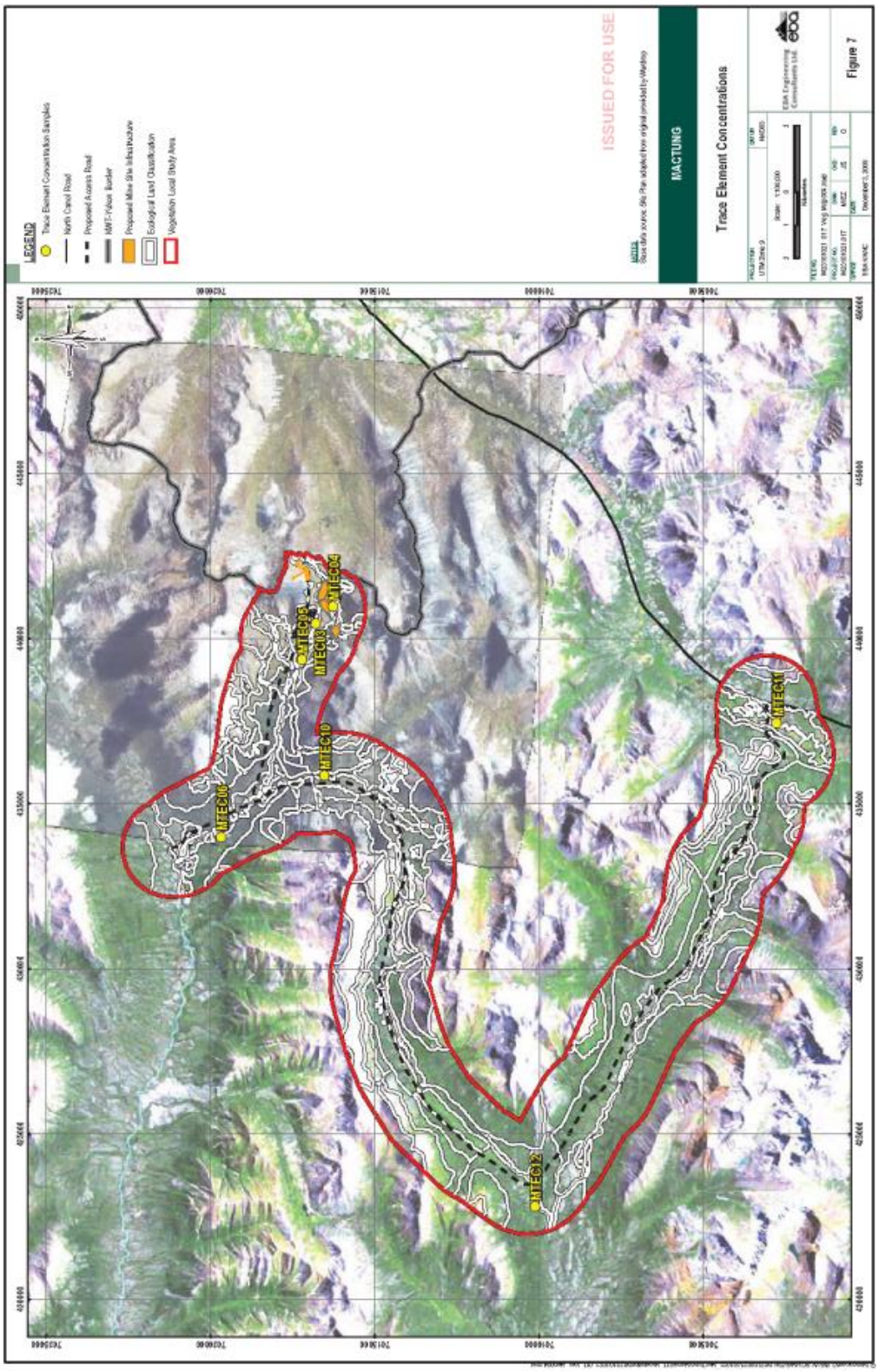

Figure 25 2008 vegetation study: trace element concentrations. (YOR 2008-0304-043-2)

4.11 HERITAGE RESOURCES

Points West Heritage Consulting Ltd. (PWH) conducted three studies on behalf of NTC in preparation of a proposal to the Executive Committee. Table 15 summarizes the objectives and major findings of these studies.

Table 15 Summary of Heritage Study Objectives and Findings

Title	Summary of Study Objectives	Findings
Appendix K1 (YOR 2008-0304-063-2) Mactung Project 2006 Archaeological Investigations December 2006	Preliminary archaeological assessment. Mine site and related infrastructure options in the Yukon and NWT. Objective was to identify areas where further archaeological assessment was required.	Mill site, tailings facility, and waste rock storage area have sufficient archaeological potential to justify additional field investigation.
Appendix K2 (YOR 2008-0304-064-2) 2007 Mactung Project Archaeological Investigations November 20, 2007	Archaeological assessment of localized landforms considered to have moderate or higher potential near the proposed waste rock storage area, tailings facility and mill site.	No new archaeological sites were encountered. The location for mine facilities are considered to have a very low archaeological potential.
Appendix K3 (YOR 2008-0304-065-2) Mactung Project 2008 Archaeological Investigations October 15, 2008	Archaeological overview and preliminary inventory and site assessment of the proposed access road, water pumping station and extension of Macmillan Pass Aerodrome.	One archaeological site was encountered on a knoll in Macmillan Pass adjacent to the Nidd Road; if possible it should be avoided. There is little archaeological potential along the majority of the proposed mine access road (which has since been removed from the Project), pumping station, or proposed extension of Macmillan Pass Aerodrome. Areas outside of road alignment have moderate potential and should be assessed if developed (as quarry or re-alignment of road).

The PWH studies described the area as being historically utilized by the Kaska and the Sahtu for subsistence harvesting. The Chu Ta Dena/Mountain Slavey people in the Ross River Dena Council were identified as the traditional land stewards of the Mactung area (YOR 2008-0304-005-2). The area was likely periodically utilized for hunting, trapping, and fishing. Trails within the area were likely used to access Yukon posts for trade including the route the North Canol Road now generally follows.

The construction of the North Canol Road and pipeline in 1942 resulted in an influx of people and money into the area. The North Canol Road runs from Norman Wells to Ross River, and was responsible for opening up the area to increased use; it continues to provide access. Abandoned vehicles and equipment found along the North Canol Road are evidence of the historic activities related to the road and pipeline construction and use.

4.12 TRADITIONAL LAND USE

The Project is located within the traditional territories of the RRDC, Liard First Nation and the First Nation of Na-Cho Nyak Dun. The RRDC have identified traditional use activities such as hunting, trapping and gathering, and have indicated having interests in the entire area overlapped by the proposed project (YOR 2008-0304-019-2, 2008-0304-230-1, 2008-0304-169-1, 2008-0304-146-1). The ecoregion displays the highest diversity of mammals in the Taiga Cordillera of Yukon and encompasses habitat for the following species: woodland caribou, mountain goats, Dall sheep, porcupines, squirrels, hoary marmots, wolves, foxes, lynx, otter, wolverines, martens, weasels, minks, black and grizzly bears, moose, and numerous rodent species (Smith, Meikle and Roots 2004). Many or all of these species are important for traditional land use. The Chu Ta Dena/Mountain Slavey people in RRDC were identified as the traditional land stewards of the Mactung area (YOR 2008-0304-005-2).

4.13 LAND AND RESOURCE USE

The mine site, water intake infrastructure at Hess River South Tributary, access road and Macmillan Pass Aerodrome overlap with Registered Trapping Concession (RTC) #112. The North Canol Road and staging areas overlap with Group Trapping Concessions #405 and #415.

Registered Trapping Concession #112, which is registered under Neilson Sisson, is delimited to the north by a tributary of the Hess River, to the east by the Yukon–NWT border, to the southeast by the North Canol Road and to the west-southwest by another tributary of the Hess River. Mr. Sisson uses the existing Nidd Road (also referred to as the Cominco Road) as a trapline while other trappers from the Group Trapping Concessions #405 and #415 use the North Canol Road and surrounding area as a trapline and as access. As mentioned by NTC in its proposal, data from Government of Yukon, Department of Environment indicates that the region around the project area has been active in each of the past ten years (YOR 2008-0304-019-2).

The proposed project activities also overlap with Game Management Subzones (GMS) #435, 436, 439, 440, 449, 450, 1101, 1102, 1106, 1107 and 1108, which include the area from Ross River to the Yukon–NWT border and the mine site area. Hunting season occurs from August 1 to October 31, with a spring bear hunt from April 15 to June 21. The North Canol Road and adjacent area is used extensively for moose-hunting by resident hunters.

The location of project activities also overlaps with Outfitting Concession #9, owned by Jarrett Deuling of Deuling Stone Outfitters (DSO). Mr. Deuling stated that the operations in the Keele Peak region provide for approximately 50 percent of DSO's income (YOR 2012-0060-034-1).

In addition to Class 1 mineral exploration activities in the region, several exploration projects and the proposed Mactung Mine have been submitted to YESAB. As in other regions of the Yukon, the area was recently subject to intense mineral staking, particularly in 2010. Several camps supporting these activities are located in the area, particularly along the North Canol Road. The Macmillan Pass Aerodrome is used by companies accessing the general area.

5.0 SCOPE OF ASSESSMENT

The scope of assessment identifies the matters considered in the screening. It is determined by considering the matters set out in s. 42 of YESAA (outlined above in section 2.6.1). The Executive Committee has employed a valued component based assessment methodology to assess the environmental and socio-economic effects of the Mactung Mine Project. The valued environmental and socio-economic components (VESECs) are identified, in part, on views and information submitted during the project assessment.

5.1 CONSIDERATION OF COMMENTS RECEIVED DURING SCREENING OF PROJECT PROPOSAL

The Executive Committee solicited comments during the adequacy review stage to determine if there was sufficient information to draft a scope of project document and commence the screening. Comments received were considered when drafting two adequacy review reports which outlined additional information required by the Executive Committee. Several issues were identified during the adequacy review stage for which additional information was required, including:

- the proposed access road;
- infrastructure;
- acid rock drainage and metal leaching;
- water quality and quantity;
- mine engineering issues; and
- wildlife.

Key concerns were related to water quality and the hydrology of the project area and the potential effects to the downstream receiving environment. There were also questions related to water baseline data, water models developed for the Project, and the overall water management plan. The construction and use of the proposed access road was also discussed. North American Tungsten Corporation Ltd. (NTC) provided additional proposal information addressing the key issues identified in the adequacy review stage (YOR 2008-0304-082-2 and YOR 2008-0304-099-2). The Executive Committee determined that sufficient information was provided to commence the screening.

The public comment period lasted from October 22 to December 7, 2009. During this period, comments were received from 21 parties. The Executive Committee also hosted a public meeting in Ross River on November 9, 2009, where additional comments were received. Comments submitted and those received during the public meeting formed the basis of an additional information request regarding the following topics:

- fish and fish habitat and related project effects;
- project compliance with the *Metal Mining Effluent Regulations*;
- hydrology and water balance information;

- project-related water management – surface and sub-surface;
- mine site acid rock drainage and metal leaching predictions;
- mine site infrastructure design and performance;
- access road and consideration of the alternative Mactung Spur Road; and
- cost estimates for operating and maintaining the North Canol Road in the winter.

Key issues and concerns were related to effects of the Project on:

- wildlife and wildlife habitat and aquatic resources;
- weather monitoring;
- the use and upgrade of the North Canol Road;
- the construction of the proposed access road and reservoir dam;
- the use of an alternative to the proposed access road;
- land related valued components;
- heritage resources; and
- socio-economic effects to communities.

NTC provided several documents between October 2009 and September 2012 to address the issues identified in the information request and follow-up requests. This information related particularly to:

- water balance;
- mine infrastructure;
- geochemical comparisons between Mactung and Cantung deposits;
- geochemical reports;
- geochemical characterization, background and modelling;
- water quality;
- proposed access road option and decision;
- water treatment plant;
- backfilling and sealing of stopes; and
- fish barriers.

The Executive Committee continued to receive comments after NTC responded to the information requests outside of the formal public comment period. These comments reinforced earlier concerns and provided feedback on new information provided by the Proponent. A technical working group was held March 22, 2012 to discuss the method for disposing mined material and issues related to water quality during operations and post closure.

A list of all submissions received and considered during the screening is included in Appendix C. These submissions are available for review on the YESAB Online Registry located at www.yesab.ca/registry or in paper copy at the YESAB Head Office in Whitehorse.

5.2 CONSIDERATION OF COMMENTS RECEIVED DURING THE DRAFT SCREENING REPORT PUBLIC COMMENT PERIOD

On October 12, 2012 the Executive Committee completed the Draft Screening Report (DSR) and made it available for public comment. The comment period on the DSR remained open for 60 days until December 13, 2012 for the public to review the DSR and associated project proposal material. During this time the Executive Committee held public meetings in Ross River and Watson Lake.

Fifteen comments were received by the Executive Committee during this time, as well as the presentations and summaries from the public meetings held in Ross River and Watson Lake. Based on these responses the Executive Committee issued a supplementary information request to the Proponent on January 4, 2013. Additional information was requested on mine site water management; geochemical characterization of waste rock and borrow material; effects to fish and fish habitat; access road to the Mactung mine; heritage resources and traditional land use; wildlife and use of alternative water sources.

NTC provided a letter on February 26, 2013 indicating that they were withdrawing the proposed access road from the project proposal and would pursue upgrading the existing road located in the NWT. Many of the concerns raised in the DSR and from comments received were related to the effects of the development and use of the proposed access road.

On October 18, 2013, the Executive Committee received a response to the January 4, 2013 information request from NTC. The Executive Committee solicited comments from Government of Yukon, Fisheries and Oceans Canada (DFO), Environment Canada and RRDC on the completeness of the NTC response. At the request of RRDC, the Executive Committee held a community meeting in Ross River to receive community feedback on the supplemental information response. The Executive Committee also asked EcoMetrix to provide a technical review of the geochemical and geotechnical responses provided by NTC. As a result of discussions between RRDC and NTC during the community meeting, NTC requested the Executive Committee to extend the review of supplementary information period as further discussions were required between NTC and RRDC that may result in additional information provided to the Executive Committee for consideration. The Executive Committee agreed to the extension until December 1, 2013.

The Executive Committee issued an information request at the conclusion of the December 1, 2013 review period outlining further information required from NTC. This information request considered additional comments provided by Government of Yukon, RRDC, DFO and EcoMetrix. A technical meeting was held on December 10, 2013 to discuss the preparation of a response from NTC. NTC provided a response to the information request on December 23, 2013. On January 9, 2014, the Executive Committee determined that NTC had provided sufficient information to prepare the Screening Report.

A complete copy of the comments provided as well as the supplementary information request and response are available on the YESAB Online Registry located at www.yesab.ca/registry or in paper copy at the YESAB Head Office in Whitehorse.

5.3 Removal of Nidd Road Access Option

NTC was proposing to construct a new access route to the mine site rather than upgrading and utilizing the existing access route. The new access route would be located entirely in Yukon and would require construction of approximately 31 km of new road, as well as substantive upgrades and re-alignment to 19 km of an existing road.

In its Draft Screening Report, the Executive Committee set out that, based on preliminary investigations, that there did not appear to be:

- any regulatory or land ownership obstacles preventing the Proponent from applying for a permit(s) to access the mine site via the existing access road; and
- from an environmental and socio-economic effects perspective, it was reasonable to anticipate there would be fewer adverse effects.

The Executive Committee set out its view that the Proponent had not demonstrated adequate consideration of the existing access route and found that it was completely unacceptable to construct a new 31 km access road through remote undeveloped valleys to access the mine site if it is feasible to upgrade the existing route. Many of the concerns raised in the DSR and from comments received on the DSR were related to the effects of the development and use of the proposed access road.

On February 26, 2013, NTC indicated that they were withdrawing the proposed access road from the project proposal and would pursue upgrading the existing road located in the NWT.

5.4 Consideration of Upgrade and Use of North Canol Road

NTC proposes to use the Campbell Highway to Ross River, the North Canol Road, and then its existing access road to access the mine site. The existing access route, referred to as the Mactung Spur Road, is approximately 11 km long and is accessed from the North Canol Road in the NWT. Except for its terminus at the mine site in Yukon, the Mactung Spur Road is located entirely in the NWT. The Campbell Highway and North Canol Road are listed in the *Highways Regulations* and are considered as public roads. The Campbell Highway is open year-round while the North Canol Road is not maintained in the winter.

The Executive Committee has received comments and concerns from members of the Ross River Dena Council, Deuling Stone Outfitters, the holder of trapline concession #112, Government of Yukon, and the Yukon Conservation Society about the use and upgrading of the North Canol Road.

The Executive Committee notes that the upgrading and maintenance of the North Canol Road are not addressed in this screening report since these activities are not proposed by NTC. Government of Yukon, Department of Highways and Public Works indicated in a letter to YESAB that it is preparing a proposal for the upgrading of the North Canol Road. The letter dated November 14, 2008 indicates that:

> *It is understood that any project proposal submitted by North American Tungsten or Overland Resources will not include an assessment of the road upgrades, as this is the Yukon Government's responsibility, as the Proponent of the project.*
>
> (YOR 2008-0304-029-2)

The Executive Committee agrees with the above approach since NTC has indicated that it can carry out the Project, assuming that regular public road maintenance is performed, without upgrading the North Canol Road. However, the Executive Committee will consider the use of the North Canol Road as an activity for the Project and will address the potential effects in the appropriate sections of this report.

5.5 CONSIDERATION OF ALTERNATIVES

Section 50(2) of YESAA requires a proponent, when preparing their proposal, to consider alternatives to the project, or alternative ways of undertaking or operating the project, that would avoid or minimize any significant adverse environmental or socio-economic effects. The Proponent reviewed a number of alternative methods and locations for undertaking the Project. NTC provided rationale for the decision to use the preferred location or methodology as described in the project description. NTC concluded in their effects assessment that the Project would not result in significant adverse effects based on the options chosen.

Section 42(e) of YESAA also requires the Executive Committee to take into consideration alternatives to the project or alternative ways of undertaking or operating it, that would avoid or minimize any significant adverse environmental or socio-economic effects. The requirement in YESAA to examine alternatives is conditional upon a determination of significant adverse effects.

The Executive Committee determined that the Project would result in significant adverse effects and considered a number of alternatives to avoid or minimize any significant effects. Based on additional information and issues identified in comments received during the assessment, the Executive Committee considered the following alternatives that may avoid or minimize significant adverse effects:

- The use of the Mactung Spur Road in the Northwest Territories instead of the access road located in the Yukon.
- Waste rock and tailings disposal in the dry-stacked tailings facility (DSTF) instead of underground disposal above the water table.
- Drawing water from Tsichu River in the NWT for mine use instead of from the Hess River South Tributary.
- Locating the mine camp near the Macmillan Pass Aerodrome instead of near the mill.

The Executive Committee considered the Mactung Spur Road to be the preferred access route to the mine site. NTC amended the project scope by removing the proposed Nidd Road option indicating that they would use the Mactung Spur Road. Section 5.3 of this report provides additional information on this change to the scope of the Project.

The Executive Committee considered alternative disposal methods of waste rock and tailings to mitigate effects of the Project on water resources due to possible acid rock drainage and metal leaching potential

from disposed waste rock and tailings underground and above the water table. The Executive Committee required additional information from the Proponent to confirm that the DSTF could accommodate the volume of material to be disposed of below ground and above the water table. The Executive Committee determined that waste rock and tailings should be disposed into the DSTF instead of underground and above the water table to minimize significant adverse effects to water resources. Further consideration of this alternative is provided in section 6.3 Water Quality.

The Executive Committee considered the relocation of the camp at the Macmillan Pass Aerodrome to mitigate effects of the Project on heritage resources, traditional land use and wildlife. The Executive Committee concluded that locating the camp away from the mine site would not be a successful strategy to avoid or minimize significant effects. This alternate location would increase the amount of traffic along the North Canol Road and access road to the mine site which would increase negative effects to traditional land use values and wildlife in and around the mine site.

The Executive Committee also considered the drawing of water from the Tsichu River in the NWT as an alternative to the proposed source on the Hess River South Tributary to mitigate significant adverse effects to fisheries, heritage resources and traditional land use. The Executive Committee requested additional information from the Proponent on January 4, 2013 to better understand the Tsichu River option. NTC provided additional rationale for why the Hess River South Tributary is the preferred water source for the mine including:

- The Tsichu River does not have confirmed water volumes sufficient for the purpose of the Project.
- Water extracted from the Tsichu River, located in the Mackenzie River watershed, would be transported and discharged into the Yukon River watershed. This may have significant effects to these water systems.
- The Tsichu River is within the regulatory jurisdiction of Northwest Territories while the discharge from the reservoir dam is located in the regulatory jurisdiction of Yukon.

Davies et al. (1992) reported their assessment of the ecological impacts of inter-basin water transfers and identified the serious nature of ecological impacts. The assessment provides examples of impacts on water systems from transfers between watersheds such as the following:

> *the loss of biogeographical integrity, the loss of endemic biotas, frequent introduction of alien and often invasive aquatic and terrestrial plants and animals, the genetic intermixing of once separated populations, the implications for water quality, the frequently drastic alteration of hydrological regimes, the implications for marine and estuary processes, climatic effects, and the spread of disease vectors, amongst many others…*
>
> (Davies et al. 1992)

The Executive Committee is of the opinion that transferring water from one watershed to another may have significant adverse effects which may result in transfer of foreign species, changes to watershed flows and water quality. The Executive Committee has also determined that there are suitable terms and conditions to mitigate significant adverse effects resulting from the withdrawal of water from the Hess River South Tributary (section 7.0 Aquatic Resources).

5.6 CONSIDERATION OF CUMULATIVE EFFECTS

The Executive Committee has considered residual effects of the Project after mitigations in combination with effects from existing and proposed projects. Each valued component has a cumulative effects section; however this section supports the overall consideration of cumulative effects.

The Executive Committee has mapped all projects assessed since 2005 within a 20 km radius of the Mactung Mine site (Figure 26) and along the North Canol Road (Figure 27). The projects were identified through the YESAB Online Registry. Generally activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance of the North Canol Road. While the level of quartz exploration had risen considerably in 2011, the activities are dispersed throughout the 20 km radius of the Project and along the North Canol Road.

The current level of activity in the vicinity of the Project is relatively low. Generally, the valued components considered in the effects assessment will not experience significant adverse effects due to cumulative effects of multiple projects as projects in the area are dispersed. Should activities continue to increase in the vicinity of the Project; cumulative effects considerations will become increasingly important. As a result, ongoing monitoring of baseline conditions is important to inform future cumulative effects assessment and/or planning processes in the project area.

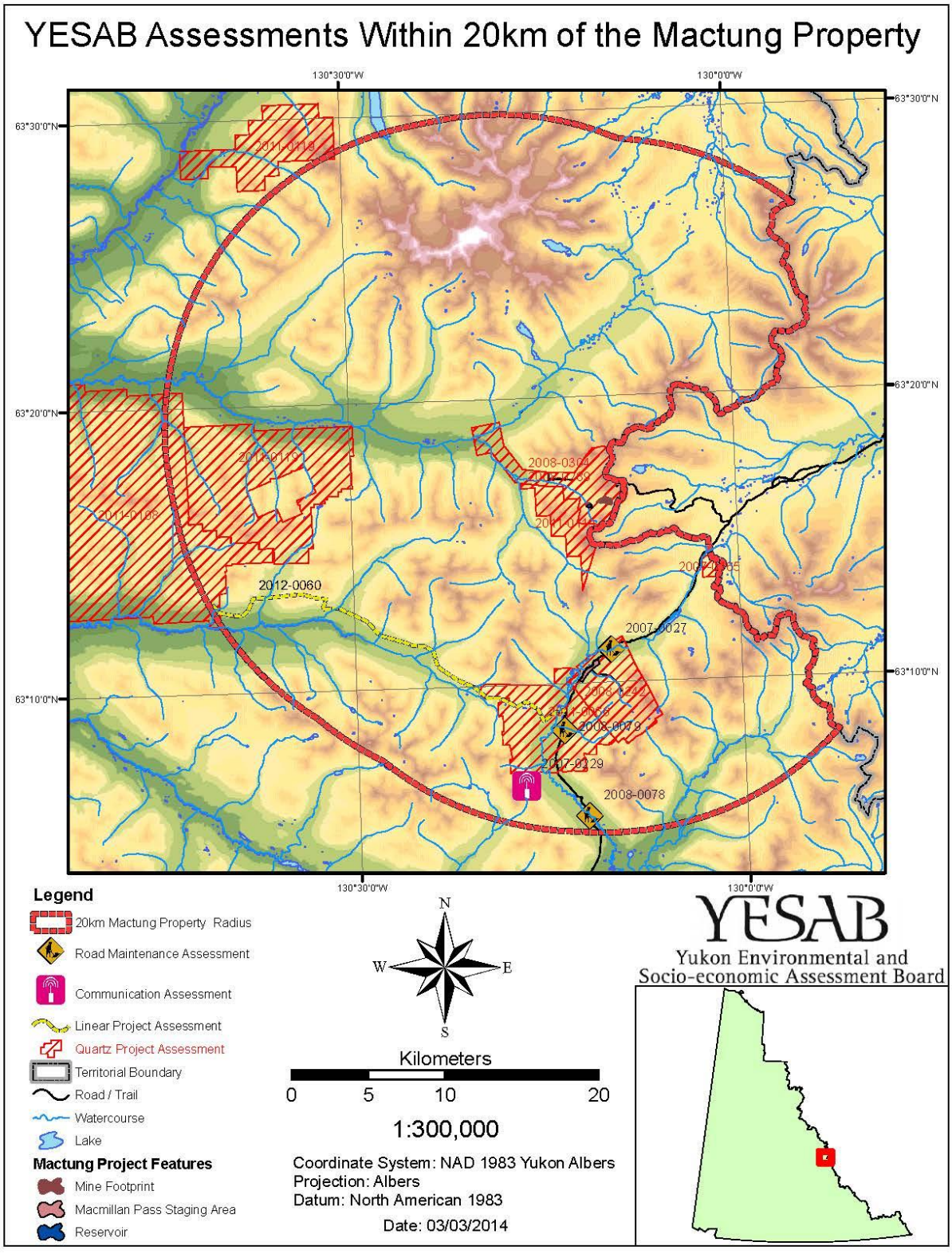

Figure 26 Previously assessed projects near the mine site.

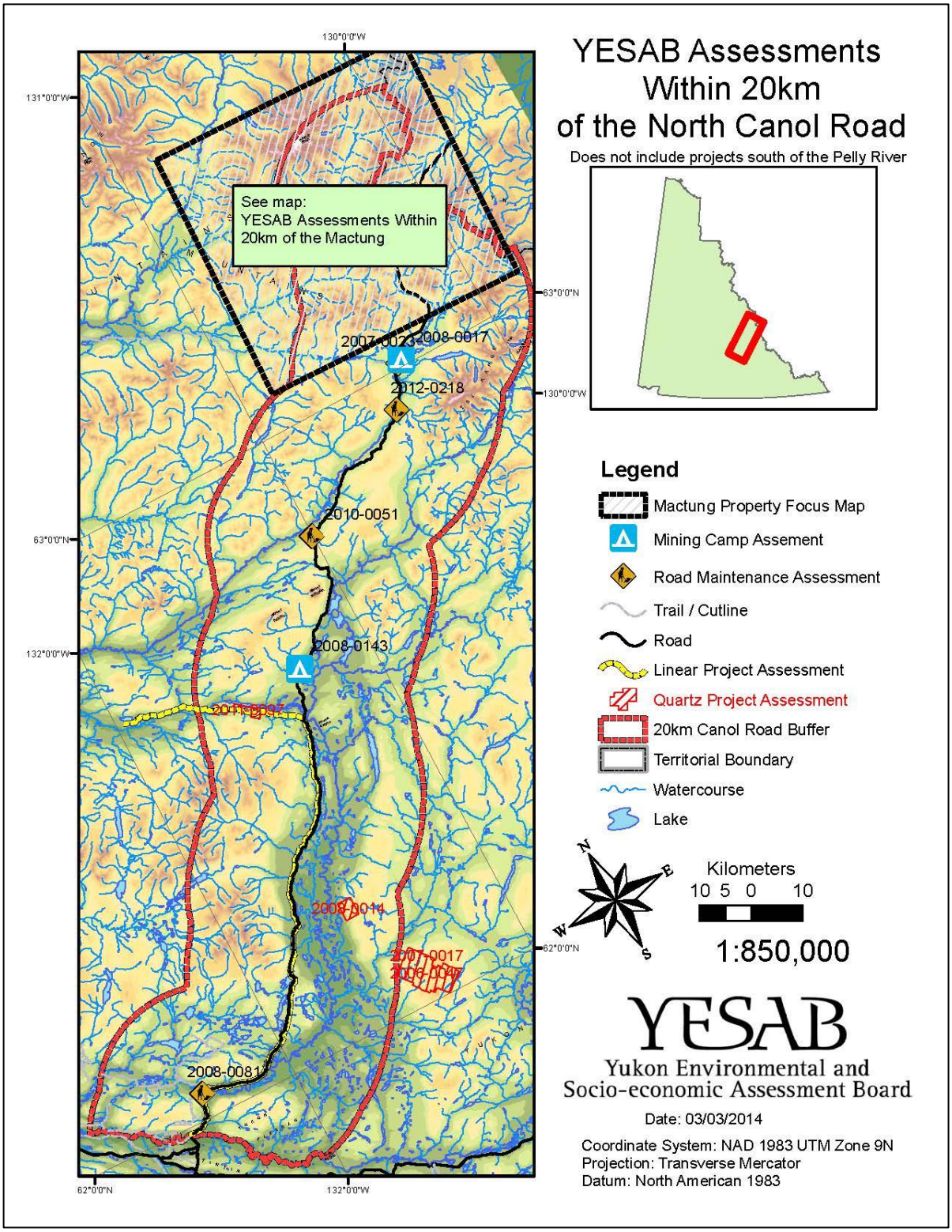

Figure 27 Previously assessed projects along the North Canol Road.

5.7 VALUED ENVIRONMENTAL AND SOCIO-ECONOMIC COMPONENTS

To assess the potential effects of the Project, the Executive Committee identified valued environmental and socio-economic components (VESECs) potentially affected by the Project. VESECs were identified by the Executive Committee considering the proposal, comments received during the screening, and technical input from experts. Table 16 sets out the VESECs considered in this assessment and the corresponding sections of the report.

PART II EFFECTS ASSESSMENT

Part II presents the Executive Committee's effects assessment for the Project. The valued environmental and socio-economic components set out in Table 16 have been considered.

Table 16 Valued Environmental and Socio-economic Components

Values	Sections
Water Resources	6.0
Aquatic Resources	7.0
Wildlife	8.0
Health and Safety	9.0
Environmental Quality	10.0
Heritage Resources and Traditional Land Use	11.0
Land and Resource Use	12.0
Cultural and Community Well-being	13.0

For each valued component, an overview of the component is provided, followed by the effects characterization analysis and significance determination. Mitigative measures are specified where required. Potential cumulative effects are examined, and a final determination is made of the significant adverse effects on each valued component.

6.0 WATER RESOURCES

This section addresses potential effects of the Project on water resources. An understanding of the environmental and socio-economic setting for water resources is provided, and potential adverse effects are characterized and discussed in the context of the proposal, stakeholder comments, relevant legislation and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on water resources.

6.1 OVERVIEW

North American Tungsten Corporation Ltd. (NTC) is proposing to modify Tributary C water flows by constructing a reservoir dam for mill water use and for receiving mill effluent and contact water. The reservoir's operational capacity is between a minimum of 12 000 m^3 and a maximum of 540 000 m^3 with an additional volume of 72 000 m^3 for emergency storage. The reservoir dam will be approximately 315 m long and 35 m high at its highest point with a crest width of 25 m. Construction will require stripping overburden to the surface of bedrock and excavating highly weathered/fractured bedrock (using machinery and hand scaling) to a more competent bedrock surface. A catchment area, approximately 2.43 km^2 in size, above the reservoir dam will continue to flow into the reservoir (Figure 28).

A seepage water dam will be constructed below the reservoir dam to collect reservoir seepage and any groundwater underflow. The seepage water dam will be approximately 8 m high and 60 m wide with a capacity of 5 250 m^3.

The Proponent proposes diversion channels to collect and route non-contact water around mine infrastructure to discharge directly into Tributary C below the seepage water dam. The diversion channels will reduce the quantity of water contacting mine infrastructure and storage. The Proponent will extract water from the reservoir for milling purposes in addition to water pumped from the Hess River South Tributary.

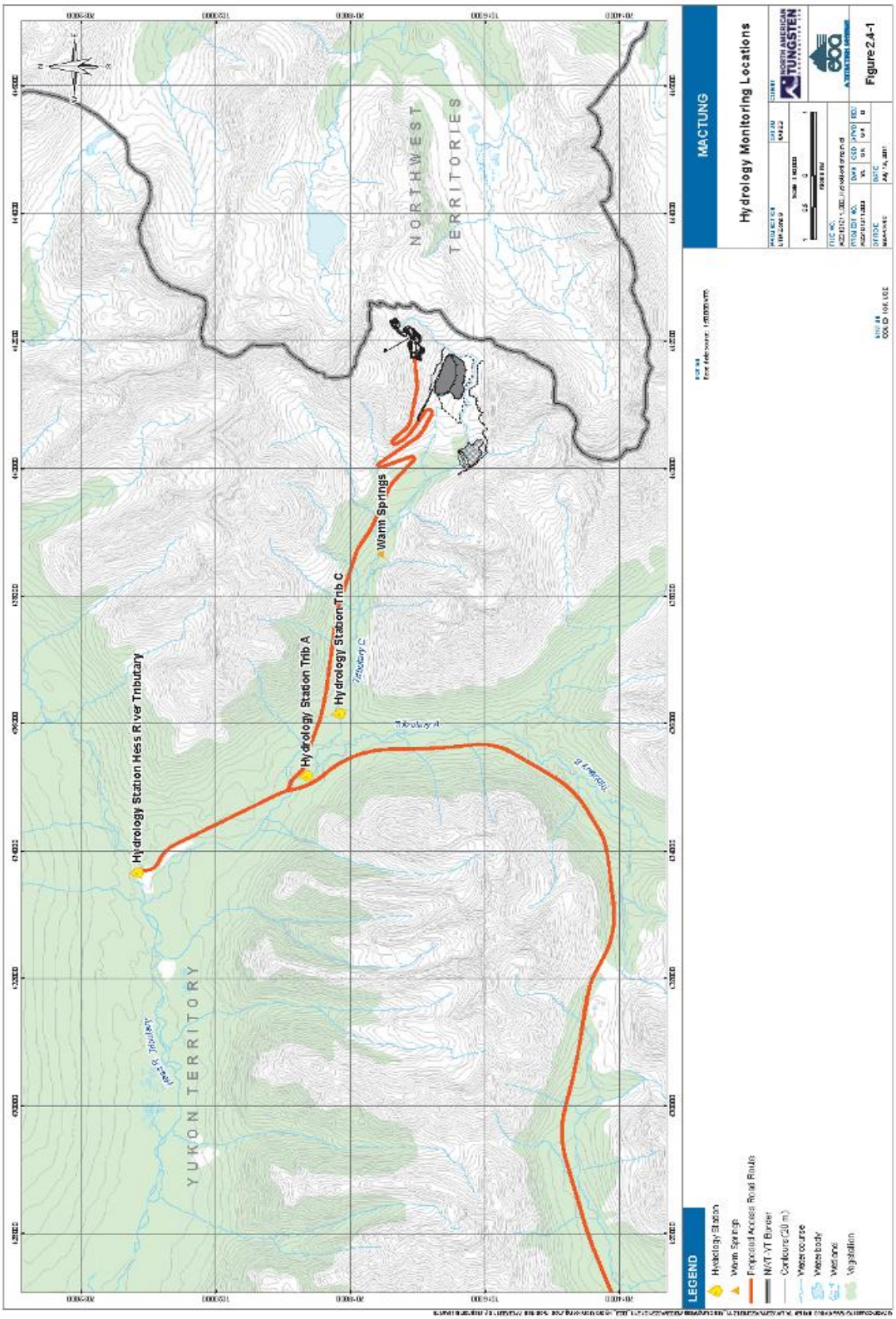

Figure 28 Overview of related infrastructure and monitoring locations. (YOR 2008-0304-176-1)

NTC identified the following inputs into the reservoir:

- the 2.43 km^2 catchment area above the reservoir;
- direct precipitation;
- runoff from the mine site;
- runoff from the temporary waste rock piles;
- runoff from the dry-stacked tailings facility;
- mill discharge;
- wastewater discharge from the camp; and
- groundwater inputs, potentially affected by underground workings.

The water balance developed for the mine site predicts that the site will have a positive balance requiring discharge of contact water from the reservoir to Tributary C to maintain volumes below the maximum storage capacity. Water withdrawal from the Hess River South Tributary and the storage and discharge to Tributary C will be the primary pathways of effects to water resources.

Effects on two aspects of water resources are considered in this section: impacts to water quantity and impacts to water quality.

6.2 WATER QUANTITY

6.2.1 Precipitation

Evaluation of Baseline Information - Precipitation

The precipitation estimates in this report are based on a regional analysis provided by NTC in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). Based on the regional analysis the mean annual precipitation for Mactung was estimated to be 704 mm with a standard deviation of 141 mm. Table 17 provides the monthly distribution of precipitation that was developed based on the precipitation distributions observed regionally. Table 18 provides estimates of Mactung wet and dry rates for 2-year through 200-year return periods by using a normal distribution from the Faro and Macmillan Pass sites.

Table 17 Mactung Mean Annual Precipitation and Monthly Distribution Estimate (Table 6-3)

Month	Precipitation (mm)	Distribution (%)
January	38.0	5%
February	42.4	6%
March	48.5	7%
April	38.9	6%
May	32.2	5%
June	71.0	10%
July	91.0	13%
August	100.4	14%

September	80.3	11%
October	61.4	9%
November	48.1	7%
December	52.1	7%
Mean Annual	704.2	100%

Table 18 Mactung Wet and Dry Annual Precipitation Estimates (mm)

Return Period	Dry Condition	Wet Condition
200	617	1088
100	639	1066
50	665	1041
20	703	1003
10	736	970
5	776	929
2	853	853

Effects Characterization – Precipitation

A meteorological station with a precipitation gauge was installed on August 12, 2013, which will be used in the future to validate precipitation estimates used in the water balance and water quality predictions. Currently, the Executive Committee remains concerned that without on-site rain and snowfall monitoring at the site, the precipitation scenarios based on regional meteorological station data cannot be validated. Environment Canada recommended in their review of the Draft Screening Report that "the collection and presentation of site-specific data [sic] should also explicitly stipulate that site-specific rainfall and snowfall data be collected and incorporated into the water balance and water quality models" (YOR 2008-0304-281-1).

NTC used the precipitation scenarios with the hydrograph developed using Tributary C hydrology measurements (section 6.2.2 Overview – Tributary C Hydrology) to estimate the runoff coefficient which was then used in the water balance. The runoff coefficient is the total reported runoff divided by the total precipitation within the catchment. The runoff coefficient for Tributary C was estimated to be 0.63. The single runoff coefficient of 0.63 was applied to the total precipitation rate to get total runoff and then flow was partitioned monthly to get the monthly runoff values for Mactung. The runoff volumes estimated in the GoldSim water balance model are based on total annual precipitation and monthly distribution.

A sensitivity analysis of the runoff coefficient was completed by NTC in their GoldSim water balance model. It was found that the runoff coefficient significantly affects the calculated magnitude of annual inflow into the reservoir.

NTC recognized the uncertainty of the runoff coefficient as it is based on the precipitation scenario and not from on-site precipitation measurements. NTC modeled the variability of the 0.63 runoff coefficient for Tributary C by applying a standard deviation of 0.16 which accounts for a 25 percent variation of the

runoff coefficient to assess the impact of variability of annual inflow due to the uncertain runoff coefficient.

The Executive Committee accepts this as the appropriate approach for the screening. However the runoff coefficient should be further validated through on-site precipitation measurements with on-site hydrological measurements of Tributary C.

The mine will have local effects on Tributary C during construction, operations and closure. The effects could impact further downstream if infrastructure failed or during unscheduled release of untreated water.

The Executive Committee has determined that the precipitation estimates and runoff coefficient must be further validated to ensure the water balance model is appropriately estimating water inputs into the reservoir system. The Executive Committee has determined that the Project will result in significant adverse effects to water resources without additional confidence in precipitation estimates and the runoff coefficient.

Terms and Conditions – Precipitation

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

In order to reduce uncertainties associated with the precipitation scenario and water balance model, as well as provide sufficient basis for future monitoring:

1) The Proponent shall incorporate precipitation monitoring at the Mactung Mine site as part of the meteorological monitoring program. Daily site-specific rainfall and snowfall data shall be collected. The precipitation data shall be collected to allow a determination of crucial flow periods and site hydraulic responses such as during freshet and transition from rainfall to snowfall. This information shall be provided to the appropriate regulators during the regulatory approval process.

2) The Proponent shall review and update the runoff coefficient using on-site rainfall, snowfall, and Tributary C streamflow data collected or update the model in a way that will account for site-specific precipitation data. Should changes to predictions from the model result, the Proponent shall ensure appropriate measures are in place and update the water management plan to account for changes. This information shall be provided to the appropriate regulators during the regulatory approval process.

6.2.2 Tributary C Hydrology

Evaluation of Baseline Information – Tributary C Hydrology

Tributary C hydrology information summarized in this report is based on a regional analysis as provided by NTC in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). A summary of manual and continuous water flow measurements from the Tributary C and Hess River South Tributary were provided from 2006 to 2012 including monthly averages from year-round continuous monitoring in 2012. The monthly averages from the Hess River

South Tributary and Tributary C were provided in the response and are reproduced in this report in Section 4.6.1 Surface Water Flow.

NTC has found the runoff coefficient for Tributary C to be 0.63 based on the flow measurements of Tributary C carried out from 2006-2012 (as summarized in section 4.6 Hydrology) and the regional precipitation estimates (as summarized in the previous section). A regional frequency analysis was conducted to determine extreme flow conditions for Tributary C. The results of the regional frequency analysis are included in Table 19 below.

Table 19 Tributary C Mean Monthly Runoff (mm) (Table R2-5)

Event		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Median		7	3	2	3	77	133	89	72	52	24	14	8	484
Wet	5-Year	8	4	2	3	87	150	100	81	59	27	15	10	546
	10-Year	9	4	3	3	92	159	106	86	62	28	16	10	578
	100-Year	10	4	3	4	106	182	121	98	71	33	19	12	663
Dry	5-Year	6	3	2	2	68	117	78	63	46	21	12	7	425
	10-Year	6	3	2	2	63	109	72	58	43	19	11	7	395
	100-Year	5	2	1	2	52	90	60	48	35	16	9	6	326

NTC provided a flood frequency analysis using the index flood method with a return period of 2.33 years using regional water stations in the Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). Table 20 summarizes various return periods (years) and Tributary C floods.

Table 20 Index Flood Method Ratios and Tributary C Floods (Table R2-7)

Return Period (Years)	Regional Median Ratio to $Q_{2.33}$	Tributary C Floods (m^3/sec)
1,000	2.42	11.4
200	1.99	9.3
100	1.82	8.6
50	1.66	7.8
20	1.48	6.9
10	1.33	6.2
5	1.18	5.6
3	1.05	4.9
2	0.91	4.3

The results from the frequency analysis were used to predict potential impacts to fish and fish habitat and in determining the performance of the dam.

Effects Characterization – Tributary C Hydrology

The Executive Committee is encouraged that the Tributary C hydrology is based on manual and continuous flow measurements of Tributary C. The Executive Committee is also encouraged that in 2012, one year of continuous flow data was recorded including seasonal changes of flow periods such as freshet and freeze-up. This new information is consistent with the recommendations provided by Government of Yukon.

> *Baseline water quality/quantity data is incomplete. There is a lack of sampling during peak flows and during winter low flow (ie. the proponent has not presented one complete year of data, but has portions of year's data).*
>
> …
>
> *Prior to the assessment process, the proponent should present at least one year of complete water quality data, and address hydrological gaps for water balance calculations.*
>
> (Government of Yukon YOR 2008-0304-278-1)

The Executive Committee recognizes that regional frequency analysis from other river systems with hydrology stations with long-term data sets was used to determine extreme water flows and flood frequency analysis. As on-site precipitation and hydrology data is collected, the extreme water flows should be revisited to ensure that site flow data are reflected within the variability of extreme water flow events.

The Project will have local effects on Tributary C during construction, operations and closure. The effects could impact further downstream if infrastructure failed or during an unscheduled release of untreated water.

The Executive Committee has determined that the hydrology estimates of Tributary C, especially during critical periods of winter low flow and freshet peak flows and taking into account wet years and dry years, must be further validated to ensure the water balance model is appropriately estimating water baseline flows for Tributary C. The Executive Committee has determined that the Project will result in significant adverse effects to water resources unless there is additional confidence in Tributary C estimates.

Terms and Conditions – Tributary C Hydrology

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

In order to reduce uncertainties associated with the Tributary C hydrology and water balance model, as well as provide a sufficient basis for future monitoring:

3) The Proponent shall update flow rates for Tributary C to include a minimum two years of continuous data and use this data to update the water balance model. The updated flow data and water balance model shall be provided to the appropriate regulators during the regulatory approval process.

6.2.3 Groundwater Estimates

Evaluation of Baseline Information – Groundwater Estimates

Groundwater flow in bedrock is largely controlled by a few conductive fractures or other rock mass discontinuities. Three constant rate pumping tests were conducted to provide information on the hydraulic conductivity of the bedrock: one at each of MW-MT-08-01 (downgradient of the DSTF), MW-MT-08-02 (downgradient of the reservoir dam), and MW-MT-08-08 (mill site). The MW-MT-09-10 borehole test was conducted in August 2009 to further characterize the underground workings. The pumping tests provide a range of estimated bulk hydraulic conductivity between approximately $1x10^{-6}$ to $2x10^{-7}$ m/s.

Several analytical models were used to estimate groundwater inflow in the underground workings. NTC predicted inflow rates to range from approximately 1 m^3/day to 1000 m^3/day with an overall mean inflow rate of 75 m^3/day (YOR 2008-0304-082-2).

NTC updated the estimated inflow rates to 4 to 19 m^3/day with the 90 percent probability level inflow rates. NTC updated the water inflow rate estimates using a Monte Carlo simulation that uses a stochastic approach to develop a probability distribution of possible outcomes (YOR 2008-0304-299-1).

Effects Characterization – Groundwater Estimates

The Executive Committee recognizes that NTC has updated the uncertainty analysis of the groundwater estimates. However, there remain some significant uncertainties with respect to the groundwater flow estimates. Two wells have been used to estimate groundwater flows, but further testing is required to build confidence in the estimates. Natural Resources Canada stated in their comments on the Draft Screening Report:

> *Hydraulic conductivity is a critical parameter to quantify groundwater flow, and is essential to understanding rates of groundwater flow and for use in hydrogeological modeling. Additional validation of hydraulic conductivity of the overburden aquifer through in-situ tests is therefore required to refine groundwater flow models and to update water quality prediction models*
>
> (YOR 2008-0304-279-1)

The Executive Committee has determined that groundwater estimates must be further validated to ensure the water balance model is appropriately estimating water inputs into the reservoir system. The Executive Committee has determined that the Project will result in significant adverse effects to water resources unless there is additional confidence in groundwater estimates.

Terms and Conditions – Groundwater Estimates

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

In order to reduce uncertainties associated with the groundwater estimates and the water balance model as well as provide sufficient basis for future monitoring:

4) The Proponent shall validate hydraulic conductivity for the overburden aquifer by on-site in-situ tests in order to refine the hydrogeological model. This information shall be provided to the appropriate regulators during the regulatory approval process.

6.2.4 Water Balance

Overview

The reservoir water balance is the accounting of all water volumes that enter and leave the reservoir. NTC correlated regional data from meteorological and hydrological stations to estimate precipitation and Tributary C runoff inputs and precipitation inputs into the reservoir. NTC estimated water inputs from the mine infrastructure including the mill, the camp, DSTF runoff, waste rock storage area (WRSA) runoff, and seepage reservoir pump back. Outputs from the system include mill water requirements, seepage (captured in the seepage reservoir and pumped back), and because the water balance has a net positive balance, direct discharge to Tributary C. Figures 29 shows the conceptual water balance provided by NTC for the Project.

Water balance modeling is an important tool for project planning and management and relies on a number of approximations and assumptions to simplify a complicated set of parameters. Model predictions have some uncertainty based on the assumptions and approximations used. NTC water balance tables are provided in NTC's Response to YESAB's Request for Supplementary Information Dated January 4, 2013 that was submitted October 18, 2013 to the Executive Committee (YOR 2008-0304-299-1).

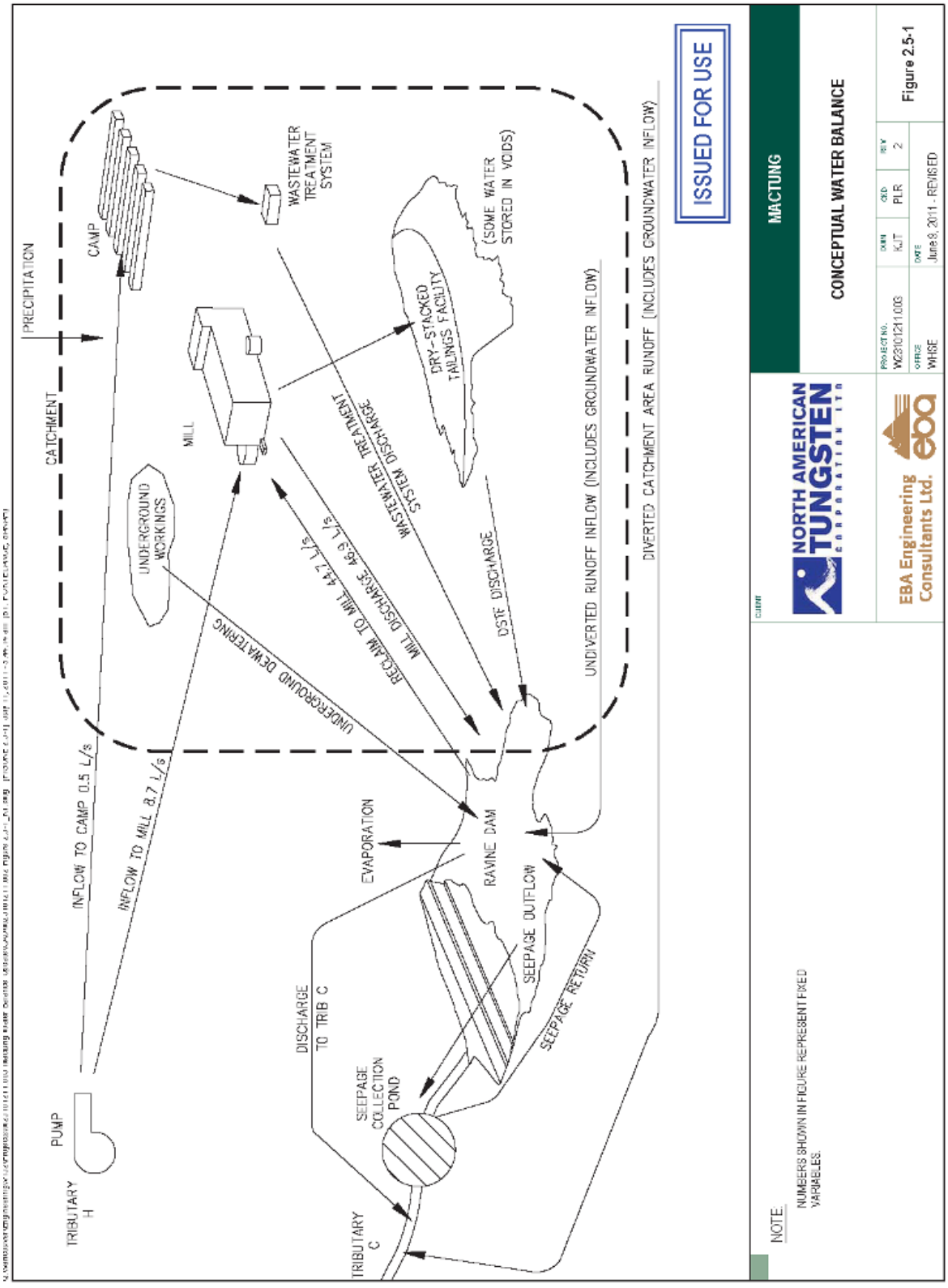

Figure 29 Conceptual Water Balance

Mine Infrastructure Inputs

NTC provided water balance parameters and inputs into the water balance in their estimates of mine site water inputs in the Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1).

Table 21 below summarizes those parameters and inputs.

NTC used GoldSim to carry out the water balance for the Project which accounts for all inputs and outputs of the reservoir. Inputs and outputs include:

- Upstream runoff;
- Rainfall falling directly onto the reservoir;
- Snowmelt from the reservoir surface area;
- Mill discharge;
- Wastewater treatment discharge;
- DSTF discharge;
- Underground dewatering starting at year six;
- Seepage return to the reservoir;
- Reclaim to the mill;
- Seepage outflow;
- Discharge to Tributary C; and
- Evaporation from the reservoir surface area.

NTC provided a sensitivity analysis on the input parameters:

- T-rain: Temperature threshold above which all precipitation in month is rain
- T-snow: Temperature threshold below which all precipitation in a month is snow
- Meltmax: maximum melting rate
- Runoff Coefficient STDEV: the standard deviation applied to runoff coefficient to evaluate variability.

The sensitivity analysis found that the influence to changes to the variability of the runoff coefficient does have a significant affect to the magnitude of annual inflow to the reservoir. To accommodate this model, the runoff coefficient 0.63 derived from the comparison of precipitation scenarios with hydrological data from Tributary C and standard deviation of 0.16 was applied. The standard deviation allows the simulations to take into account the possibility of a larger runoff coefficient at the site.

Table 21 Estimated Discharge Amounts

Parameter/Input	Description	Values
▪ Precipitation	▪ Mean annual precipitation applied a normal distribution with a standard deviation and monthly distribution	▪ Mean Annual Precipitation = 704 mm ▪ Standard Deviation = 141 mm ▪ Monthly Distribution see Table R6-3
▪ T_{-rain}	▪ Temperature threshold above which all precipitation is rain	▪ 3 °C
▪ T_{-snow}	▪ Temperature threshold below which all precipitation is snow	▪ 0 °C
▪ meltmax	▪ Maximum melt rate	▪ 0.9
▪ Temperature	▪ Mean monthly temperatures based on historical data at Mactung site	▪ See Table R8-2
▪ Evaporation	▪ Reservoir surface evaporation	▪ Based on Hamon equation, daylight and temperature
▪ Runoff Coefficient	▪ Fraction of precipitation that is observed as runoff for Tributary C	▪ Mean Coefficient = 0.63 ▪ Standard Deviation = 0.16
▪ Runoff	▪ Undiverted runoff and diverted runoff based on precipitation, runoff coefficient and monthly distribution	▪ Monthly Distribution see Table R1-2
▪ Mill Discharge	▪ Discharge from the mill process plant to the reservoir	▪ 46.9 L/sec
▪ Wastewater Treatment Discharge	▪ Discharge from the wastewater treatment Plant	▪ 0.5 L/sec
▪ Dry-stacked tailings facility Discharge	▪ Discharge from the dry-stack	▪ 0.3 L/sec from May to October
▪ Underground dewatering	▪ Discharge from underground dewatering	▪ Based on Response R7 ▪ Lognormal Mean = 1.3 m^3/day ▪ Standard Deviation = 0.76 m^3/day ▪ Starting at Year 6 of Water Balance
▪ Seepage outflow and return	▪ Seepage outflow from reservoir and seepage return to reservoir	▪ Seepage outflow and inflow balanced (not included in water balance)
▪ Reclaim	▪ Reclaim to the Mill	▪ 44.7 L/sec
▪ Discharges	▪ Release to Tributary C	▪ Outlet Control Elevation = 1506.2 m ▪ Overflow Spillway Elevation = 1514 m

Expected Average Baseline Flow

NTC provided the average and range of outcomes from the GoldSim water balance scenarios at three locations along Tributary C in the Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). Table 22 and Table 23 below reproduce those summaries:

Table 22 Changes to Tributary C Flows at Hydrometric Station (Table 8-6)

%	Event	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
At Tributary C Monitoring Station (24.5 km^2)													
5th	Baseline	32.1	17.3	12.3	12.3	404.6	700.7	451.5	370.1	273.9	100.9	44.3	41.8
50th	Operation	28.7	15.5	11.1	11.1	442.3	702.7	469.1	377.8	278.4	105.3	39.7	37.5
95th	% Diff.	-10%	-10%	-10%	-10%	9%	0%	4%	2%	2%	4%	-10%	-10%
	Baseline	52.7	28.4	20.3	20.3	664.8	1151.3	741.8	608.1	450.0	166.2	72.9	68.9
	Operation	47.2	25.4	18.2	18.2	697.1	1139.6	769.1	625.3	461.0	173.8	65.4	61.7
	% Diff.	-10%	-10%	-10%	-10%	5%	-1%	4%	3%	2%	5%	-10%	-10%
	Baseline	75.2	40.5	28.9	28.9	949.2	1643.6	1059.1	868.1	642.4	236.8	104.0	98.2
	Operation	67.4	36.3	25.9	25.9	972.5	1612.7	1094.2	897.6	664.2	251.0	93.2	88.0
	% Diff.	-10%	-10%	-10%	-10%	2%	-2%	3%	3%	3%	6%	-10%	-10%
At Fishery Station													
5th	Baseline	28.1	15.1	10.8	10.8	354.4	613.8	395.5	324.2	239.9	88.4	38.8	36.6
50th	Operation	24.8	13.3	9.5	9.5	392.1	615.9	413.1	331.9	244.5	92.8	34.2	32.3
95th	% Diff.	-12%	-12%	-12%	-12%	11%	0%	4%	2%	2%	5%	-12%	-12%
	Baseline	46.2	24.9	17.8	17.8	582.4	1008.6	649.9	532.7	394.2	145.6	63.9	60.4
	Operation	40.7	21.9	15.7	15.7	614.7	996.8	677.2	549.9	405.2	153.2	56.3	53.2
	% Diff.	-12%	-12%	-12%	-12%	6%	-1%	4%	3%	3%	5%	-12%	-12%
	Baseline	65.9	35.5	25.4	25.4	831.5	1439.9	927.8	760.5	562.8	207.5	91.1	86.0
	Operation	58.1	31.3	22.3	22.3	854.9	1408.9	962.9	790.0	584.6	221.6	80.3	75.8
	% Diff.	-12%	-12%	-12%	-12%	3%	-2%	4%	4%	4%	7%	-12%	-12%
Immediately Downstream of Reservoir (5.0 km^2)													
5th	Baseline	6.6	3.6	2.5	2.5	83.6	144.8	93.3	76.5	56.6	20.8	9.2	8.6
50th	Operation	3.3	1.8	1.3	1.3	120.8	146.8	110.9	84.2	61.1	25.1	4.6	4.3
	% Diff.	-50%	-50%	-50%	-50%	45%	1%	19%	10%	8%	21%	-50%	-50%
	Baseline	10.9	5.9	4.2	4.2	137.4	237.9	153.3	125.6	93.0	34.3	15.1	14.2
	Operation	5.4	2.9	2.1	2.1	169.6	226.1	180.6	142.8	104.0	42.0	7.5	7.1
	% Diff.	-50%	-50%	-50%	-50%	23%	-5%	18%	14%	12%	22%	-50%	-50%
95th	Baseline	15.5	8.4	6.0	6.0	196.1	339.6	218.8	179.4	132.7	48.9	21.5	20.3
	Operation	7.7	4.2	3.0	3.0	219.9	308.7	253.9	208.9	154.6	63.1	10.7	10.1
	% Diff.	-50%	-50%	-50%	-50%	12%	-9%	16%	16%	16%	29%	-50%	-50%

Notes: % - percentile, where 50th percentile is the median
L/sec – litres per second

Table 23 Summary of Monte Carlo Water Balance Results (L/sec) (Table R 8-7)

	%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tributary C	5th	3.33	1.79	1.28	1.28	41.97	72.67	46.83	38.38	28.40	10.46	4.59	4.34
	50th	5.47	2.94	2.10	2.10	68.95	119.41	76.94	63.07	46.67	17.23	7.57	7.15
	95th	7.80	4.20	3.00	3.00	98.44	170.48	109.85	90.04	66.63	24.57	10.78	10.19
	5th	0.00	0.00	0.00	0.00	0.00	8.89	5.21	3.68	0.00	0.00	0.00	0.00
	50th	0.00	0.00	0.00	0.00	0.34	11.66	7.01	5.19	0.23	0.00	0.00	0.00
	95th	0.00	0.00	0.00	0.00	7.20	14.43	8.80	6.67	2.50	0.00	0.00	0.00
	5th	0.00	0.00	0.00	0.00	0.01	1.22	1.17	0.66	0.00	0.00	0.00	0.00
	50th	0.00	0.00	0.00	0.00	0.33	1.54	1.55	0.84	0.17	0.00	0.00	0.00
	95th	0.00	0.00	0.00	0.00	1.01	1.90	2.01	1.09	0.49	0.00	0.00	0.00
	5th	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	50th	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09
	95th	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	0.95	0.95	0.95
	5th	0.00	0.00	0.00	0.00	78.33	74.83	64.52	46.22	32.94	14.77	0.00	0.00
	50th	0.00	0.00	0.00	0.00	101.24	107.78	104.41	80.36	57.70	24.99	0.00	0.00
	95th	0.00	0.00	0.00	0.00	123.15	139.79	145.17	119.84	88.68	38.94	0.00	0.00

Note: Monte Carlo results based on a 1,000 simulations

Effects Characterization - Capacity of Reservoir

The operating capacity of the reservoir is 540 000 m^3. The maximum volume of water the reservoir can hold before spilling water through the emergency spillway is 612 000 m^3. NTC provide a reservoir dam stage-storage-area curve table (reproduced in Table 24) to describe the relationship between the height, surface area and volume of water in the reservoir and at what elevation outlet features will be installed.

Table 24 Reservoir Dam Stage-Storage-Area Curve (Table R 8-1)

Stage (m ASL)	Volume (m^3)	Surface Area (m^2)	Comment
1,500.5	11,200	7,000	
1,501.0	15,000	7,600	
1,501.5	20,000	10,000	
1,502.0	26,000	12,000	
1,502.5	33,000	14,000	
1,503.0	41,000	16,000	
1,503.5	50,200	18,400	
1,504.0	60,500	20,600	
1,504.5	72,000	23,000	
1,505.0	84,700	25,400	
1,505.5	98,900	28,400	
1,506.0	114,000	30,200	Outlet Control Invert
1,506.5	131,000	34,000	

1,507.0	150,000	38,000	
1,507.5	171,200	42,400	
1,508.0	194,800	47,200	
1,508.5	221,000	52,400	
1,509.0	248,700	55,400	
1,509.5	278,300	59,200	
1,510.0	309,100	61,600	
1,510.5	341,400	64,600	
1,511.0	374,800	66,800	
1,511.5	410,000	70,400	
1,512.0	446,100	72,200	
1,512.5	483,900	75,600	
1,513.0	540,000	81,379	Maximum Operating Level
1,513.5	580,000	84,761	
1,514.0	612,000	88,143	Emergency Spillway Invert
1,516.5	793,333*	98,423	Crest of Dam

Notes: * linear extrapolation to top of dam m asl – m above mean sea level
m3 – cubic metres
m2 – metre square

NTC estimated that taking into account 95th percentile water inflow, the maximum water level would be at about 1512.30 m ASL or about 470 000 m^3. The reservoir will retain approximately 70 000 m^3 volume additional capacity during the highest water level during a wet year using the water balance estimates. In the event that regular discharge to Tributary C cannot occur (e.g. pump break-down) when the reservoir was at its maximum estimated level, the reservoir will have approximately six to eight days before reaching the operational maximum capacity and another six to eight days till reaching the emergency spillway reservoir at elevation 1514 m ASL. The Executive Committee is satisfied that a six to eight day reserve volume between the expected operating volume and the maximum operating volume, and six to eight day reserve volume between the maximum operation volume and the emergency spillway, as described, are adequate measures, within the framework of an adaptive management plan for site waters. The adaptive management plan should define an operating level less than the maximum operating level that will trigger actions to avoid exceedance of the maximum operational level.

NTC has proposed an emergency spillway for the reservoir dam designed using the 1,000 year return period based on the Inflow Design Flood (IDF) for a high consequence dam. The selection of the IDF based on the 1,000 year return period is consistent with guidelines published by the Canadian Dam Association for a high consequence dams. The approach used to design the spillway appears to be adequate, although the spillway capacity will need to be reviewed during licensing when additional details of the Project are available. Notwithstanding any hydrologic or hydraulic computations, a 1 m wide spillway is susceptible to debris and ice blockage.

The water balance produced tries to account for uncertainties of water inputs and variability in the water system to predict the effects of the operational mine. One of the concerns with the water balance is the lack of precipitation data (rain and snowfall) at the mine site. This concern has been addressed in section 6.2.1 Precipitation. Groundwater also continues to have uncertainties with respect to pathways and rate of flow. The water balance potentially compounds these uncertainties which reduce the

confidence in the water balance predictions. The Executive Committee acknowledges that the approach to the water balance tried to address the uncertainties and variability of input sources to develop estimates with probabilities and sensitivity analysis that highlight the input parameters that may influence the outcome of the water balance predictions.

The water balance will have to be updated as more site-specific data and information is gathered regarding precipitation, groundwater movement and inflow and hydrology of Tributary C.

The Executive Committee has determined that precipitation, groundwater estimates and hydrology of Tributary C must be further validated to ensure the water balance model is appropriately estimating water inputs into the reservoir system. The Executive Committee has determined that the Project will result in significant adverse effects.

Effects Characterization - Water Discharge into Tributary C

Tributary C will be affected by the discharge of water from the proposed reservoir dam. Changes to water quantity and flow rates may alter conditions for aquatic and terrestrial life especially in riparian areas downstream of the mine site. Changes in quantity and flow may also change the physical characteristics of the water (e.g. temperature).

Tributary C will be affected by discharge water quality. Effluent constituents of potential concern include arsenic, cadmium, chromium, copper, lead, selenium and zinc. Effluent water quality will be further addressed in section 6.3 Water Quality.

NTC expects that the maximum reservoir level will be below the maximum operating level of 1513 m ASL (95 percent of the time) and that operational discharges will be controlled solely by the outlet control. NTC estimates that immediately downstream of the reservoir, winter flows will be decreased by approximately 50 percent compared to baseline flows as the mine is not proposing to release water from the reservoir during the winter. It is estimated that winter flows will have approximately 23 percent reduced flow at the fishery monitoring station and approximately 10 percent at the Tributary C monitoring station. This conclusion will be discussed further in section 7.0 Aquatic Resources.

It is estimated that summer flow will generally increase due to discharge from the reservoir in combination with discharge from the diverted and natural catchment. At the fishery monitoring station and Tributary C monitoring station, the relative contribution of the reservoir discharge is less.

NTC proposes to manage discharge to Tributary C considering physical constraints such as those relating to erosion, peak flows, winter low flows, and freshet. NTC's proposed discharge management will consider the following:

- Discharges from the reservoir dam will be regulated in order to prevent unwanted downstream channel erosion due to excessive flow volumes. The regulation of flows using gates or pumps will allow for the mimicking of natural flow conditions based on flows within the diversion channel. Flows will be monitored to assist in regulation of the reservoir dam discharges;
- Pump discharge scenarios involve a regulated discharge that is based on the total pumping capacity. The maximum pumping capacity considered for the reservoir dam would be on the order of

(0.51 m^3/s) which is less than the estimated 10-year peak runoff (Q10) of 1.34 m^3/s for the reservoir dam catchment;

- A gated discharge system for the reservoir would be used in the same manner as a pumped discharge system;
- A water release regime plan for the reservoir will be subjected to regulatory review by both the Yukon Water Board and DFO;
- Winter low flow levels in Tributary C will be maintained as necessary according to the terms of the Water Licence or other regulation; and
- Early summer discharges can be regulated if deemed necessary to approximate natural freshet flows

The water balance should be further validated to ensure the water balance estimates reasonably predict future conditions of the system. The Executive Committee has determined that the Project will result in significant adverse effects to water resources without additional confidence in the water balance model.

Terms and Conditions – Water Balance

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

To reduce the uncertainties of the water balance model:

5) The Proponent shall update the water balance model assumptions, incorporating the most recent environmental data and rerun scenarios. Should the updated predictions indicate that changes to the design of water management structures or to the water management plan are warranted, the Proponent shall ensure these are incorporated in the final designs for the Project. The Proponent shall provide an updated water balance model to the appropriate regulators.

6) During operations, the Proponent shall monitor inputs to the reservoir and report total monthly inputs from the different mine components. This information should be used to validate the water balance model and to identify follow-up programs that should be conducted to improve the accuracy of the model should discrepancies be found between the measured data and the model assumptions and/or predictions.

To minimize the risk of discharging untreated water with constituents of potential concern to Tributary C:

7) The Proponent shall develop additional management options in the event the reservoir volume exceeds the operational capacity of 540 000 m^3. Management options to meet discharge criteria must consider the potential that water treatment at a described rate is required to meet discharge targets. Management options must be provided to the appropriate regulators for consideration and, if necessary, approval prior to operation.

6.2.5 Terrain and Infrastructure Stability

The mine site is located in an area of moderate seismic hazard, rated 3 on a scale of 5 (NRC 2005). The seismic hazard for the area has been incorporated into the design of major infrastructure components such as the reservoir dam and the DSTF.

The mine site falls within the discontinuous permafrost zone. However due to the elevation of the mine site, the site is expected to be generally within a permafrost zone (YOR 2008-0304-031-2). NTC has indicated permafrost and incompetent bedrock will be cleared for the mill and reservoir dam foundation.

In assessing effects related to changes in terrain or infrastructure stability, the Executive Committee considered stability of the reservoir dam and DSTF.

Storage Capacity of Reservoir Dam

NTC has classified the reservoir dam as a significant consequence classification in accordance with the Canadian Dam Safety Guidelines (CDA). The CDA recommends that the inflow design flood (IDF) for a significant consequence classified dam be between 1:100 and 1:1000 year flood event. NTC has proposed the reservoir dam and diversion channels around the DSTF be designed for an IDF 1:100 year flood event (YOR 2008-0304-017-2). NTC used the lower threshold concluding that the watershed is small and the 1:100 year flood event was determined using a regression analysis from a much larger watershed of the South Macmillan River. Environment Canada, Government of Yukon and Yukon Conservation Society all raised concerns with this approach. Environment Canada states:

> *smaller basins can yield higher unit peak floods, especially if those basins are located in steep high gradient areas, this may be an incorrect interpretation on the part of the proponent. Although the basin area is smaller, the dam IDF should take into account greater discharge units. Ignoring this could potentially result in environmental impacts to the downstream environment through uncontrolled release of contaminants.*
>
> (YOR 2008-0304-140-1)

The Executive Committee agreed with the concerns about the design criteria for the reservoir dam. General trends show that the north will experience increased average temperatures and more extreme weather events as a likely result of climate change (Government of Yukon 2011).

The Executive Committee recommended in the Draft Screening Report that NTC design the reservoir dam to an IDF 1:250 year flood event. For the reservoir dam to be effective at storing water during an extreme flood event, the Executive Committee also recommended that the water diversions around the mine site infrastructure must be constructed at an IDF level at least equal to that of the reservoir dam. Finally the Executive Committee recommended that the diversion channel around the DSTF be constructed to a standard to prevent flood events from contacting and/or disturbing the DSTF.

Natural Resources Canada provided the following comments based on the recommendations contained within the Draft Screening Report:

> *Diversion structures and the ravine dam are important components of water management for the mine site. To prevent erosion (including erosion of the DSTF) and minimize effects on water quality these structures must be designed to accommodate extreme events. NRCan agrees with*

> *ExComm that utilization of the 1:250 year event be utilized for design to account for uncertainty in flood prediction. The terms and conditions recommended by ExComm including #6, 7, and 8 adequately address this uncertainty and the recommended approach will provide increased protection against erosion, channel washout and impacts on water quality.*
>
> (YOR 2008-0304-279-1)

However, Government of Yukon made the following comment based on the recommendations:

> *The proponent has then chosen a IDF (inflow design flood) of 100 years which is the lowest of th e recommended IDF of between 100 - 1000 years. YESAB has recommended a IDF of 250 year s. There is very little information contained in this report to make these assignments. During the Water License process more detail will be required.*
>
> (YOR 2008-0304-278-1)

The Executive Committee agrees that the appropriate IDF should be defined based on a more detailed design of project infrastructure and understanding of variability of water inflows. Engineering design and increased understanding of water flows will be required during the regulatory review of the Project. As a result, the Executive Committee has determined the Project will result in a significant adverse effect on water resources.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

To minimize the risk of reservoir overtopping and discharge channel washout during severe weather events:

8) The Proponent shall design the reservoir dam to a minimum IDF 1:250 year flood event. The design standard will account for variability and uncertainties as a result of flood event predictions, higher unit peak floods in smaller basins in steep high gradient areas, and climate change.

9) The Proponent shall design the discharge channels around the DSTF and on the north slope of the valley to an IDF equivalent as the reservoir dam. This will prevent a washout scenario for the DSTF and will ensure non-contact water from the north slope of the valley is successfully diverted around the reservoir during severe weather events.

10) The Proponent shall ensure that discharge channels are lined in a manner that is stable.

6.2.6 Hess River South Tributary Intake

Evaluation of Baseline Information – Hess River South Tributary

Hess River South Tributary hydrology information is based on a regional analysis as provided by NTC in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). A summary of manual and continuous water flow measurements from the Hess River South Tributary were provided from 2006 to 2012. The Executive Committee notes continuous flow

measurements have not been recorded for any one-year period. The monthly averages from the Hess River South Tributary are reproduced in section 4.6.1 Surface Water Flow and in Table 25 below.

Table 25 Measured Flow (m^3/s) of Hess River South Tributary

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008			0.14*	–	–	15.48	14.22	12.84	7.89	–		
2009		0.27*	–	0.26*	10.23*	11.31	8.86	11.28	11.09	–	0.54*	1.43*
2010			–	–	–	16.63	12.35	9.95	3.75	1.74*		1.43*
2011	0.54*		–	0.24*	13.65	14.76	11.39	9.80	5.51	3.02		
2012	0.45*		–	–	11.95	20.92	14.87	11.12	7.81	5.98	0.46*	
Average	0.50	0.27	0.14	0.25	11.94	15.82	12.34	11.00	7.21	3.58	0.50	1.43

Based on manual flow measurements and flows computed from other regional hydrometric stations NTC developed a summary of mean monthly runoff for the Hess River South Tributary Table 26.

Table 26 Hydrograph of Hess River South Tributary

Month	Mean Monthly Flows (m_3/sec)	Mean Monthly Flows (l/sec)	Mean Monthly Runoff (mm)	Monthly Distribution (%)
Jan	0.50	500	4	1
Feb	0.27	270	2	0
Mar	0.14	140	1	0
Apr	0.25	250	2	0
May	11.94	11940	94	19
Jun	15.82	15820	121	24
Jul	12.34	12340	97	19
Aug	11.00	11000	87	17
Sep	7.21	7210	55	11
Oct	3.58	3580	28	6
Nov	0.50	500	4	1
Dec	1.43	1430	11	2
Mean Annual	5.41	5410	506	100

Effects Characterization – Hess River South Tributary

Surface water flow and quantity of Hess River South Tributary will be affected by the withdrawal of water for reservoir filling, camp use, and milling use. The Project will extract approximately 9.2 L/s from the Hess River South Tributary during construction and operation of the mine. During construction the intake from the Hess River South Tributary will be used to fill the reservoir while maintaining relatively natural flows of Tributary C. During operations, approximately 0.5 L/s will be used for the camp and 8.7 L/s will be used for mill processing.

Changes to water quantity and flow rates may alter conditions for aquatic and terrestrial life, especially in riparian areas downstream of the intake site. NTC developed stage-discharge curves to calculate flow rates for the Hess River South Tributary hydrometric station (YOR 2008-0304-299-1). The total upstream catchment area of the Hess River South Tributary hydrometric station was determined to be 340 km^2. During the open water season, mean monthly flows range from a minimum of 3.6 m^3/sec in October (3 data points) to a maximum of 15.8 m^3/sec in June (5 data points). During the winter, base-flow is generally the only contribution to stream-flow. The data presented by NTC for flows during winter months are based on manual measurements. Flow measurements to date indicate that stream flows during the winter vary between a minimum of 0.14 m^3/sec in March (one measurement in 2008) to a maximum of 1.4 m^3/sec in December (average of 2 measurements in 2009 and 2010). Approximately 250 m below the intake site is the confluence of Tributary A. Changes in quantity and flow may also change the physical characteristics of the water (e.g. temperature, dissolved oxygen).

The Proponent committed to limit water withdrawals to not exceed 10 percent of the overall channel flow during the period of the withdrawal (Appendix C).

The stream flow data for the Hess River South Tributary indicates that the proposed water use rate of 0.0092 m^3/sec does not exceed ten percent of overall water flow. However, there are very few measurements of flows during the winter (one or two measurements for each winter month over the 2008 to 2012 time period). The Executive Committee considers that the single data point available for each February and March is insufficient to characterize the flows. Further flow monitoring of Hess River South Tributary C is required during the winter months to better understand the variability of the system and the potential that water extraction will not exceed ten percent.

The Executive Committee remains concerned that very few flow measurements during low flow periods (winter) and high flow (freshet) are available to accurately understand the variability of baseline flows. Currently the mine and camp require approximately 9.2 L/s from the creek and NTC has committed that no more than ten percent of water will be withdrawn from the Hess River South Tributary. The Executive Committee recognizes that for most of the year it appears this commitment will be attainable. Without better understanding the variability of baseline flows particularly during the low flow winter months, the ten percent commitment and the requirement to extract 9.2 L/s for camp and mill use may not be both attainable.

The Executive Committee has determined that further flow measurements of Hess River South Tributary area required to ensure no more than ten percent of water flows will be extracted for camp and mill water use. The Executive Committee has determined that extracting more than 10 percent of the Hess River South Tributary will result in a significant adverse effect. NTC will be required to develop a contingency plan to ensure that should water levels be low, an alternative measure is available.

Terms and Conditions – Hess River South Tributary

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quantity.

To minimize the risk of withdrawing more than 10 percent surficial flow of Hess River South Tributary:

11) The Proponent shall update the Hess River South Tributary hydrograph based on additional data collected from Hess River during the low-flow winter period and high flow periods. The monitoring

results will include at least two years of continuous flow measurements. The monitoring results will be provided to the appropriate regulators.

12) The Proponent shall not withdraw more than 10 percent surficial flow of Hess River South Tributary.

13) The Proponent shall develop an adaptive management plan to accommodate periods when 10 percent of the Hess River South Tributary flows is insufficient for the mine and camp water requirements.

6.3 WATER QUALITY

Geochemical characterization undertaken for the Project indicates that mined material (i.e. ore/tailings and waste rock) has the potential to result in acidic drainage conditions containing elevated concentrations of constituents of potential concern (COPCs). This section provides an overview of the geochemical characterization for the Project. Original data and interpretation were provided in several submissions by North American Tungsten Corporation Ltd. (NTC) including:

- The project proposal (YOR 2008-0304-023-2),
- NTC Response to Adequacy Review Report – Addendum 1 (YOR 2008-0304-082-2)
- July 2009 Supplementary Geochemical Submission (YOR 2008-0304-095-2),
- July 2011 NTC Response to YESAB Information Request Dated August 4, 2010 (YOR 2008-0304-176-1), and
- Appendix B: Mactung Geochemical Characterization and predictive Water Quality Modeling Report, October 2011 (YOR 2008-0304-177-2).

NTC updated the geochemical characterization and predictive water quality report in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-198-1 to 304-1) that was submitted October 18, 2013 to the Executive Committee.

A commonly used approach to assess geochemical characteristics includes determination of the mineralogy in conjunction with acid base accounting (ABA) and metals results. The mineralogy is used to understand the forms of sulphides and carbonates that are the key minerals associated with acid generation, neutralization and metal leaching. ABA estimates the potential for acidic drainage to result from mineral weathering when materials, containing sulphide minerals, are exposed to air and water in the environment (Price 2009). Table 27 summarizes the various geochemical characterization and analytical methods that were used to predict acid rock drainage and metal leaching potential related to the prediction of water quality.

Table 27 Summary of Geochemical Characterization Samples Provided for Mactung Mine

Unit	Estimated Tonnage[a] (tonnes)	Estimated Minimum Sampling Requirement[c]	Mineralogy			Static Testing		Shake Flask	Kinetic Testing
			Petro-graphy	XRD (Rietveld)	Metals by ICP-MS	ABA[d]	Carbon - Sulphur	Leachate Analysis[e]	Humidity Cell Leachate[f]
Ore	6,692,312	62	5	0	118[g]	39	62	11	0
Tailings	4,260,608[b]		0	1	2	1	0	0	2
Unit 1 Waste Rock	178,526	13	6	0	23	27	27	18	2[h]
Unit 3C Waste Rock	1,925,310	34	4	0	24	35	48	26	4[h]
Other Waste Rock (Unit 3E, 3F, 3H, 4)	-		5	0	9	9	9	9	0
Existing Waste Rock	-		0	0	6	6	6	0	0

Notes

a - Tonnages reported on Table 6 of July 2009 Supplementary Geochemistry Information submission.

b - Tonnage of tailings reported from project proposal

c - Estimated minimum sampling requirement reported by Proponent on Table 6 of July 2009 Supplementary Geochemistry Information submission.

d - ABA includes sulphur species, NP, MPA, NPR, NPP, Carbon species, fizz test. ABA for tailings sample reported on Laboratory Certificate in Appendix D of July 2009 Supplementary Geochemical Information submission.

e - Shake Flask leachate analysis includes pH, conductivity, sulphate, hardness and leachable metals. Several tests were conducted under acidic conditions, and remainder under neutral conditions.

f - Kinetic Testing leachate analysis includes pH, redox, conductivity, acidity, alkalinity, sulphate, hardness and leachable metals.

g - Total number of samples includes 100 ore-grade samples analyzed for metals by ICP-MS and used to form the tailings composite samples.

h – waste rock humidity cell tests were started on May 3, 2013. Results were not used in the water quality predictions.

6.3.1 Geochemistry and Mineralogy of the Deposit and Waste Rock

Mineralogy

Knowledge of mineralogy is critical to the understanding of potential risk for acid generation and metal leaching. As stated in Price, 2009 “mineralogical properties determine the physical and geochemical stability and relative weathering rates of geologic materials under different weathering conditions”. Two test methods were used to provide an understanding of the mineralogy of the deposit and non-economic waste rock: petrographic analysis and Rietveld x-ray diffraction (XRD).

Petrographic Analysis

Thin section microscopy by Vancouver Petrographics Ltd. provided the identification and qualitative estimates of minerals within 15 selected ore and waste rock samples. Petrographic analysis on thin section focuses on a small sample area and therefore is representative of a relatively small volume of rock. Petrographic analysis was completed on six samples from Unit 1, four samples from Unit 3C and five samples representing other waste rock units. Common non-sulfide minerals identified in the selected samples are plagioclase, quartz, biotite, sericite, ilmenite, calcite, chlorite, diopside, apatite, ankerite, tremolite, epidote, muscovite, phlogopite, limonite and garnet. Common sulphide bearing minerals identified in the selected samples are pyrrhotite, pyrite, chalcopyrite and sphalerite. Petrographic analysis is described in the project proposal and the results are presented in Appendix D1 of the project proposal (YOR 2008-0304-034-2).

An estimate of mineral distribution for the ore zone presented in the project proposal indicates sulphide mineralization comprises approximately 11 percent and calcite comprises approximately five percent of the ore body. This mineral distribution estimate indicates that Fe-Mn carbonates (ankerite and siderite) do not occur in significant concentrations.

X-Ray Diffraction – Rietveld Analysis

Rietveld x-ray diffraction provides a quantitative estimation of mineral abundance. Reitveld XRD was conducted on the feed material and processed tailings material of the 2008 composite sample. This quantitative analysis indicated that quartz, hedenbergite, plagioclase, and pyrrhotite compose the majority of the samples. In decreasing abundance biotite, calcite, actinolite, clinochlore, pyrite, K-feldspar, dolomite and siderite make-up the remainder of the sample. The source material for the tailings also contains scheelite, the tungsten bearing mineral. Additional information is reported in July 2009 Supplementary Geochemistry Information submission (YOR 2008-0304-095-2).

Carbonate neutralization potential is primarily provided by calcite and dolomite, which compose approximately five percent of the total mineralization. Sulphide mineralization (pyrrhotite and pyrite) accounts for 15.5 percent and 17.9 percent of the feed and tailings samples respectively.

Total (near-total) Elemental Analysis

Metals analysis by Inductively Coupled Plasma Mass Spectometry (ICP-MS) provides total elemental concentrations of constituents in samples. Total elemental analysis provides a very conservative estimate of available metals while the aqua regia digest provides an estimate of total leachable metals under acidic conditions. Metals analysis by aqua-regia and four acid digestion methods was conducted

on ore, tailings, and waste rock samples. Three separate sampling programs occurred. Exploration sampling programs completed in 2005 and 2008, included the submission of ore-grade materials for aqua regia analysis of total metals contents. The 2008 geochemical characterization program also included ore-grade and waste rock samples that underwent four-acid "near total" digestion analyses. Finally, the waste rock characterization program completed in 2011 included the submission of samples for aqua regia digestion and analysis of total metals contents by ICP-MS. As indicated in the project proposal *"*The 'near-total' dissolution method uses a series of acids to dissolve the various metals and the results of this technique represent the maximum theoretical metals loading that can result from a material as it weathers*".* (YOR 2008-0304-019-2) This contrasts with the aqua regia method which utilizes a less aggressive digestion method.

In either case, the metals contents as measured in the rock solids provide an indication of the total inventories of metals that have the potential for leaching. The potential for leaching of constituents from these materials is typically verified by other test methods.

Shake Flask

The intended purpose of shake flask tests is to determine the mass of soluble constituents (mg/kg) at higher water to solids ratios available to be leached from the solids fraction at the time of sample collection (Price 2009). Standard shake flask testing uses a water to solids ratio of 3:1, with mixing of the materials for a 24-hr period. This method provides an indication of constituents that are available to leach from the mine materials immediately, upon rinsing. This test is not intended to provide estimates of long-term leaching that may occur during future weathering with exposure to water and air.

Shake flask tests were conducted on ore and waste rock samples. Testing was conducted under neutral conditions (standard procedure) on ore grade material and under both neutral and acidic conditions (modified method - MEND) for Unit 1 and Unit 3C (Table 28).

The Executive Committee notes that the sample set used for shake flask tests was different than the elemental/mineralogical samples. As a result, the elemental/mineralogical information cannot be directly used to help interpret shake flask results.

Three shake flask testing programs have occurred. The 2008 shake flask analysis program consisted of 11 samples of ore grade material and eight samples of waste material, including some from the area of the proposed mill site and reservoir dam. Tests were conducted with distilled water using the method outlined in Price (1997). These results were originally reported in the project proposal on Table 4.1.4-8.

The 2009 shake flask analysis program consisted of four samples from Unit 1 and 10 samples from Unit 3C waste rock. Tests were conducted with weak acid extraction techniques also outlined in Price (1997). Leachate solutions used in the testing procedure had pH values of between 1 and 2. These results were originally reported on Table 11 in the July 2009 Supplementary Geochemistry Information submission.

The 2011 shake flask analysis program consisted of 14 Unit 1 samples and 17 Unit 3C samples. These were conducted under neutral conditions and the results were reported in the October 2011 Information Response on Table 6.

Leachate from the shake flask testing conducted on ore-grade material under neutral conditions were frequently elevated in aluminum, arsenic, copper, iron and selenium. Leachate from shake flask testing

conducted on Units 1 and 3C waste rock material under neutral conditions indicated several constituents of potential concern.

Leachate from shake flask testing conducted on Unit 1 and Unit 3C samples with an acidic extractant indicated several constituents of potential concern, including aluminum, arsenic, chromium, copper, iron, lead, selenium, silver, and zinc. Results were similar for both Unit 1 and Unit 3C samples.

Summary of Selected Parameter from Shake Flask Extraction Tests Conducted Under Both Neutral and Acidic Conditions												
		Samples	Aluminum Al	Arsenic As	Chromium Cr	Copper Cu	Iron Fe	Lead Pb	Molybdenum Mo	Nickel Ni	Selenium Se	Zinc Zn
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Neutral Shake Flask Tests												
Unit 1	Average	14	0.42	0.0044	0.00028	0.006	0.028	0.0011	0.0071	0.0007	0.001	0.018
	SD		0.28	0.006	0.00012	0.013	0.042	0.0035	0.010	0.0003	0.001	0.049
	Max		0.89	0.019	0.0007	0.03	0.16	0.01	0.034	0.0015	0.0014	0.16
	Min		0.06	0.0003	0.00025	0.0006	0.004	0.00002	0.00016	0.0004	0.00006	0.001
Unit 3C	Average	17	0.38	0.025	0.0003	0.001	0.018	0.0001	0.005	0.001	0.006	0.003
	SD		0.23	0.07	0.00023	0.0004	0.012	0.00003	0.007	0.0005	0.011	0.002
	Max		1.04	0.278	0.0012	0.0017	0.035	0.00015	0.0264	0.002	0.0391	0.008
	Min		0.1	0.0003	0.00025	0.0006	0.003	0.00002	0.00027	0.0002	0.00007	0.001
Ore Grade	Average	11	0.24	0.01	<0.0005	<0.005	46.5	0.0002	0.015	0.0014	0.0030	0.0019
	SD		0.22	0.00	-	-	65.7	-	0.020	0.0010	0.0025	0.0015
	Max		0.72	0.01		<0.03	93.0	0.0002	0.054	0.0025	0.0075	0.0059
	Min		0.03	0.01		<0.0006	0.05	0.0002	0.0002	0.0007	0.0012	0.0010
Acidic Shake Flask Tests												
Unit 1	Average	4	115.8	0.0078	0.071	0.25	57.0	0.023	0.001	0.05	0.002	0.069
	SD		44.9	0.013	0.031	0.16	15.5	0.009	0.0006	0.03	0.0008	0.009
	Max		168.0	0.027	0.110	0.42	68.0	0.033	0.002	0.07	0.003	0.080
	Min		66.0	0.001	0.037	0.10	34.8	0.014	0.0001	0.02	0.001	0.059
Unit 3C	Average	10	47.7	0.011	0.080	0.18	29.7	0.022	0.017	0.07	0.0038	0.25
	SD		29.3	0.013	0.084	0.16	23.1	0.010	0.044	0.08	0.0043	0.23
	Max		97.5	0.043	0.280	0.50	70.06	0.04	0.14	0.27	0.015	0.73
	Min		2.8	0.001	0.001	0.029	0.080	0.004	0.001	0.01	0.0010	0.04
CCME Guideline for Protection of Aquatic Life			0.1	0.005	0.0089	0.002-0.003	0.3	0.002-0.0004	0.073	0.065-0.11	0.001	0.03
MMER – Maximum Mean Monthly				0.5		0.3		0.02		0.5		0.5

See CCME, Al, Cu, Pb, Ni variable – add note re hardness/pH dependent standards.

Table 28 Summary of Selected Parameter from Shake Flask Extraction Tests Conducted Under Both Neutral and Acidic Conditions

Acid Base Accounting

As noted earlier, acid base accounting (ABA) analyses are typically used to estimate the potential for acid drainage, resulting from the weathering of sulphide minerals such as pyrite and pyrrhotite present in waste materials. The ratio of effective neutralization potential (NP) to acid generation potential from sulphide minerals (AP), expressed as NPR=NP/AP, provides an indication of the future balance between acid generating and neutralizing reactions. If this ratio is less than or equal to one the sample is classified as potentially acid generating (PAG). If the ratio is greater than two, the sample is classified as non-potentially acid generating (NAG) when the NP is effective. Effective NP can neutralize internal and external acidity inputs sufficiently to maintain a near-neutral drainage pH, and is typically associated with calcium and magnesium carbonate minerals. Carbonate NP (Carb-NP) is typically calculated from the measured carbonate content that is reported as CO_2 or CO_3. Samples with ratios between one and two are classified as uncertain as to whether acidic conditions will occur and further investigation of these materials is warranted (Price 2009).

The original data for ABA testing were provided in Table 3 and 4 of Appendix D1 of the project proposal, Table 8 of the July 2009 Supplementary Geochemical Information submission, and Table 4 in Appendix B: Mactung Geochemical Characterization and Predictive Water Quality Modeling Report, October 2011 Information Response (YOR 2008-0304-177-2).

The ABA results for tailings and composite samples provided on the laboratory certificate are included in Appendix D of July 2009 Supplementary Geochemical Information submission.

With the exception of sample B348092, B348344 and MS 170-177.7-1, all samples have higher Sobek-NP than Carbonate-NP values, indicating that the Sobek-NP values include some neutralization potential in excess of the carbonate NP. This suggests that the Carbonate-NP values represent a more conservative estimate of effective or available NP. Table 29, Figure 30 and Figure 31 represent these findings.

In either case, using Sobek-NPR or Carbonate-NPR values shows that a substantial fraction of the waste rock and all tailings are classified as PAG. Therefore, in the long-term, without appropriate mitigation measures, the rock and tailings will be expected to generate acid and have elevated levels of metals in any drainage that is released from those materials.

Table 29 Summary of ABA results

Unit	Sample Numbers	Estimated Volume of Material[1] (m^3)	ARD Classification (percent of samples/Classification)
Unit 1 – Waste Rock	27	180,045	59% PAG; 15% Uncertain
Unit 2B – Ore	38	6,692,312	79% PAG; 16% Uncertain
Tailings	1	4,260,608	100% PAG
Unit 3C – Waste Rock	39	1,925,310	56% PAG; 8% Uncertain
Other Waste Materials	12		42% PAG; 25% Uncertain

(YOR 2008-0304-177-2) Volumes include both development and stoping)

[2]PAG has been defined as having Sobek-NPR <1

[3] NAG has been defined as having NPR >2

[4] Uncertain has been defined as having NPR between 1 and 2

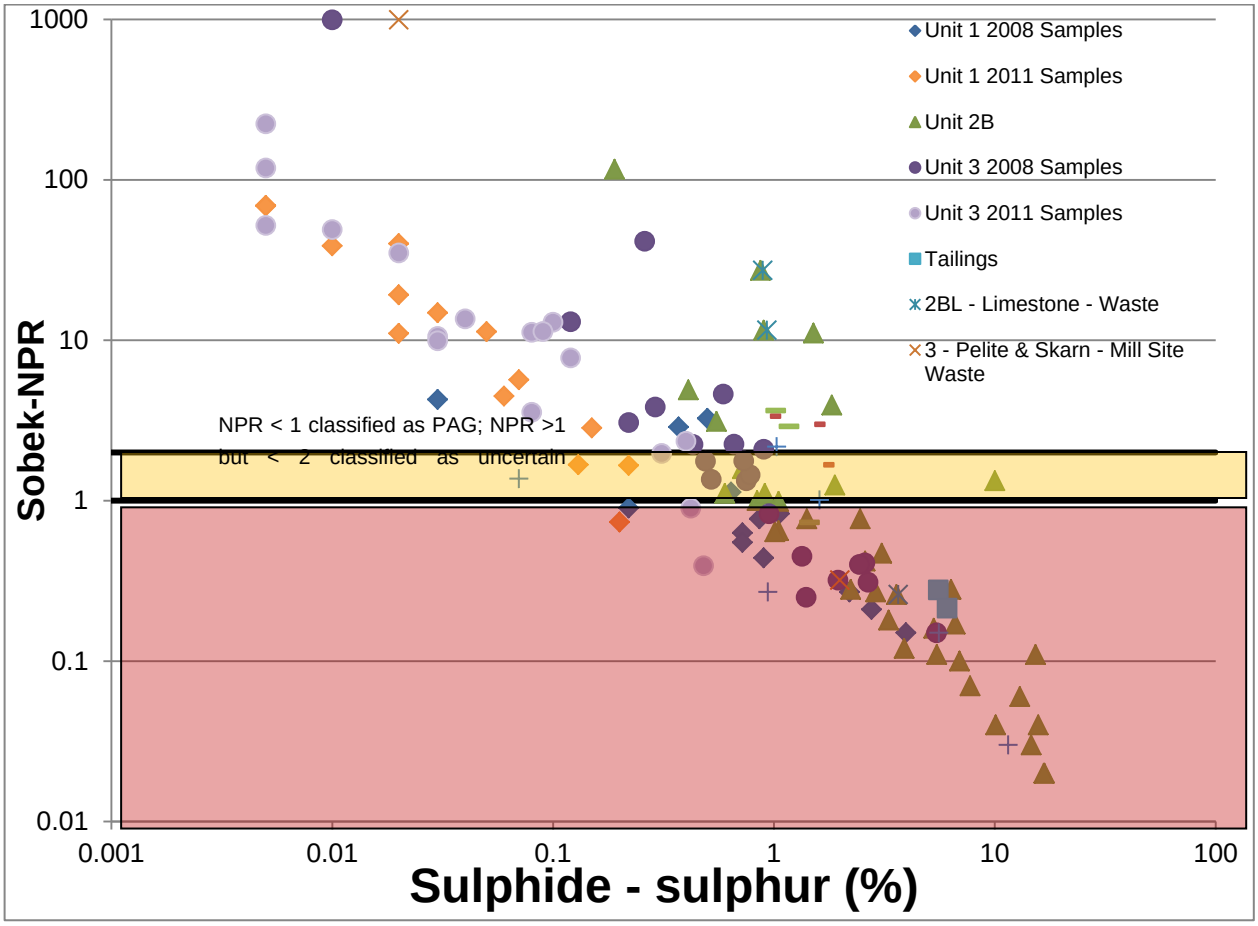

Figure 30 Comparison of sample classification between sulphide (%) and Sobek-NPR. Samples in the red area are classified as PAG. Graph derived from data provided in Table 4.1.4-3 and Table 4 of 2011 info response.

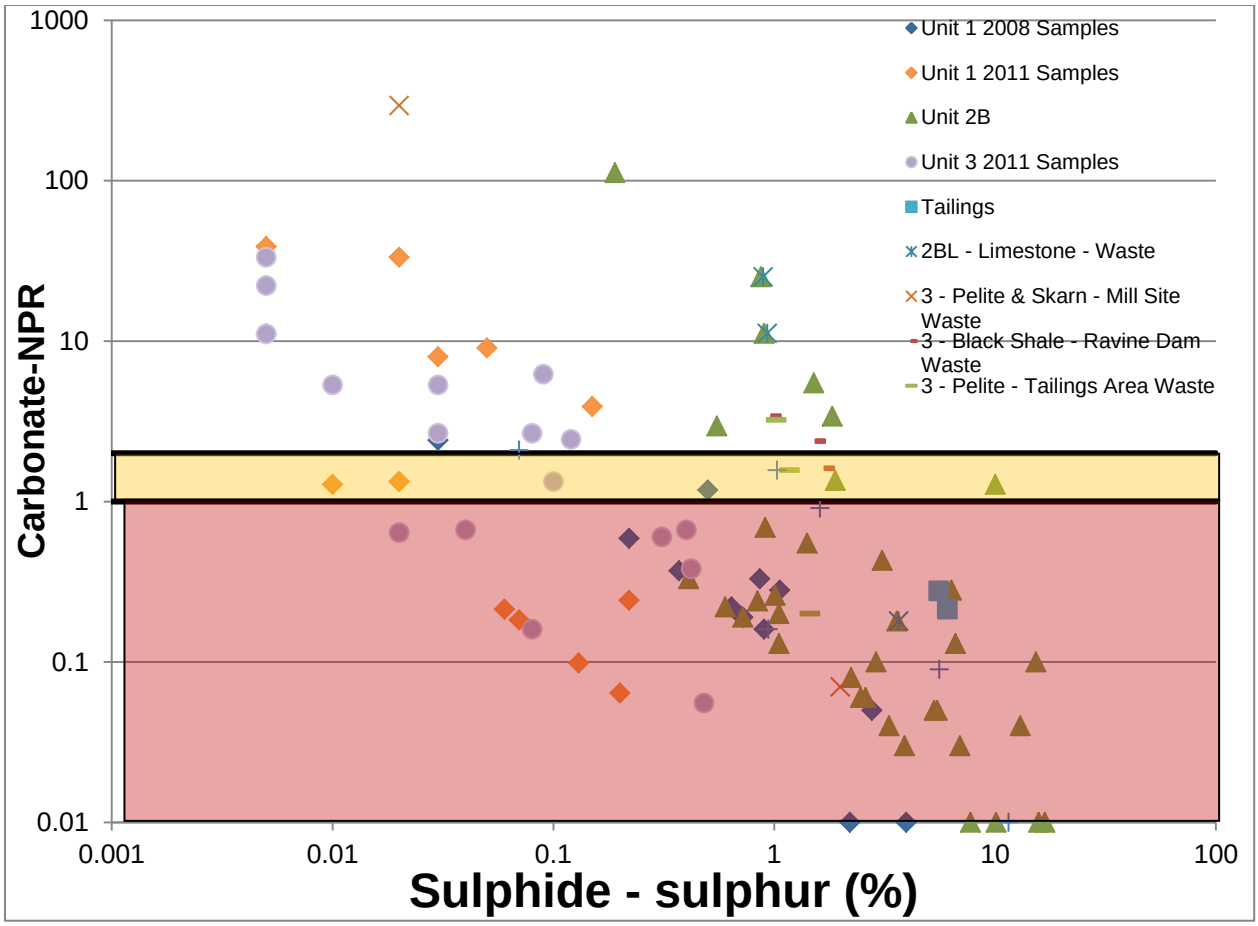

Figure 31 Comparison of sample classification between sulphide (%) and Carbonate-NPR. Samples in the red area are classified as PAG. Graph derived from data provided in Table 4.1.4-3 and Table 4 of 2011 info response

Kinetic Tests – Humidity Cells

Humidity cells are typically used as long-term (weeks to years) tests conducted for the purpose of predicting primary reaction rates under aerobic weathering conditions (Price 2009). Kinetic tests are some of the best available laboratory tests for predicting discharge quality from exposed rock. However, the laboratory test conditions do not necessarily reflect the field conditions under which mined material will be placed. Test results provide an indication of potential rates of acid generation and acid neutralization, as well as metal release or leaching rates. The frequent flushing required in the test procedure, removes weathering products that are soluble in water and therefore the leachate will not represent drainage chemistry of the field material but can provide a basis for estimating loading rates that can be used to estimate water quality in drainage and the receiving environment. Other differences in conditions in the laboratory, such as temperature and proportion of mineral surface area exposed, may differ from field conditions and add uncertainty to estimates. Typically, assumptions are made to estimate adjustment factors that are then used to scale the humidity cell test results to loading rates and concentrations in the field setting.

Two composite tailings samples (generally referred to as 2008 composite (2009-1) and 2005 composite (2009-2) in project proposal documents), were produced by a bench scale milling (metallurgical) process. The 2005 composite sample consists of 53 drill core samples from Unit 2B sourced from the western portion of the deposit. The 2008 composite sample consists of 47 samples from both ore-grade and sub-ore-grade material sourced from the eastern portion of the deposit.

The humidity cell results are provided in the October 2011 Appendix B: Mactung Geochemical Characterization and Predictive Water Quality Modeling Report. Construction/set-up details on the humidity cells are presented in NTC Response to Adequacy Review Report of Addendum 2 (YOR 2008-0304-099-2).

The results reported for the kinetic testing represent approximately 100 weeks of testing. These results indicate that the pH of the leachate from the 2008 composite (2009-1) decreased from 6.8 to 5.97 between weeks 89 and 90. By week 105 the measured pH was 3.6. Metals release rates and percent remaining are reported in Supplement D, provided with the October 2011 Appendix B. Increases in release rates of aluminum, beryllium, cadmium, cobalt, copper, iron, lead nickel and zinc from the 2008 composite occur around week 85 to 90 which coincides with the drop in pH.

The results from the leachate analyzed for the 2005 composite (2009-2) have been relatively stable since week 15. The pH was reported as 7.82 on week 105 and the metal release rates to the leachate have remained relatively steady for all constituents since week 15.

NTC stated that six new humidity cell tests on waste rock were initiated on May 3, 2013 including two humidity cell tests from Unit 1 and four humidity cell tests from Unit 3C. NTC stated that the humidity cell results had not progressed far enough to use in the water quality predictions as provided in the Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1) that was submitted October 18, 2013 to the Executive Committee. However the results of these humidity cell tests will be used to update the water quality tests in the future.

Confidence of Geochemistry Characterization

The geochemical characterization undertaken for the Project indicates that mined materials, tailings and waste rock, have the potential to result in acidic drainage conditions with elevated concentrations of COPCs. Some COPCs may be problematic in neutral drainage as well. The characterization of rock units lacks some information that increases the uncertainty of rock behaviour and prediction of water quality.

Humidity cell testing used to better understand the geochemical characterization program for waste rock was started in May 3, 2013. This testing has been initiated however, according to NTC, the humidity cell tests had not progressed far enough (the humidity cell test had progressed to week 19 when NTC submitted the response in October 2013), to use these results in the water quality predictions. The omission of humidity cell testing for waste rock material results in a degree of uncertainty about the resulting water quality of drainage from the temporary storage of waste rock on the surface and possibly the drainage from rock co-disposed with tailings. NTC has used results of shake flask tests on waste rock and humidity cells tests on tailings to estimate the time to generate acidity in the temporary waste rock storage.

EcoMetrix provided the following comment regarding using the shake flask results for predicting waste rock runoff contributions to water quality:

> *We consider that shake flask test data are not the preferred data to use for long-term water quality predictions for the waste rock when humidity test cell data are available.*
>
> (YOR 2008-0304-313-1)

This view is supported by comments on the Draft Screening Report from Environment Canada and a consultant for Ross River Dena Council:

> *The proponent relies to a significant extent on short-term initial screening level testwork in order to draw conclusions and provide information for their predictions; for instance, in the water quality model. There are no humidity cell results for some of the rock units, including the proposed blended waste. No testing was conducted for borrow material and quarry rock. In not testing the present waste rock for metal release, the proponent has missed the opportunity to provide an insight on labile metals that may be readily leached from weathered materials. Humidity cell testing for major units is typical for such undertakings; unfortunately it is questionable whether a determination of significance can be made without this information.*
>
> (Environment Canada, YOR 2008-0304-281-1)
>
> *Kinetic testing of PAG waste rock in humidity cells should be required from the Proponent in order to reduce uncertainty on the time at which the waste rock will start producing acid drainage. In particular, it is important to know whether the waste rock will start producing acid drainage while it is temporarily stored on surface or while it is backfilled underground but not yet covered by water, as the groundwater table will take time to recover after the end of mining operations. This information is needed for developing realistic decommissioning and water management plans.*
>
> (Dr. L. Catalan, YOR 2008-0304-273-1)

The purpose of waste rock characterization is to inform water quality predictions. The Executive Committee is encouraged that a kinetic test program for waste rock has been initiated. However, humidity test cell results for waste rock are not available to the Executive Committee at this time.

The Executive Committee recognizes that NTC has provided additional water treatment plant description to account for the updated site water balance and water quality predictions. The water quality predictions use shake flask results as a conservative estimate of waste rock contributions to reservoir water quality. Finally, the Executive Committee recognizes that additional waste rock disposal options have been presented to manage waste rock material in the case of a temporary closure.

The Executive Committee has determined the project will result in significant adverse effects. Therefore, the Executive Committee has determined that further humidity cell tests are required to properly characterize waste rock contributions to water quality. This information, together with the predicted water quality update, shall be made available to the appropriate regulators during the licensing process. The following term and condition will ensure the Project will not result in a significant adverse effect to water quality due to insufficient geochemical characterization of waste rock.

Terms and Conditions

The following term and condition is specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quality.

To minimize the uncertainties with respect to the geochemical characterization of waste rock and tailings:

14) The Proponent shall provide the results of geochemical characterization of geologic units that make up the waste rock including a minimum 40 weeks of kinetic testing results to the appropriate regulators as part of the licensing process. The geochemical characterization shall be consistent with the MEND Report 1.20.1 "Prediction Manual Drainage Chemistry from Sulphidic Geologic Materials" (Price 2009).

6.3.2 Water Quality Prediction Model

NTC provided an update to the geochemical modeling in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). The geochemical modeling used the software PHREEQCI Version 2.17.4799, a reaction path chemical equilibrium model supplied by the U.S. Geological Survey (USGS). The geochemical model was updated to use a loadings approach for all waste rock and tailings samples and include supplementary surface and groundwater quality data that was collected and reported in the January 4, 2013 submission. The mixing proportions were based on the updated water balance as discussed in section 6.2.4 Water Balance. Inputs into the geochemical model included:

- Above ground temporary waste rock storage area;
- Tailings runoff;
- Tailings seepage;
- Undiverted runoff;
- Precipitation;
- Waste water; and
- Mill process water inputs.

The model assumed the material composition of the waste rock and the dry-stacked tailings facility (DSTF) to be constant over time. NTC summarized the model input and assumptions in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). Two humidity test cell results from composite ore samples were used to estimate tailings contributions.

Three water balance scenarios, based on the water input/output estimates were considered:

- Average precipitation;
- Wet year above average precipitation; and
- Dry year with below average precipitation.

Based on these water balance scenarios and material compositions, NTC developed predictions of water quality in the reservoir. NTC concluded that the reservoir will not have metal concentrations exceeding maximum allowable monthly mean concentrations of listed metals identified in the *Mining Metal Effluent Regulations* (MMER). Some reservoir metal concentrations will exceed Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life.

Based on the 2008 supernatant characteristics, chloride, fluoride, cadmium, chromium, copper selenium and rarely arsenic may exceed CCME guidelines levels for the protection of aquatic life during operations. During late mine life fluoride, aluminum cadmium chromium, copper, nickel, selenium, and zinc and rarely arsenic and thallium are predicted to have concentrations greater than the minimum CCME guidelines concentration.

Using the 2005 supernatant chloride characteristics, fluoride, arsenic cadmium, copper and selenium may exceed CCME guidelines levels. During late mine life fluoride, aluminum, arsenic, cadmium, copper, nickel, selenium and zinc are predicted to have concentrations greater than the minimum CCME guidelines. During the summer months in late mine life, nitrate, chromium, iron, lead, mercury, sliver, and thallium were predicted to exceed CCME guideline levels.

NTC also noted that should tailings management strategies not be successful and acid generating conditions develop, concentrations of copper, nickel and zinc are predicted to exceed MMER maximum authorized monthly mean concentrations in the summer months using both the 2008 and 2005 supernatant characteristics.

Confidence in Water Quality Predictions

The Executive Committee retained EcoMetrix Incorporated (EcoMetrix) as technical specialists to review the water quality predictions and other aspects of the proposal. Their conclusions can be found in the memo titled “Mactung Project (2008-0304) – Adequacy Review of Information Provided in response to YESAB’s January 4, 2013 Request for Supplementary Information” (YOR 2008-0304-313-1). EcoMetrix recommended that additional information be provided to evaluate the water quality modeling results. NTC provided a memo dated December 20, 2013 outlining their response (YOR 2008-0304-340-1). NTC provided additional details on how the shake flask test results were used to represent each waste rock unit as well as additional details of how the model predicted loadings.

The use of shake flask results to estimate waste rock contributions to reservoir water quality is not a preferred approach. However, the Executive Committee recognizes that NTC has committed to the construction of a water treatment plant to account for the updated site water balance and uncertainties in water quality predictions. The Executive Committee recognizes that additional waste rock disposal options have been presented to manage waste rock material in the case of a temporary or long-term closure. These measures are discussed further, below. The Executive Committee has determined that conceptually these additional measures provide confidence that the Project can manage water quality within the reservoir. The water quality predictions will be required to have increased certainty during the regulatory review and detailed design phase of the Project.

The Executive Committee has determined that the Project may result in significant adverse effects to water resources. As a result, an update to the water quality prediction model is required to properly characterize waste rock contributions to water quality. This information shall be made available to the

appropriate regulators prior to licensing. The following term and condition will ensure the Project will not result in a significant adverse effect to water quality.

Terms and Conditions

The following term and condition is specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quality.

To minimize the uncertainties associated with water quality predictions:

15) The Proponent shall update the water quality prediction model providing an interpretation based on loadings (e.g. mg-constituents of potential concern per time per mass of material or mg/kg/wk) and results of the waste rock humidity cell tests. In addition, the time to acid generation in the waste rock will be estimated from the humidity cell test results. This information shall be provided to appropriate regulators during the licensing process.

6.3.3 Storage and Disposal of Waste Rock and Tailings

The water quality prediction model relies on waste rock and tailings being managed in ways to offset potential ARD/ML conditions. This section discusses the various components of waste rock and tailings management.

Dry-Stacked Tailings Facility (DSTF)

NTC proposed to dispose of approximately 50 percent (approximately 2 130 500 m³) of dewatered and filtered mill tailings in the dry-stacked tailings facility. NTC provided an Adaptive Management Plan as part of their information response titled Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). NTC indicated in the adaptive management plan that in the event that co-disposal of waste rock and tailings above the natural water table was not successful during a long-term monitoring program, the DSTF could accommodate up to 4.5 million m^3 of material. NTC has provided a conceptual plan showing that the DSTF could accommodate all tailings and waste rock from the facility. Additional design requirements for this update include: an updated slope stability analysis for the larger DSTF and the diversion trench design to be adapted to accommodate the larger DSTF.

NTC has described that the DSTF will be constructed in lifts where exposed surfaces of the tailings facility will be continuously covered with new compacted tailings reducing oxygen availability and isolating previously oxidized material. Further, NTC indicates that the tailings facility will be covered with snow and frozen for portions of the year. The Executive Committee recognizes the DSTF as an effective facility for disposing of tailings, however there remains an active layer that will be exposed to the environment and discharge from this layer must be accounted for in the water quality predictive model.

In the water quality predictions, NTC estimated that the top 0.3 m will remain actively exposed to the environment. The Executive Committee agrees with the approach.

At closing, the DSTF will be covered with an impermeable liner to control and decrease air and water ingress into the tailings. A soil cover will be placed over the impermeable liner to reduce the risk of damage to the liner. In a technical memo dated April 16, 2012, NTC provided a summary of DSTF

construction and operation techniques that will be utilized to minimize the potential risks related to disposal of PAG tailings. These include:

> *1. Diversion ditches up gradient of the DSTF will be constructed to divert the majority of the run-on water around the facility rather than allowing the surface run-on water to enter and run across the stacked tailings. This diverted water will report to the reservoir.*
>
> *2. The DSTF will be constructed against the north slope of the valley where the Project will be located. This will allow the DSTF to maintain a relatively low profile with the planned height of compacted tailings not to exceed about 18 m (see Figure 5.4.2-23 of the Project proposal, December 2008). The total surface area of the completed DSTF will be relatively small at 25 hectares.*
>
> *3. The manner in which the DSTF is constructed is important. The tailings will be deposited (either trucked or by conveyor) to the area of tailings placement and will be spread and compacted with construction equipment in engineered lifts of typically 600 mm thickness. At the start of mining the tailings will be placed at the lower reaches of the DSTF and, with time and placement of subsequent lifts, the stack will attain the final stack profile as shown in Figure 5.4.2-23. The sequence of tailings placement will be scheduled to maximise the benefits of being able to freeze the tailings in-situ and keep it frozen within the stack. The time between one layer being deposited and the next layer being added is not expected to be more than one month, which is not long enough for ARD or ML to become a concern.*
>
> *4. The development of the DSTF is a bottom-up construction. Therefore, once the lower portions of the stack are complete there will be the opportunity to progressively reclaim (cover) the stack once it achieves its design configuration. Any surface run-off from the stack will report to the reservoir where the water quality will be monitored prior to release to the downstream receiving environment. At closure of the DSTF in year 11 a geomembrane liner and soil/rock layer will cover the entire DSTF and will minimize or prevent the establishment of conditions that could generate ARD and ML.*
>
> (YOR 2008-0304-219-1)

The Executive Committee is satisfied that the membrane-covered DSTF is an appropriate disposal method for tailings at the site. Environment Canada commented in their review of the DSR that:

> *Given several known and unknown performance dimensions for this product* [LLDPE geomembrane] *(it is only assumed the material is stable for ~100 years), long-term monitoring of liner performance well into the post-closure period is recommended* (sic).
>
> (YOR 2008-0304-281-1)

The Executive Committee agrees that long-term monitoring of DSTF liner conformance and potential DSTF discharge will be required to confirm that the construction/operation/decommissioning activities are in fact minimizing air and water ingress into and discharge from the tailings material and preventing ARD/ML.

NTC committed that:

> *Inspections of the DSTF cover system will be conducted at a frequency to be determined by Government of Yukon, Energy Mines and Resources; however, the duration of the inspection period is anticipated to extend to the initial three year post-closure period.*
>
> *Mitigation of the potential for malfunction of the DSTF cover system will be provided in the form of Financial Security provided by NATC to allow for ongoing periodic inspections in addition to repairs to the cover system in the first 10 years following closure.*
>
> (Appendix C)

The Executive Committee agrees with NTC that a long-term monitoring of the DSTF cover system is required. However, the Executive Committee is not convinced that the timelines outlined in these commitments are sufficient. The Executive Committee is of the opinion that a failure of the DSTF cover system, will result in significant adverse effects to water resources. The Executive Committee has expanded on NTC's commitments to mitigate the significant adverse effect.

Temporary Waste Rock Storage

NTC stated that they do not expect ARD conditions to affect the discharge from the temporary waste rock storage, as the material will be permanently disposed of before the onset of ARD conditions. However, a temporary closure of the mine may result in the waste rock remaining on surface and result in ARD/ML conditions. As a result, the Executive Committee requested a temporary closure plan from NTC.

NTC provided a Temporary Closure Plan for the Mactung Project as part of their information response titled Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). The closure plan indicates that should temporary closure occur, the waste rock characterized as PAG would be relocated to the DSTF to isolate PAG material at a single facility for monitoring. The waste rock would be disposed of in a geotechnical stable manner. NTC has indicated that should NAG waste rock be successfully segregated from PAG material, then NAG material may not be required to be relocated.

At permanent closure all waste rock will either be comingled with tailings and disposed of underground or disposed of within the tailings facility.

The Executive Committee is satisfied that the Proponent has described in sufficient detail how waste rock will be temporally stored and how it will be managed should the mine be temporarily or permanently closed. However, should the Proponent not be in a position to implement its Temporary Closure Plan, project security should be available for the cost of completing the Temporary Closure Plan. The Executive Committee has determined the Project will result in significant adverse effects to water resources if the Temporary Closure Plan is not undertaken. Terms and conditions to mitigate this significant adverse effect include sufficient project security to account for the costs to complete the Temporary Closure Plan.

Underground Disposal in Mined Out Stopes

Disposal of comingled tailings and waste rock in mined out stopes below the water table can be an effective way of limiting oxidation and acidification of encapsulated rock. Underground disposal of waste

rock and tailings, below the water table, have been shown to be effective methods to minimize oxidation of PAG materials and decrease or eliminate the generation of ARD/ML. Portions of the underground workings will be below the water table and will require pumping during operations to remain unflooded. After closure, underground workings below the water table will flood.

Backfilled stopes that are flooded during mine closure may experience a 'rinsing' period where oxidized waste rock and tailings dissolve COPCs. Dr. Catalan provided the following comment on behalf of the Ross River Dena Council during the review of the DSR:

> *As the water table rises during mine decommissioning, oxidation products present in the tailings and/or waste rock will start dissolving upon contact with the flooding water. As a result, the groundwater will become contaminated with acidity and elevated metal concentrations, even if the flooding is effective at preventing further oxidation.*
>
> (YOR 2008-0304-273-1)

The Executive Committee recognizes that during the initial period when stopes are allowed to flood, additional monitoring measures will be required and water treatment may be required. NTC will, if necessary, consider other mitigation measures such as to maintain neutral or alkaline pH values.

The Executive Committee is satisfied that the backfilling of comingled tailings and waste rock in stopes below the water table is an effective mitigation to minimize the risk of ARD/ML issues. Additional terms and conditions are required to monitor and if necessary mitigate an increase in dissolved COPCs when the stopes are flooded at closure to mitigate significant adverse effects to water quality.

The Proponent proposed to backfill stopes above the water table and use shotcrete bulkheads to prevent air and water access to backfilled comingled tailings and waste rock. NTC indicated that when the first stopes are backfilled and sealed, instrumentation will monitor oxygen levels, temperature and pH of leachate that may be present. If the monitoring indicates any ARD problems then additional measures would be taken. These include:

> *By limiting air and water access to PAG materials, the production of ARD/ML conditions can be limited. The Executive Committee is not aware of other mines that currently use or propose to use shotcrete bulkheads to reduce air and water access to backfilled stopes above the water table to prevent the onset of ARD/ML. In the April 12, 2012 Technical Memo NTC describes the disposal methods to minimize ARD/ML iss1. The stopes will be backfilled with non-structural filtered tailings with an approximate moisture content of 15% to 20%, and comingled waste rock. As much of the stope void will be filled as possible to reduce available air space and overall oxygen levels.*
>
> *2. The stopes, when filled, will be sealed off with shotcrete bulkheads. This will further limit the available oxygen to the backfilled material.*
>
> *3. During the early operations of the mine when the first stopes are backfilled and sealed off with shotcrete bulkheads, instrumentation will be installed behind the bulkheads to monitor moisture and oxygen levels, temperature and the pH of any water that may be present.*
>
> *4. The lower sections of the underground workings will be flooded post-closure by the recharging groundwater. This will further minimize any potential ARD issues.*

5. For the upper sections of the underground mine that are above the anticipated recharged water table the limited oxygen and moisture and low temperature conditions are not anticipated to lead to ARD and/or metal leaching for reasons explained in points 2 and 3 above. However, should any of the monitored closed stopes indicate that ARD could be present or become a problem then additional measures could be implemented as described in the following points.

6. Additional seals can be placed around the shotcrete bulkheads to ensure that oxygen diffusion to the backfilled stopes is minimized.

7. The distance between shotcrete bulkheads in the backfilled stopes can be varied accordingly to reflect the sulphur content of the backfilled material, or to take account of known fractures in bedrock that may allow the ingress of moisture and oxygen to the backfilled stopes. A shorter distance between bulkheads provides a greater level of control over the backfilled material between the bulkheads.

8. Where fractured bedrock is encountered that has the potential to permit the ingress or egress of water and ingress of oxygen to the backfilled material then shotcrete, or a similar sealing product, can be used as a 'grout' in fractures to minimize any oxygen or water flow. A shotcrete layer around the entire inside surface of the stopes is also an option, although likely an unnecessary and extreme measures.

(YOR 2008-0304-219-1)

It is not clear how the backfilled tailings and waste rock can be managed if the comingled materials begin producing and releasing acidic drainage in the stopes. Access to the backfilled stopes, particularly after closure when much of the underground workings will no longer be accessible, would not be feasible. If ARD/ML conditions begin, management of impacted mine water and groundwater may not be practical.

The Executive Committee requested an adaptive management plan that includes an in-situ feasibility study on a backfilled stope to confirm the effectiveness of the described approach. The Executive Committee also requested that an alternative be included as part of the adaptive management plan should the study show that the backfilled stope was not successful in mitigating ARD/ML effects.

NTC provided an Adaptive Management Plan as part of their information response titled Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1).

The Adaptive Management Plan outlines the options for tailings and waste rock disposal at the Mactung mine to include:

1. A surface dry-stacked tailing facility which will include disposal of waste rock, within the tailings.

2. Underground co-disposal of waste rock and tailing in mined out stopes above the water table behind bulkheads.

3. Underground co-disposal of waste rock and tailings in mined out stopes below the water table behind bulkheads.

(YOR 2008-0304-301-1)

The alternative for option two was identified as options one and three.

In order to implement option two, a baseline monitoring program to monitor underground water quality and quantity, temperature and oxygen was proposed for a backfilled test stope and a control stope without backfill above the water table. NTC proposed to monitor the test and control stopes for three years or as dictated by results of the kinetic tests.

The adaptive management plan identified triggers when the alternative options for tailings and waste rock disposal would be undertaken. NTC indicated that if the leachate reaches 80 percent of the MMER effluent quality criteria then contingency measures will be implemented. The adaptive management plan also outlined steps that would be undertaken to limit the effects on groundwater.

EcoMetrix stated in their January 4, 2013 memo that:

> *Co-disposal of tailings and waste rock in stopes above the natural water table is not a demonstrated technology for mitigating potential adverse effects on water quality. NATC has not provided convincing support for this proposed waste management option either by providing examples of where this technology has been used effectively or through other methods. Without supporting evidence, the proposed backfill of waste rock and tailings above the natural water table in the permafrost zone should not be considered an effective mitigation measure to prevent water quality impacts over the long term.*
>
> (YOR 2008-0304-287-1)

Government of Yukon identified in their review of the Draft Screening Report that:

> *Two mitigations have unproven technology and hence should not be considered 'mitigation' until having been demonstrated to work: 1) storage of tailings and waste rock above the water line in the underground, and 2) relying on a permafrost cap of unknown longevity.*
>
> (YOR 2008-0304-278-1)

Government of Yukon concluded that three years may not be a sufficient amount of time to prove that the disposal of tailings and waste rock with bulkheads, above the water table, will be effective over the long-term, post closure. The Executive Committee agrees with this finding and notes that NTC also identified that an additional time may be required should three years of in-situ monitoring prove inconclusive.

The Executive Committee is not confident that backfilled stopes above the water table with bulkheads is an effective disposal method to manage ARD/ML issues. The Executive Committee is concerned that the baseline monitoring plan may not provide conclusive evidence that the disposal method is effective for some time. Before using backfilled stopes above the water table as a disposal method, conclusive evidence must demonstrate containment and geochemical stability based on the in-situ monitoring program. There are no such assurances at this time. The Executive Committee has concluded that tailings and waste rock shall be either disposed of underground in mined out stopes below the natural water table or within the DSTF.

Should NTC proceed with a baseline monitoring program of stopes above the water table, and prove that the disposal option effectively manages ARD/ML effects, then, NTC can seek an amendment to their mine activities.

As a result, the Executive Committee has determined that the Project will result in significant adverse effects to water quality without additional mitigations as a result of the proposed waste rock and tailings disposal methods.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quality due to the mine closure.

To minimize effects from the DSTF and underground disposal below the water table:

16) The Proponent shall account for the costs of temporary mine closure including those costs related to the transfer of all waste rock and tailings that is not characterized as NAG to the DSTF as part of the mine security.

17) The Proponent shall inspect the DSTF cover system at a frequency to be determined by appropriate regulators.

18) The Proponent shall account for the costs of DSTF inspection and DSTF discharge monitoring after closure for the duration to be determined by the appropriate regulators as part of the mine security.

19) The Proponent shall not dispose tailings or waste rock into any stope above a level that will be above the water table after closure with the exception of one stope should the Proponent proceed with its proposed stope monitoring program.

20) The Proponent shall put in place management controls prior to proceeding with co-disposal of waste rock and tailings below the water table to ensure that waste rock will be completely encapsulated within the tailings during co-disposal.

21) During operations, the Proponent shall monitor drainage in the mine and in the backfilled waste to demonstrate that metal leaching effects are acceptable for water quality in the mine, and measures such as pumping and treating non-compliant mine waters are a part of a Water Quality Management Plan in order to avoid inputs of poor water quality to groundwater and conditions down gradient of the backfilled material.

22) As the water table rises during mine decommissioning, the Proponent shall monitor flooded backfilled waste is required to demonstrate how soluble products that form prior to flooding are affecting water quality in the mine. Measures such as pumping and treating non-compliant mine waters are required as part of a Water Quality Management Plan in order to avoid inputs of poor water quality to groundwater and conditions down gradient of the flooded backfilled material.

6.3.4 Discharge from the Reservoir to Tributary C

The reservoir discharge to Tributary C will be the primary pathway for constituents of potential concern (COPCs) to enter into the natural environment. Water quality of Tributary C may be affected by runoff from the reservoir dam and seepage dam, and direct discharge from the reservoir dam. Discharge of COPCs could lead to acute and chronic effects to the downstream aquatic ecosystem and wildlife species if concentrations of COPCs in the receiving environment exceed threshold values.

The reservoir will receive input from the DSTF, temporary waste rock storage area (WRSA), mill input, camp waste input, underground mine dewatering, and general surficial drainage within the footprint of mine infrastructure. The reservoir is expected to receive groundwater flow from the Mount Allan aquifer, which includes seepage from the mine workings (more so after closure when the water table is not lowered to keep mine working dry for operations). The reservoir will collect all contact water from mine infrastructure.

NTC reported that no COPCs are anticipated to exceed the MMER concentrations at discharge (below the reservoir dam) based on the updated water balance and the water quality prediction model that was provided in their information response titled Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-299-1). NTC outlines proposed conformance points and target conformance concentrations. NTC has also committed to install a water treatment plant on-site to manage COPCs within the effluent discharge. The following sections address these aspects of the proposal.

Proposed Conformance Points

NTC has proposed the target downstream conformance point concentrations at WQ1 located slightly downstream of a potential fish barrier (Figure 32).

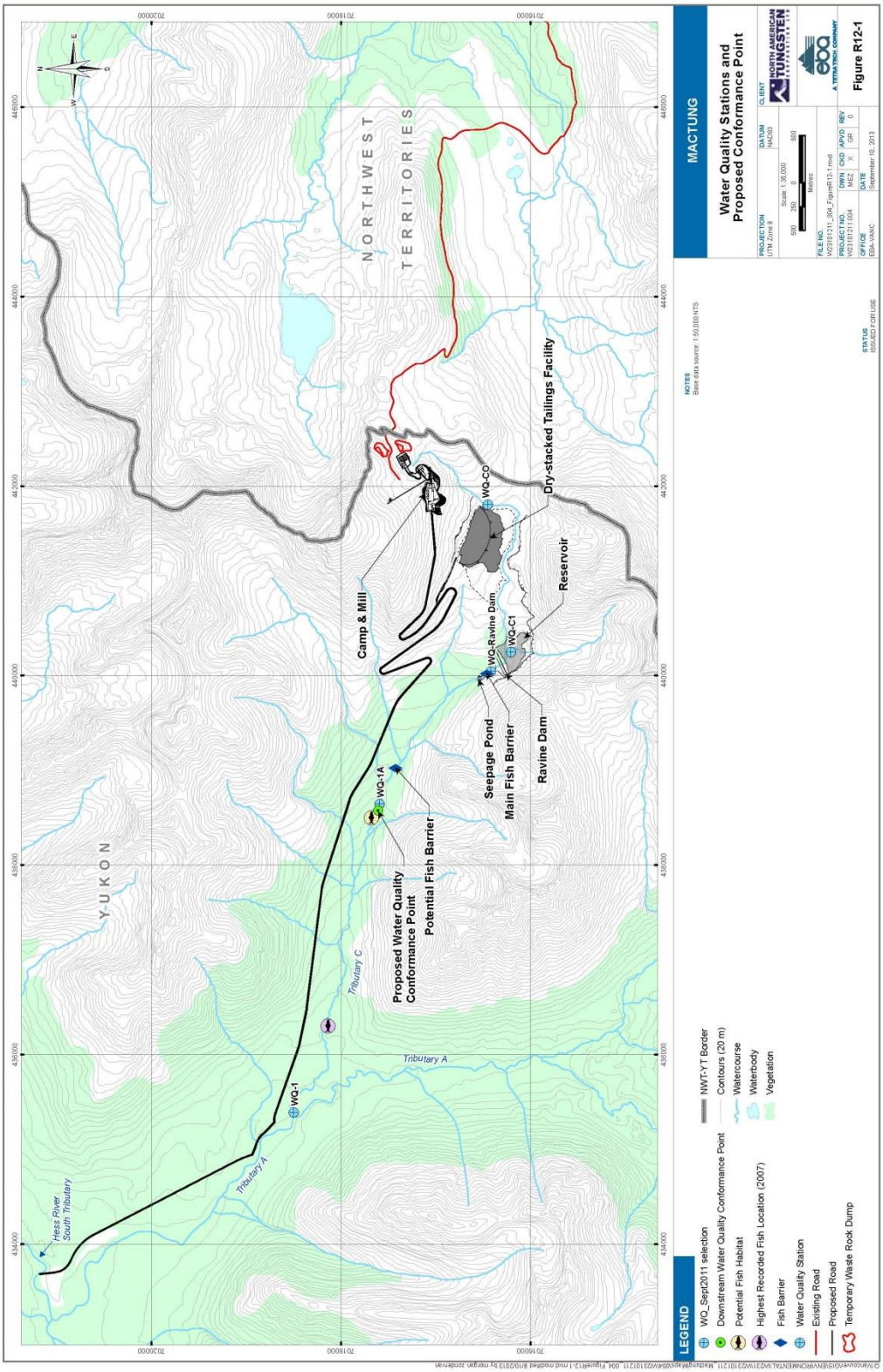

Figure 32 NTC proposed conformance point for water quality

The Executive Committee recognizes that the proposed conformance point is conceptual and that further analysis will be required to show that this is a suitable conformance point location and that there is sufficient baseline to determine target conformance concentrations at this site.

WQ1 is located downstream of a potential fish barrier. The barrier has not yet been described in sufficient detail to determine with certainty that it is a barrier to fish movement. This issue is discussed in more detail in the section 7.0 Aquatic Resources.

Due to the naturally high concentrations of COPCs within Tributary C, NTC is proposing that the target concentrations at the conformance point to equate to the 95th percentile concentrations of the natural baseline concentrations, based on the water quality data collected at WQ-1A. However, only 52 water quality measurements have been taken at WQ1 over the period of June 2006 to March 2013. Further baseline monitoring of water quality is required to ensure a sufficient basis for determining the 95th percentile concentrations.

The Executive Committee has determined that the Project will result in significant adverse effects to water quality due to uncertainties in water quantity and quality predictions. Additional terms and conditions are required to mitigate significant adverse effects to water quality.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quality.

To improve the reliability of water quality model predictions leading to a decreased likelihood of effects on water resources:

23) To account for the uncertainty associated with the water quantity and quality predictions, in advance of their Water Licence Application, the Proponent shall ensure that the proposed water treatment plant is designed to provide for:

    a) the range of possible water quality predictions to remain below appropriate threshold values for COPCs in the receiving environment;

    b) water treatment approaches that are readily adaptable should the quality of COPCs at risk of being above threshold water be different from that predicted;

    c) redundancies in pump design and power supply; and,

    d) maintaining sufficient water treatment plant reagent supplies on-site to allow the plant to function for 30 days.

24) The Proponent shall monitor quantity and quality of contact waters during operations, closure and post-closure in order to characterize contact waters from the different sources, verify assumptions and inform the mine closure plan. The monitoring program shall, at a minimum, specify routine surface water monitoring from temporary waste rock storage areas, the DSTF, mill and reservoir. The data shall be reviewed periodically to update loading assumptions for COPCs in the site water balance and water quality models.

25) The Proponent shall implement follow-up programs to verify the assumptions and conclusions of geochemical predictions and effectiveness of the resulting mitigation measures.

To minimize the risk of ARD/ML conditions in the DSTF and temporary WRSA during temporary closure:

26) The Proponent shall ensure that contact water discharged by the mine during post-closure meets discharge criteria established by the regulators.

27) At closure, the Proponent shall ensure that active mine water treatment is in operation until water quality meets discharge criteria established by the regulators.

6.3.5 Overview - ARD/ML Potential of Construction Material

Proposed borrow material for the construction of the reservoir dam consists of till. Results of geotechnical investigations estimate the volume of the potential borrow material as 81 000 m^3 at the reservoir dam location and 448 000 m^3 at the DSTF borrow site (YOR 2008-0304-099-2).

The Proponent has identified extensive deposits of granular material suitable for use in road construction along the proposed road access route. Borrow material is identified as glaciofluvial sand and gravel, till and colluvium. 16 potential borrow pits sites have been identified and described (YOR 2008-0304-099-2).

Source materials proposed to be used for the construction of the reservoir dam and seepage water dams have not been geochemically assessed. If the material requires physical blasting or milling, ARD/ML processes may begin. The Executive Committee has determined that terms and conditions are required to minimize significant adverse effects.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on water quality resulting from acid rock drainage and metal leaching.

To minimize the risk of ARD/ML from source material used for construction of infrastructure:

28) The Proponent shall conduct ABA characterization on blasted or milled rock that is intended for construction of mine infrastructure. If indicated by ABA results, kinetic testing should be completed to assess metal leaching potential of those materials. Only rock that is classified as non-acid generating and non-metal leaching shall be used for construction purposes.

6.4 CUMULATIVE EFFECTS ASSESSMENT

Residual effects are those effects that remain from project activities after implementing mitigation measures. The potential residual effects of the Project on water resources include changes to water quantity and quality to Tributary C due to discharge from the reservoir. Section 5.6 describes existing projects and infrastructure within a 20 km radius of the Project. Generally, activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance of the North Canol Road. Exploration activities may have residual effects on the Hess River and its tributaries as a result of river crossings, accidents and spills, or other activities that occur close to the creeks and streams. These activities however have a short duration and are widely dispersed.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on water resources. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on water resources.

7.0 AQUATIC RESOURCES

This section addresses potential effects of the Project on aquatic resources. An understanding of the environmental and socio-economic setting for aquatic resources is provided, and potential adverse effects are characterized and discussed in the context of the proposal, stakeholder comments, relevant legislation and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on aquatic resources.

7.1 OVERVIEW

The Hess River is a productive river system known to support populations of Chinook salmon, Dolly Varden, and Arctic grayling. As well, other fish species such as lake trout, slimy sculpin, least cisco and whitefish have been observed in the Hess River. This river system provides suitable habitat for all life stages. The Executive Committee has considered the effects of the Project on the Hess River by considering the effects of the Project on the Hess River South Tributary and the tributary's contribution to Hess River water quantity and quality.

The Hess River South Tributary contains Dolly Varden, Arctic grayling and slimy sculpin. This tributary likely supports suitable juvenile nursery habitat as well as suitable spawning habitat. The Executive Committee has considered the effects of the Project on the Hess River South Tributary to include:

- erosion and sedimentation during construction and operation of the water intake;
- fish entrainment or impingement at the water intake;
- changes to watercourse flow due to water withdrawal at water intake; and
- changes to water quality due to potential contributions from mine discharge (from Tributary A and C).

Tributary A flows into the Hess River South Tributary and contains a variety of fish species. Given the proximity of Tributary A to downstream and upstream fish-bearing waters, this tributary could support a population or act as a migration corridor between the Hess River South Tributary and Tributary C. The Executive Committee has considered the effects of the Project on Tributary A by considering the effects of the Project on Tributary C and subsequently Tributary C's contribution to Tributary A water quantity and quality.

Tributary C flows into Tributary A and provides suitable fish habitat that includes overwintering areas and supports Dolly Varden year-round. The Executive Committee has considered the effects of the Project on Tributary C to include:

- erosion and sedimentation during construction and operation of the reservoir dam and seepage dam;
- loss of fish habitat due to the construction of reservoir dam and seepage dam; and
- changes to Tributary C water quality and flow due to the reservoir storage and discharge of effluent.

7.2 EVALUATION OF BASELINE INFORMATION

7.2.1 Fish and Fish Habitat

North American Tungsten Corporation Ltd. (NTC) conducted fisheries studies during 2006-2008 to prepare for an application for an Executive Committee Screening. The studies provided information regarding fish and fish habitat as described above, however the level of detail has been criticized during the course of the assessment. On December 7, 2009, Department of Fisheries and Oceans Canada (DFO) commented that:

> *The fisheries assessment conducted on behalf of the proponent is useful; however, in order to adequately determine fish presence/absence it is necessarily to conduct the study over multiple years at various times using an assortment of sampling methods. The proponent did conduct their study over a three year period, however, only the Hess River Tributary was assessed during various times of the year using a variety of sampling methods. Tributaries A and C were assessed using electro-fishing gear during the month of August in 2006 and 2007.*
>
> (YOR 2008-0304-144-1)

Ross River Dena Council (RRDC) has identified that a unique variety of trout is present within the headwaters of the Hess River. RRDC commented that the fisheries studies have not recognized this species as being present. The Ross River Dena Elders provided the following comment in their response:

> *The fisheries resource is also significant. A unique variety of trout lives here, in a few scattered lakes and in the creeks that drain into the Hess River. Salmon are also known to occur downstream from the project area.*
>
> (YOR 2008-0304-271-1)

RRDC concluded:

> *As concluded by the federal Department of Fisheries and Oceans (DFO) and consistent with our TK, fish studies prepared for NAT are not sufficient to determine fish presence and absence in the creeks that were assessed.*
>
> (YOR 2008-0304-271-1)

RRDC provided a traditional land use map that outlines wildlife and aquatic resource values within the Hess River South Tributary and Tributary C (YOR 2008-0304-344-1). The map shows that the Project may impact areas where the unique variety of trout is located.

Government of Yukon also identified deficiencies in the understanding of fish and fish habitat in their review of NTC's Response to YESAB's Request of Supplementary Information Dated January 4, 2013, stating:

> *Given the ecological association between benthos and fish, it is important to quantify the bentho s and fish communities over time to ensure the proposed project does not further negatively imp act aquatic resources.*

(YOR 2008-0304-278-1)

As a result of comments received on the Draft Screening Report, The Executive Committee requested NTC to "Provide the results of studies that identify riparian and fish habitat along Tributary C and Hess River South Tributary that may be affected by the impacts of a reduced flow due to the Project." (YOR 2008-0304-289-1) NTC outlined their findings from the 2006 to 2008 studies in their Response to YESAB's Request for Supplementary Information Dated January 4, 2013 (YOR 2008-0304-300-1). The Executive Committee accepted this response as adequate as a result of the updated baseline hydrology of Tributary C and Hess River South Tributary, updated water balance, and updated water quality predictions that support effects characterization of fish and fish habitat. However, the Executive Committee recognizes that the understanding of the fish and fish habitat must be improved to prepare for detailed mine planning that will be considered during the regulatory review process.

7.2.2 Fish Barrier on Tributary C

NTC characterized the upper reach of Tributary C as non-fish bearing as a result of a field survey and identified that fish barriers downstream of the reservoirs prevent fish passage up Tributary C. NTC provided photos (Figure 33 and Figure 34) of two physical barriers - the 'western barrier' and 'eastern barrier' on Tributary C (YOR 2008-0304-238-1 and 2008-0304-239-1). The photos were taken in response to DFO's concerns that the fish surveys and previous description of physical barriers of Tributary C were insufficient to conclude upper portions of Tributary C are not fish bearing (YOR 2008-0304-237-1).

Given that NTC has confirmed that the eastern barrier is located approximately 130 m upstream of the proposed seepage pond, the barrier will be removed or submerged as a result of the Project (YOR 2008-0304-239-1).

Based on the response from DFO, the Executive Committee is not satisfied the photos provide conclusive evidence that the physical barrier limits fish passage (YOR 2008-0304-040-1). DFO provided a subsequent letter in their review of the NTC supplemental response stating that:

> *As no new information was provided to support the assertion that the western potential barrier is a true barrier to fish passage, DFO is unable to determine whether Tributary C above FS 10 is fish bearing and therefore cannot provide further advice on the anticipated effects expected to result from the flow reductions. Furthermore, in the absence of this information, it is difficult for DFO to determine whether it would have to issue an authorization for this project. As previously advised, the results of the additional sampling for fish presence and additional information related to the potential barriers can be provided during the regulatory phase of the project. From a regulatory perspective this remains true.*
>
> (YOR 2008-0304-318-1)

The Executive Committee will use the precautionary approach and assume the upper reaches of Tributary C are fish-bearing.

Figure 33 Photo of an approximate 2.5 m physical drop on Tributary C

Figure 34 Aerial photo of physical drop on Tributary C

7.3 EFFECTS CHARACTERIZATION

7.3.1 Fish Habitat Loss from Dam Construction

The construction of the seepage dam and reservoir dam will effectively remove any available fish habitat at and above these structures if the upper reach of Tributary C is fish bearing. DFO has indicated that if the upper reaches of Tributary C are identified as being a natural water body frequented by fish, the reservoir may require an amendment of Schedule 2 of the *Metal Mining Effluent Regulations*.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources should the western barrier not prevent fish passage. The Executive Committee has determined additional mitigations are required to minimize effects to aquatic resources from fish habitat loss.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on aquatic resources.

To improve the understanding of the western barrier on Tributary C:

29) The Proponent shall develop a program using appropriate professionals with suitable experience to determine the extent of fish distribution within Tributary C.

30) If Tributary C above the western barrier is fish bearing, the Proponent shall submit the new information to the appropriate regulators for consideration and appropriate approvals. Should it be found that approvals pursuant to the Federal *Fisheries Act* are required; the Proponent will be required to develop plans to offset any losses to fisheries productivity.

7.3.2 Alterations to Water Flow

Changes to water quantity and flow rates may alter conditions for aquatic and terrestrial life, especially in riparian areas downstream of the intake site and discharge site. Changes in quantity and flow may also change the physical characteristics of the water (e.g. temperature, dissolved oxygen).

Hess River South Tributary

Surface water flow and quantity of Hess River South Tributary will be affected by the withdrawal of water for filling the reservoir, camp use, and milling use. The Project will extract approximately 9.2 L/s from the Hess River South Tributary during construction and operation of the mine. During construction the intake from the Hess River South Tributary will be used to fill the reservoir while maintaining relatively natural flows of Tributary C. During operations, approximately 0.5 L/s will be used for the camp and 8.7 L/s will be used for mill processing. Approximately 250 m below the intake site is the confluence of Tributary A.

The Proponent committed to limit water withdrawals to not exceed 10 percent of the overall channel flow during the period of the withdrawal (Appendix C). However as discussed in section 6.2 Water Quantity,

the Executive Committee remains concerned that few flow measurements during low flow periods (winter) and high flows (freshet) are available to accurately understand the variability of baseline flows of Hess River South Tributary. The Executive Committee recognizes, however, that based on the current flow measurements of Hess River South Tributary, water withdrawal will not exceed six percent of the lowest rate of flow measured.

The Executive Committee is also concerned that the fish and fish habitat within Hess River South Tributary is not clearly understood.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources due to uncertainties regarding the presence of fish and fish habitat. The Executive Committee has determined additional mitigations are required to minimize significant adverse effects to aquatic resources from changes to Hess River South Tributary flow.

Tributary C

NTC estimates that immediately downstream of the reservoir, winter flows will be decreased by approximately 50 percent as the mine is not proposing to release water from the reservoir during the winter. It is estimated that winter flows will have approximately 23 percent reduced flow at the fishery station and approximately 10 percent at the Tributary C monitoring station.

NTC has characterized the upper reaches of Tributary C as non-fish bearing as a result of the fish barrier and a field survey of the creek. As a result, NTC has characterized the effects of changes of water flow to fish and fish habitat at FS6 approximately two kilometres downstream of the reservoir dam. At FS6 the flows will be will be within 12 percent of baseline flows which NTC considers to be within the natural variability of the stream.

The Executive Committee remains concerned that the fish barrier on Tributary C has not been satisfactorily proven to prevent fish passage and will continue to consider areas upstream of the barrier as fish habitat.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources due to uncertainties regarding the presence of fish and fish habitat. The Executive Committee has determined additional mitigations are required to minimize significant adverse effects to aquatic resources from changes to Tributary C flow.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on aquatic resources.

To improve the understanding of fish and fish habitat in Tributary C and in the Hess River South Tributary:

31) The Proponent shall conduct additional studies for fish presence and fish habitat along Hess River South Tributary and provide additional information to appropriate regulators describing the extent of fish habitat loss as a result 10 percent reduction of flows during low flow periods. The studies shall be conducted by appropriate professionals with suitable experience.

32) The Proponent shall conduct additional studies for fish presence and fish habitat along Tributary C and provide additional information to appropriate regulators describing the extent of fish habitat loss as a result of a reduction of flows during low flow periods. The studies shall be conducted by appropriate professionals with suitable experience.

33) The Proponent shall predict potential impacts to fish and fish habitat due to the reduction of flow in Tributary C and Hess River South Tributary resulting from the construction of the reservoir and seepage dams and water intake. This prediction will include an analysis of the amount and type of fish habitat likely to be affected in both Tributary C and the Hess River South Tributary. The Proponent shall submit the prediction to appropriate regulators.

34) The Proponent shall conduct benthic invertebrate monitoring and fisheries investigations on an annual basis at water quality sampling locations on the Hess River South Tributary and Tributary C. Annual reports detailing the result of the monitoring and investigations shall be submitted to appropriate regulators.

7.3.3 Water Quality Affecting Aquatic Resources

The reservoir discharge to Tributary C will be the primary pathway for constituents of potential concern (COPCs) to enter into the natural environment. Water quality of Tributary C may be affected by runoff from the reservoir dam and seepage dam, and direct discharge from the reservoir. Discharge of COPCs could lead to acute and chronic effects to the downstream aquatic ecosystem and wildlife species if concentrations of COPCs in the receiving environment exceed threshold values. In section 6.3 Water Quality, the Executive Committee discusses the proponent commitments. In that section, the Executive Committee recommends a number of additional measures to ensure effluent discharge will not result in a significant adverse effect to water quality.

NTC has identified the target downstream conformance point concentrations at WQ1 located slightly downstream of the potential fish barrier (western barrier). The Executive Committee concludes that the proposed conformance point is not suitable at this time as the fish barrier has not been described in sufficient detail to confirm that it is impassable by fish.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources due to uncertainties regarding the presence of fish and fish habitat. The Executive Committee has determined that additional mitigations are required to minimize significant adverse effects to aquatic resources from water quality.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on aquatic resources.

To ensure the conformance point on Tributary C protects fish and fish habitat:

35) If the western barrier does not prevent fish passage, the Proponent shall identify an appropriate conformance point that protects fish and fish habitat to the satisfaction of appropriate regulators.

7.3.4 Erosion and Sedimentation

Proposed activities such as the construction and operation of the water intake and the construction and operation of the reservoir dam and seepage dam will cause increased erosion of the stream banks and surrounding areas, and consequently increased sedimentation of Tributary C and the Hess River South Tributary. The introduction of unnatural sediment loads into water can affect water quality, and subsequently fish survival. The introduction of sediments to the aquatic environment can result in several detrimental effects. Sediment loading in and along watercourses may increase turbidity to the point that the water quality is rendered unsuitable for aquatic organisms. This will in turn adversely affect local and downstream aquatic resources.

NTC provided the following commitments to mitigate effects of erosion and sedimentation:

> *conducting a permitting review with the Department of Fisheries and Oceans (DFO) prior to any works. All works will adhere to the terms of either the Fisheries Act Authorization or Letter of Recommendation resulting from that review;*
>
> *all instream works will be conduc**t**ed in isolation from the active channel to reduce the potential risk to fish habitat; these activities will be monitored by environmental professionals;*
>
> *an environmental management plan (EMP) will be developed and employed by NATC and its contractors for all works. This plan will outline best management practices for construction, control of activities on site, site stabilization, environmental monitoring, and instream works, based on the following literature:*
>
> *− DFO Standard Operational Procedures;*
>
> *− Land Development Guidelines for the Protection of Aquatic Habitat (DFO and BCMOE 1993);*
>
> *− A Users' Guide to Working In and Around Water (BC Ministry of Land Water and Air Protection, 2005);*
>
> *− Standards and Best Management Practices for Instream Works (BC Ministry of Land Water and Air Protection, 2004);*
>
> *clearing limits and riparian reserve areas will be adhered to during construction activities;*
>
> *wherever possible, instream works and works in the vicinity of fish-bearing watercourses will be conducted at low flow periods; and*
>
> *fords will not be installed or used as watercourse crossings due to the abundance of sediment fines and the high precipitation microclimate in the footprint area.*
>
> (Appendix C)

Numerous best practices detail effective erosion control methods that, when followed, will reduce or eliminate the adverse effects from the proposed project. The Proponent has outlined their approach to managing erosion and sedimentation issues.

The construction of the reservoir dam and seepage dam has the potential to cause sedimentation loading downstream in Tributary C. Tributary C downstream is habitat for Dolly Varden, which can be susceptible to increased sediment loading (YOR 2008-0304-144-1). DFO recommended that a sediment

and erosion control plan be developed to minimize the risk of sedimentation issues. The Executive Committee recognizes that NTC has committed to work with DFO to follow regulatory requirements during construction. However, the details of how NTC will effectively manage erosion issues are still unknown.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources due to erosion and sedimentation. The Executive Committee has determined additional mitigations are required to minimize significant adverse effects to aquatic resources from sedimentation loading downstream of the reservoir dam and seepage dam due to construction.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on aquatic resources.

To minimize the effects of erosion and sedimentation on fish and fish habitat:

36) The Proponent shall develop and implement an effective sediment and erosion control plan designed by appropriate professionals with suitable experience.

37) The Proponent shall conduct in-stream works during the time of year that poses the least risk to the fish species that use the watercourse. When it is not possible to conduct works during the period of least risk, the work should be conducted in a manner that prevents fish mortality.

7.3.5 Fish Entrainment or Impingement

Withdrawal of up to 9.2 L/s from the Hess River South Tributary River may result in the death or injury of fish. Water withdrawal may result in fish entrainment (trapping of fish in the water intake) or impingement (entrapment of fish in contact with the intake screen). The use of appropriate screening during water withdrawal will reduce fish injury and mortality associated with this activity.

The Executive Committee has determined that the proposed project will have significant adverse effects on fish related to harm or injury from water withdrawal. The DFO guidelines speak to several aspects of fish screen use including screen size, materials to be used, screen shapes, and screen installation.

The Executive Committee has determined that the Project will result in significant adverse effects to aquatic resources due to fish entrainment or impingement. The Executive Committee has determined that additional mitigation relating to following of the DFO guidelines is required.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on aquatic resources.

To minimize the effects of entrainment or impingement on fish and fish habitat:

38) The Proponent shall use fish screens according to DFO's "Freshwater Intake End-of-Pipe Screen Guidelines".

7.4 CUMULATIVE EFFECTS ASSESSMENT

Residual effects are those effects that remain from project activities after implementing mitigation measures. The potential residual effects of the Project on aquatic resources include changes to water quantity and quality to Tributary C, due to discharge from the reservoir. Cumulative effects are any residual project effects in combination with the effects of other existing or proposed projects. Section 5.6 describes existing projects and infrastructure within a 20 km radius of the Project. Generally, these activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance of the North Canol Road. Exploration activities may have residual effects on the Hess River and its tributaries as a result of river crossings, accidents and spills, or other activities that occur close to the creeks and streams. These activities however have a short duration and are widely dispersed.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on aquatic resources. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on aquatic resources.

8.0 WILDLIFE

The Executive Committee received comments regarding the section on wildlife in the Draft Screening Report (DSR) that was issued on October 12, 2012. The importance of the Macmillan Pass area for wildlife values has been identified by RRDC, Government of Yukon and several other parties during this screening. The comments provided have identified the project area as very valuable for several wildlife species. These comments and specific issues related to wildlife are addressed in this section of the Screening Report.

The Executive Committee has considered new information provided by Ross River Dena Council (RRDC), Environment Canada and Government of Yukon (YG) during the comment period for the DSR. The additional information was related mainly to caribou, sheep, moose and grizzly bear habitats.

The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on wildlife.

8.1 OVERVIEW

The use of the North Canol Road, the construction of a mine site, staging areas and road to the Hess River South Tributary, and the extension of the Macmillan Pass Aerodrome will overlap spatially and temporally with habitat for a variety of wildlife species. For a description of wildlife species distribution and life-stage habitats in and near the project area see section 4.8. Project-related activities may result in the following effects:

- Habitat loss, disturbance, and alterations due to land clearing, use and site preparation
- Habitat avoidance due to human activities such as:
    - construction activities and noise;
    - road use and noise;
    - terrain hazard management; and
    - other induced activities related to the road such as maintenance.
- Barriers preventing habitat connectivity
- Direct injury and/or mortality
- Human-wildlife conflicts such as:
    - traffic accidents; and
    - animal mortality due to food attractants.
- Increased hunting pressure (human)

The species or species groups considered are woodland caribou, moose, Dall sheep, grizzly and black bear, small mammals and birds. The Executive Committee notes that North American Tungsten Corporation Ltd. (NTC) completed specific effects assessment sections for wolverine and hoary marmot

species. These species are included in the Executive Committee's consideration of small mammals. The Proponent did not consider the effects to Dall sheep in their effects assessment due to the low observations of sheep during baseline studies. However, RRDC and YG confirmed that key Dall sheep habitat overlaps with the project area, therefore Dall sheep are considered in this effects assessment.

8.2 EVALUATION OF BASELINE INFORMATION

8.2.1 Woodland Caribou

The Caribou Herd Ranges 2012 map (section 4.8.2, Figure 15) produced by Government of Yukon indicates that three caribou herds use the project area and areas along the North Canol Road. The Tay River Herd range is on the north side of the North Canol Road, the Finlayson Herd range is on the south side of the North Canol Road and the Redstone Herd range is along the Yukon–NWT border mainly on the NWT side. Individuals or groups from these herds are known to migrate through any of these ranges. RRDC identified that individuals from the Bonnet Plume and Keele River herds have also been known to use the project area from time to time (YOR 2008-0304-271-1).

Woodland caribou are identified by COSEWIC and SARA as a species of special concern. The Redstone Caribou Herd is also relied on as a food source by local First Nations and others. Environment Canada estimates the Redstone Herd population at between 5 000 to 10 000 individuals although there is low confidence in the estimate. The last survey for the herd was conducted in 1997 (Environment Canada, 2011). According to YG data, the Finlayson Herd was estimated at around 4 130 animals in 1999 and declining, while the Tay River Herd was considered stable in 1996 at 3 750 animals.

The mine site, temporary camp and the Macmillan Pass Aerodrome overlap with all three caribou herds' key habitat areas. The North Canol Road and the staging areas near Ross River overlap with the Tay River and Finlayson caribou herds.

These project activities overlap with spring and fall migration corridors, calving and post-calving (early summer), and summer foraging areas (section 4.8.2, Figure 16 and Figure 17). The construction, operation and use of the mine and road to the Hess River South Tributary affect caribou due to their tendency to avoid such areas. Areas around disturbances that lead to alterations and/or avoidance of caribou activities are referred to as zones of influence.

8.2.2 Moose

The North Canol Road, mine site, staging areas, road to the Hess River South Tributary and Macmillan Pass Aerodrome will overlap with moose habitat and are located within Game Management Areas 435, 436, 439, 440, 449, 450, 1101, 1102, 1106, 1107 and 1108. YG estimates moose densities in the region to be 285 moose/1 000 km^2. However, surveys conducted by EBA in preparation for the NTC proposal indicate the moose population density is lower in the project area due to the mountainous terrain and significant alpine areas being unsuitable for moose. Moose are generalist herbivores that feed on grasses, herbaceous plants and new growth shrubs and trees. Required habitat characteristics include adequate browse, protective cover, and mineral licks. These habitat characteristics can be found in the valleys in and around the project area. An important mineral lick that is used mainly by moose is located

near the mine site (YOR 2008-0304-023-2). Maps of the spatial distribution of moose based on three years of moose survey data are provided in section 4.8.1 (Figure 11, Figure 12, Figure 13 and Figure 14).

8.2.3 Dall Sheep

Dall sheep were included in the wildlife surveys conducted by NTC in preparation of the project proposal. There were few observations of Dall sheep during the surveys conducted and no observations within the valleys or related mountain sides in the vicinity of the project site.

Government of Yukon identifies key winter habitat for Dall sheep on the northern mountainside adjacent to the Project (section 4.8.3, Figure 18) which is also confirmed by historical studies. It was suggested in the project proposal that sheep populations are low in the project area due to harsh winter conditions and an east-west aspect along these valleys that allows for strong winds.

Traditional knowledge provided by RRDC identified an overlap between critical sheep habitat and the project area. RRDC emphasized the importance of the habitat due to the limited size of the local sheep population.

8.2.4 Grizzly and Black Bear

Grizzly bear range includes the entire Yukon with an approximate population of 6 000 to 7 000 animals. An individual grizzly bear requires a large home range up to 1 682 km^2 for males and 491 km^2 for females. Black bear are also found in most of Yukon, but mainly in the southern and central parts of the territory. Male black bear have a range of up to 500 km^2 and female of up to 125 km^2. Bears commonly utilize valley bottom, stream corridors as well as alpine and sub-alpine areas for various life functions such as travel routes and denning.

During the wildlife studies conducted by NTC, grizzly bears and evidence of grizzly bear use (e.g. dens, tracks, and digs) were observed near the mine site area (section 4.8.4, Figure 19). Although grizzly bears are listed by COSEWIC and SARA as a species of special concern, they are common throughout Yukon and NWT. Additionally, the staging area on the east side of Ross River near the community overlaps with a black bear key area (section 4.8.4, Figure 20). RRDC identified the importance of the project area for denning to grizzly bear in their comments (YOR 2008-0304-271-1).

In response to the information request sent by YESAB on January 4, 2013 (YOR 2008-0304-289-1), EBA completed the Grizzly Bear Cumulative Effects Assessment for Mactung, for the Proponent. The report for this assessment identifies bear denning habitat by importance in the project area (YOR 2008-0304-307-4).

Government of Yukon identified in their November 13, 2013, comments that the grizzly bear cumulative effects assessment provided by the Proponent is not adequate. Government of Yukon indicated that due to the presence of denning habitat and known bear dens in the project area, a den survey should be conducted so that an adequate plan regarding bear-human conflicts can be developed (YOR 2008-0304-316-1).

Available bear habitat will be reduced for the duration of the Project. More importantly, the Project may result in habitat fragmentation by impeding or disrupting animal movement along established corridors. Opening the North Canol Road year-round may also increase hunting pressure on bears. Finally, the temporary camp and the main camp may be attractants to bears if proper waste/attractant management techniques are not utilized.

8.2.5 Small Mammals

The area where the mine site is located is suitable habitat for a variety of furbearing animals, including commercial furbearing species such as wolverine, beaver, muskrat, fox and marten. Other small mammals found in the area include but are not limited to collared pika, hoary marmots and arctic ground squirrel. The full list of small mammals can be found in section 4.8.5 (Table 13). Wolverine and collared pika are listed as Species of Special Concern by COSEWIC, but are not listed under the federal SARA legislation. Additionally, RRDC identified the importance of hoary marmots as a traditional source of food and fur (YOR 2008-0304-271-1).

NTC's effects assessment of small mammals focused on the key species of hoary marmot due to its cultural importance as a food and fur source. Wolverine and collared pika are also considered due to their COSEWIC designation. While small mammals as a species category are a large and diverse group with varying life histories and habitat requirements, the primary effects pathways remain the same. As a result, the Executive Committee considered the effects characterization of hoary marmot, collared pika and wolverine as applicable to small mammals in general.

8.2.6 Birds

A total of 112 bird species may nest within the study area. Of these, seven species have special conservation status designations. Table 14 provides a list of avian species with conservation status that may be affected by the Project. Government of Yukon key habitat maps indicates the presence of several species of raptors (section 4.8.6, **Figure 21**). Raptor species include gyrfalcon, golden eagle, bald eagle and peregrine falcon. RRDC also identified a ptarmigan variation that appears to be particular to the area (YOR 2008-0304-271-1).

8.3 EFFECTS CHARACTERIZATION

The following section will characterize the effects of project activities on wildlife.

8.3.1 Loss, Disruption and Alteration of Habitat

NTC identifies that the proposed mine site infrastructure including the reservoir dam, reservoir and dry-stacked tailings facility will have a footprint of approximately 53 ha. Up to 40 ha of land will be cleared for the construction of the Ross River staging areas and approximately 50 ha for the construction of the Macmillan Pass staging area and temporary camp. The Macmillan Pass Aerodrome will be expanded by approximately five hectares.

NTC identifies that the construction and use of the mine site infrastructure and North Canol Road is expected to contribute further to the disturbance of wildlife and avoidance of habitat in the area. NTC also identifies that wildlife movement and migration patterns may be altered due to the mine site infrastructure and road use.

The North Canol Road will be used to transport supplies, workers and ore. NTC indicated that 4 to 10 trucks per day would travel each way between the mine site and Ross River. Vehicles are also expected to use the mine site road network for daily operation.

The effects of the increased use of the road, as well as construction activities, will have broader effects due to avoidance tendencies of the identified wildlife species. The area around developments that cause alterations and/or avoidance by wildlife is referred to as the zone of influence. The Executive Committee considers woodland caribou, moose, Dall sheep, grizzly bears, small mammals and birds to be the most potentially affected through loss, disruption, and alteration of habitat.

Woodland Caribou

The clearing and construction of the mine site infrastructure will result in the loss of approximately 53 ha of sub-alpine habitat. The mine site road network is located in sub-alpine to alpine mid-elevation habitats. Sub-alpine habitat is used by woodland caribou, particularly during July and August when avoiding insect harassment and heat stress. NTC concludes that loss of habitat and avoidance is considered a low negative effect of the Project since the habitats affected are common within the project area and valley bottoms are not considered preferable caribou habitat (YOR 2008-0304-019-2).

The Executive Committee has considered other studies that monitored avoidance tendencies of caribou in zones of influence from road network development and use. A study conducted in northern Alberta identified that the zone of influence varies with the level of human activity around roads and seismic line developments. The report found female caribou with calves are particularly sensitive to human disturbances. Zones of influence generally range from 250 to 1 000 m. (Dyer 2001). Similarly, a study in northern British Columbia concluded that caribou avoidance tendencies are observed within one kilometre of low use roads (Polfus et. al. 2011). Avoidance within zones of influence does not mean caribou completely avoid the area, but both studies concluded that caribou used the areas less than if the road development had not occurred.

Caribou calving is identified to occur in plateaus and upland sites within the project area and post-calving in the alpine tundra and open meadows. Female caribou are particularly prone to disturbance during the calving and post-calving stage. The Executive Committee considers that the mine site area will no longer be suitable for calving and post-calving life-stages as a result of caribou avoidance of the disturbed area during the construction, operations and early closure phases of the mine.

Summer foraging and migration corridors of woodland caribou within the North Canol Road valley, mine site road network and nearby side slopes will be impacted due to road use and induced human activity.

Moose

NTC indicates that approximately 95 ha of moose habitat will be lost due to clearing of the staging areas, temporary camp and aerodrome extension. The mine site is located in sub-alpine habitat which is not preferred by moose. A mineral lick located near Tributary A will be affected by noise caused by road use

and associated activities. The mineral lick has a corresponding high moose distribution during the fall and winter as it is a critical habitat requirement. Figure 11 in section 4.8 indicates the wildlife key areas for moose along the North Canol Road. An increase in year-round activities may contribute to the disruption and displacement of moose in the project area.

NTC identifies that noise from construction and road use will cause moose to avoid areas along the North Canol Road corridor. Also, NTC identifies the road may restrict natural movements of moose, particularly during the winter months when the snow banks could act as a barrier. NTC has included a number of mitigations to reduce the effects to moose. For example, NTC committed to minimize clearing and construction activities during late winter when moose energy reserves are low and to limit snow bank height at known travel corridors.

The Executive Committee has determined that opening the North Canol Road year-round will result in moose disturbance and restrict and alter natural movements along the road.

Dall Sheep

NTC has concluded in their proposal that because sheep were not observed, the area is not utilized as it was in the 1970s.

Government of Yukon confirmed in recent comments that sheep are present near the mine site area and that further surveys focusing on lambing, summer and late winter seasons should be undertaken to understand the current status of the sheep population (YOR 2008-0304-288-1). Traditional knowledge also indicates that the project area is used for lambing (confidential information).

While sheep were not observed within the key wildlife habitat during the surveys conducted by NTC, this does not indicate that sheep do not use the area. The Executive Committee recognizes that sheep may remain within the area in low populations. The year-round use and maintenance of the North Canol Road and mine site roads will occur during the construction, operation and closure phases of the mine. The regular disturbance from these activities may cause the valley sides to be abandoned by sheep or their migration route to be altered. This disturbance may also impact on the potential rebound of the sheep populations.

Grizzly and Black Bear

All proposed project activities overlap with bear habitat. The Government of Yukon map of wildlife key areas indicates that a black bear key area (during spring) is located near Ross River and that a key area for grizzly bear (during spring, summer and fall) is located along the North Canol Road near Lewis Lake. Government of Yukon has indicated that further surveys are required to establish the use of the area by grizzly bear due to the presence of prime overwintering habitat (YOR 2008-0304-288-1). Government of Yukon also indicated that the area is important for grizzlies and that the mortality rate is believed to be sustainable at present, although just under the threshold of sustainability. For clarity, any increase in mortality rates of sow grizzly bears would likely be unsustainable for the local population of grizzly bear. Therefore, Government of Yukon has suggested that the Proponent establish a goal of “zero additive mortality” of grizzly bears related to project activities (YOR 2008-0304-345-1).

NTC identified that bears may avoid areas of construction and road use as a result of noise and disturbance during construction and use of the road network and mine site. Bear movement might be

restricted due to road use. If the construction occurs while grizzlies are denning, disturbance may result in premature abandonment of denning sites.

The Executive Committee has determined that the proposed activities and associated noise may cause disturbance and avoidance of bears to the area. It should be noted that bears can become accustomed to routine noise in the absence of threat or danger, which in turn may lead to conflicts between humans and bears. Conflicts between humans and bears will be addressed further in section 8.3.2.

Small Mammals

The area of the proposed mine site overlaps with hoary marmot and collared pika habitat. The clearing of 53 ha of subalpine and alpine areas can result in the destruction of important habitat for these small mammals since they have smaller habitat ranges, are not as mobile on the landscape as other species and spend most of their lives in the same area. These species may not be able to relocate or to find suitable habitat nearby.

Birds

The primary effects of proposed project activities to birds are the loss of habitat and risk of mortality during nesting. The proposed activities require the clearing of approximately 95 ha of valley nesting habitat and 53 ha of subalpine and alpine nesting habitat. The bird species are diverse and their nesting habitat can be expected to occur throughout the entire project site. Habitat types include wetlands, coniferous stands, shrub stands, different vegetated seral stages, dry upland to wet lowlands, and vegetated to sparsely vegetated alpine sites. Some bird species are sensitive to disturbances near their nesting sites and may abandon existing sites if disturbance is too close.

While the spatial scope for breeding birds can be large, the temporal scope during which these birds are most vulnerable to ground activities is during the breeding and nesting season. Bird nesting typically occurs from May 1 to July 31. This period is of critical importance as it overlaps with the temporal scope of the Project. Potential for direct injury or death of raptors, songbirds and forest birds includes the disturbance or destruction of nests and eggs. The incidental disturbance or destruction of nests and eggs could occur in the course of clearing and excavation, leading to direct or indirect mortality of birds.

Significance Determination

The construction of the proposed mine and associated infrastructure will result in direct habitat loss to all species (e.g. caribou, moose, grizzly bear, small mammals, birds) that rely on habitat within the mine footprint, staging areas and other planned developments. The habitat type for caribou, sheep and moose that is lost due to land clearing for the mine site infrastructure, staging areas and aerodrome expansion is relatively common in the project area. However, denning habitat for bears is not as common and requires several attributes such as aspect, elevation, slope and vegetation.

Key habitat for collared pika and hoary marmots is not as common due to their limited mobility, vulnerability when traveling and smaller ranges.

Birds nesting habitat also requires certain features and is susceptible to disturbance, which may cause birds to abandon their nest.

NTC has committed to several mitigations regarding monitoring programs for caribou, moose and grizzly bear. NTC has proposed mitigations such as minimizing clearing areas and conducting bird nesting surveys before the start of clearing activities. Development within bird habitat is regulated by the *Migratory Birds Convention Act* according to seasons and critical periods for reproduction and migration. NTC has also committed to deactivate the road and water crossings upon project completion to mitigate effects to collared pika and marmots. Government of Yukon indicated in their comments that these actions are positive but that monitoring alone is still inadequate to mitigate the effects of the Project on wildlife (YOR 2008-0304-345-1)

The duration of the Project is planned for 16 years during all seasons. However, the effects of clearing will last longer, especially in sensitive habitat. Sub-alpine and alpine vegetation is likely to take more time to recover to a point where it is useable by wildlife again. All areas that will be cleared or altered are considered 100 percent unusable by the majority of wildlife species addressed in this section for life functions purposes for the duration of the Project. The extent of the loss, disruption and alteration of habitat is localized to the areas where activities will take place.

The Executive Committee has determined that the Project will result in significant adverse effects to wildlife due to the above considerations. The Executive Committee has determined that the Proponent's commitments will not prevent all significant adverse effects to these wildlife species and therefore further mitigation is required.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on wildlife.

To improve the understanding of baseline information for woodland caribou, moose, Dall sheep and grizzly bear and minimize the effects of the Project on these species:

39) The Proponent shall establish a Wildlife Monitoring Program prior to project initiation. For this program the Proponent shall:

    a) monitor at least woodland caribou, moose, Dall sheep and grizzly bear to establish baseline information of these species;

    b) develop the program in consultation with appropriate Government of Yukon agencies, Northwest Territories Government agencies, RRDC, Sahtu Dene and communities;

    c) analyze the monitoring data and report annually to Government of Yukon and other wildlife management agencies involved. If determined to be required by a management agency, the Proponent shall develop an Adaptive Management Plan within one year after the project initiation; and

    d) establish an appropriate buffer around the mineral licks identified by RRDC and Government of Yukon to reduce the zone of influence to wildlife species using the mineral lick. The appropriate buffer zone shall be determined in consultation with a qualified biologist.

To minimize the effects of the Project on migratory birds:

40) The Proponent shall avoid clearing vegetation during the migratory bird nesting season (approximately May 1st to July 31st). If clearing must occur during this period, the Proponent shall ensure nest surveys are conducted by qualified and experienced personnel prior to clearing. If active nests or migratory birds are discovered, the Proponent shall record these locations and postpone activities in the nesting area until nesting is completed.

8.3.2 Attraction of Wildlife to Camps

The temporary work camp, the main camp and associated activities (e.g. food storage/preparation and waste storage/disposal) may attract opportunistic scavengers, such as bears, and lead to conflict between humans and animals.

The likelihood of bears repeatedly visiting a camp or infrastructure is directly linked to whether they obtain a food reward from inadequate garbage management or are immediately deterred on first contact with the site. Bears constantly assess risk and reward situations. When adequate deterrent (risk) is applied, bears will usually stay away from camps. Conversely, bears conditioned to seeking food at camps become increasingly bold and may result in bears having to be relocated or destroyed. In order to reduce the potential for wildlife-human conflict and/or property damage, garbage and other attractants must be handled so as to not become accessible to wildlife.

Significance Determination

Government of Yukon has indicated that the grizzly bear population in the area of the Project could be significantly affected by an increase in sow grizzly bear mortality. YG conducted an analysis of the bear population in the Game Management Subzones (GMS) along the North Canol Road and estimated that current reported female mortality is sustainable at present but just under the threshold of sustainability. This means that an increase in sow grizzly bear mortality for these GMS could lead to a decrease in grizzly bear population for the area in the long-term. Government of Yukon indicated that if this increased harvest/mortality is periodic (e.g., every 25 years), the decline would be recoverable. However, if the female loss is regular (e.g., every year) the decline would be catastrophic (YOR 2008-0304-345-1). Due to this sensitivity, the Project should not contribute to bear populations falling below a sustainable level.

NTC has included commitments such as managing camp, mine and construction waste in an appropriate fashion that minimizes conflicts with bears. Further mitigations such as reporting wildlife encounters and maintaining a log will help manage bear encounters and show if there are bears that might be becoming habituated. NTC has also committed to develop an employee training program to educate employees on mitigations and to review the protocol for bear encounters. The full list of commitments can be found in Appendix C.

Based on experience with other similar activities the Executive Committee has further considered human-bear conflict. Attractants can cause an increase in human-bear conflict that often results in wildlife control or direct bear mortality. While bear attractants are commonly related to camps, campsites and road use, activities may require certain wastes to be managed away from the camps. The effects assessment of the camp is considered in section 9.5 of this report.

The Project is planned to occur for 16 years and to vary in scale depending on each development phases. A temporary camp will be constructed initially at the Macmillan Pass Aerodrome to begin construction of the mine site. The main camp will be built at the mine site and will stay until final decommission of the Project. Therefore, the effects of the Project could occur for the entire duration of the Project.

The magnitude of the effects is limited mainly to the two camps, which is a relatively small area. However, smell from attractants can travel long distance and are likely to attract animals from a much larger area in addition to those animals traveling though their range.

The extent of attracting wildlife to camps, which often result in animal mortality could affect the local bear population and possibly beyond the project area. The Executive Committee has determined that the Project will result in significant adverse effects to wildlife that can be mitigated by the Proponent's commitments and the following terms and conditions.

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on wildlife.

To minimize conflicts with wildlife:

41) The Proponent shall develop a Wildlife Conflict Prevention Plan (the Plan) that includes:
    a) details of a worker education program;
    b) attractant management procedures;
    c) site containment details;
    d) aversive conditioning of bears procedures;
    e) a description of investment dedicated to bear management resources and personnel; and
    f) the Guidelines for Industrial Activity in Bear Country (MPERG, 2008).
42) The Proponent shall provide the Plan to Government of Yukon for review prior to commencing activities.
43) The Proponent shall designate a wildlife monitor on-site to:
    a) ensure that the Plan is implemented;
    b) ensure that electric fences and other related systems are operational;
    c) ensure that attractants are contained and out of reach by bears and other wildlife;
    d) monitor and report bear activity, sightings and incidents to Government of Yukon.
44) Prior to any clearing and construction of undisturbed areas, qualified personnel shall conduct a thorough search of the area to identify and record the location of bear dens. Where a bear den is found, the Proponent shall record the location and establish a one to 1.6 km no-development buffer around the den while active. Clearing and construction activities around identified active dens shall not occur between November and mid-June or until two weeks after den emergence. This

accommodates the needs of family groups that must remain close to their dens up to two weeks after den emergence.

45) The Proponent shall use bear-proof or electric fences around camps and all areas considered a potential attractant, including but not limited to food, waste and petroleum products storage areas.

8.3.3 Induced Hunting Due to Increased Access

NTC identifies that induced hunting due to increased year-round road access may indirectly cause woodland caribou injury or mortality. Moose, sheep and bear will also likely be affected by induced hunting. Studies have shown that increased access results in an increase in hunting pressure to the surrounding area (Theobold et al. 1997; Anderson et al. 2011; Swotalski et al. 2011). Government of Yukon, Department of Environment stated in their comments on the Nidd Road project, "the road upgrade will improve access for predators and hunters" (YOR 2012-0060-022-1). Although the new access road is no longer proposed, the North Canol Road will be open year-round.

Woodland Caribou

The year-round accessibility provided by the North Canol Road will increase the traffic volume in the area. Recognizing that not all new traffic will be hunting parties it is reasonable to assume this increased access will also result in an increase harvest rate due to hunting.

Given the limited baseline data available regarding the populations of the woodland caribou herds using the area and current and past harvest rates of caribou in this region, it is difficult to predict the potential increase in harvest rates.

Licensed and subsistence hunting of caribou occurs in and around the project area. The Government of Northwest Territories identified that approximately 70 to 125 woodland caribou per year are harvested in the Mackenzie Barrens/Macmillan Pass area by First Nations harvesters and NWT resident hunters. Environment Canada estimated that about 300 caribou per year are harvested in the NWT and about 100 to 200 per year in Yukon from the Redstone Herd. There is concern that the current harvest level may be unsustainable (Environment Canada 2011). Consistent with woodland caribou management throughout Yukon, Government of Yukon changed *Hunting Regulations* in January 2012 so that only bulls from the Redstone Herd may be harvested by licensed hunters within the season ending October 31 (Government of Yukon 2012).

The Executive Committee expects an increase in woodland caribou harvest as a result of the proposed year-round opening of the North Canol Road for the duration of the Project, as it will allow access to critical habitat areas for the herds. Because of the limited information on the populations of the woodland caribou herds using the area and the current harvest levels, it is challenging to determine if an increase in caribou harvest is sustainable to the herds. However, due to the relatively small size of the five herds using the area and the Species of Special Concern status of woodland caribou, the Executive Committee finds it important to consider the effects of the Project on the sustainability of the caribou herds.

Moose

NTC identifies that induced hunting due to increased year-round road access may cause moose injury or mortality. Historical moose harvest data for Game Management Subzones (GMS) 435, shows evidence of increased hunting pressure due to the Nidd Road construction and use in the 1980s. From 1979 to 1982, moose harvest from GMS 435 averaged 1.46 per annum. The Nidd Road was constructed in 1983. From 1983 to 1988 the average moose harvest from GMS 435 was 9.86 per annum. From 1989 to 1994 the moose harvest averaged at 2.54 moose (YOR 2012-0060-037-1). This data supports the conclusion that the construction and use of the Nidd Road was an associated factor for increased moose harvest. Year-round access all the way to the Yukon-NWT border due to opening the North Canol Road in winter is expected to contribute to an increase in moose harvest.

Bear

Government of Yukon indicated in their comments that an increase in access due to opening the North Canol Road year-round will likely result in an increased harvest of grizzly bear, especially during the spring bear hunting season (YOR 2008-0304-278-1).

The Executive Committee agrees that harvesting rates for most species, including grizzly and black bear, are likely to increase as a result of increased year-round road access.

Significance Determination

Induced hunting may increase the harvest rates of game species. Studies have shown a correlation between harvest rates in areas that have new access roads/corridors. (Theobold et al. 1997; Anderson et al. 2011; Swotalski et al. 2011). The Proponent proposes to minimize this impact by committing to mitigations such as a hunting prohibition for mine employees and contractors. The year-round use of the North Canol Road is not expected to result in a major increase in induced mortality since the road is already open for the majority of the hunting season for licensed hunters. The increase in induced mortality is mainly expected during the winter and spring periods as the North Canol Road will be open year-round as a result of the Project.

It is currently unclear what the harvest rate or sustainable threshold is for the Redstone Caribou Herd and other herds using the area due to limited baseline information available. The Project is planned year-round for 16 years, therefore the duration of the effects is considered to be long-term at a wildlife biological scale. The magnitude of induced hunting due to the Project extends to all of the big game species found in the area, woodland caribou, moose, Dall sheep and black and grizzly bears. The Project will also result in an increase in the duration of the hunting season due to the year-round access to the area. The extent of the Project includes the 209 km of the North Canol Road, which allows access to a much larger areas on each side of the road and in NWT.

The Executive Committee has determined the Project will result in significant adverse effects to wildlife due to induced hunting pressures that can be mitigated by the Proponent’s commitments and the terms and conditions set out in section 8.3.1 above.

8.3.4 Vehicle-Wildlife Collisions

NTC identifies vehicle-wildlife collisions from the use of the North Canol Road and the road to the Hess River Tributary as a direct cause of wildlife injury or mortality for woodland caribou, moose and bears. The Executive Committee recognizes that vehicle-wildlife collisions have the potential to impact a number of different species. Vehicle-caribou collisions may happen during summer while woodland caribou are foraging, or during spring and fall migration in and out of the project area and along the North Canol Road area.

Vehicle-wildlife collisions cause injury or death to caribou, moose, Dall sheep and bear and may increase due to the North Canol Road being open year-round. Government of Yukon provided an example of vehicle-caribou collision estimates for the Little Rancheria and Horseranch caribou herds in the Alaska Highway area. This estimate concluded that the annual mortality rate due to vehicle collisions was between one and two percent of the total population of these herds. Government of Yukon expects an increase of caribou mortality due to collisions with project-related traffic (YOR 2008-0304-278-1). The Executive Committee acknowledges that even though the Alaska Highway experiences a much larger volume of traffic, the North Canol Road will result in a significant increase in traffic that could increase wildlife mortality.

NTC commits to a number of mitigations to reduce or eliminate the effects of project activities on wildlife. For example, NTC commits to apply speed limits and post signs near sensitive wildlife habitat and provide employee training illustrating the importance of following wildlife mitigation measures.

Significance Determination

The year-round use of the North Canol Road is likely to result in an increase in wildlife mortality. Collisions may not necessarily occur between project-related traffic only but also from other users of the area who may not be as informed as regular users of the North Canol Road.

Vehicle-wildlife collisions are uncommon at present on the North Canol Road. It is difficult to determine how much impact vehicle-wildlife collisions will have on wildlife populations. However, the Executive Committee agrees with other parties that an increase in collisions is likely due to the Project. The duration of the Project is planned for 16 years; therefore, an increase in wildlife mortality over that period can be significant.

The magnitude of the effects varies for each wildlife species and also at a demographic level. For example, a collision with an older or sick animal will not affect a population as much as a collision with a female with young. This effect would especially impact populations of species that are low or vulnerable. Moose, grizzly bear and caribou have been identified as important species for that area that could be affected the most by impacts to their respective populations. Woodland caribou and grizzly bear are considered species of special concerns and moose have a high harvest rate in the Game Management Subzones along the North Canol Road.

The extent for potential of vehicle-wildlife collisions includes the 209 km of North Canol Road from Ross River to the mine site as well as the road to the Hess River South Tributary.

The Executive Committee has determined that the Project will result in significant adverse effects to wildlife due to wildlife-vehicle collisions that can be mitigated by the Proponent's commitments and the following terms and conditions

Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on wildlife.

To minimize the risk of vehicle-wildlife collisions:

46) During the winter months, the Proponent shall create breaks in the snow banks created by snow plowing along the North Canol Road to allow moose, and other wildlife, egress off the road to avoid vehicle-wildlife collisions and undue stress.

8.4 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after implementing mitigation measures. The potential residual effects of the Project on wildlife and wildlife habitat include habitat loss, wildlife disturbance and avoidance and increased rates of mortality through induced hunting and vehicle-wildlife collisions. These residual effects may occur along the North Canol Road and around the mine site and staging areas, the road to the Hess River South Tributary, the Macmillan Pass Aerodrome. Figure 26 and Figure 27 in section 5.6 describe existing projects and infrastructure within a 20 km radius of the Project. Residual effects are addressed in the sections above and are expected to decrease upon project completion.

Generally, activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance and potential upgrade of the North Canol Road. While the level of quartz exploration has risen in recent years (four exploration proposals in the area since 2011), the activities are widely dispersed within the 20 km radius and along the North Canol Road. Exploration activities have a lower residual effect on wildlife as generally they have a small footprint, have a short duration, and only occur seasonally.

The Redstone Caribou Herd uses a discrete range crossing the Yukon-NWT border. The Executive Committee has relied heavily on the findings of Environment Canada in the report *Management Plan for the Northern Mountain Population of Woodland Caribou*. The Plan describes the current state of knowledge of the herd, projects and infrastructure within the herd's range that may be affecting herd population and a projection of population trends. The following is an excerpt from the report:

> *The North Canol Road provides limited access with some associated hunting pressure. About 300 caribou per year are harvested in the NT and about 100-200 per year in YT. There is concern that this may be too much hunting pressure given that population size and trends are unknown. Local knowledge suggests hunting pressure may be increasing due to decreasing barren-ground caribou populations. There has also been increased seismic exploration in NT and there are mineral interests at MacMillan Pass. The development plan for the MacTung property at MacMillan Pass aims for mine production in 2012, although delays are likely. Plans to upgrade the Canol Road in YT may lead to increased harvest pressures and disturbance due to*

> *construction and transportation of ore. Survey respondents identified concerns about habitat destruction and overhunting on the Canol Road. Additionally, caribou in proximity to the Prairie Creek mine in NT are thought to be part of the Redstone herd. The mine is surrounded by the expanded Nahanni National Park Reserve. The Reserve is currently permitted for exploration and development of zinc, lead and silver, but permits for mine operations are pending. Amendments to the Canada National Parks Act allow for a mining access road, storage sites and other facilities connected with that road to be build within the national park to the Prairie Creek Area.* ***As once-remote areas become less remote, increased monitoring and management will be needed for the herds found in both the NT and YT regions of the Mackenzie Mountains.*** *Some of the herd's range is protected by the new Nahanni National Park Reserve boundary. The proposed Naats'ihch'cho National Park will protect an additional part.* ***[Emphasis added]***
>
> (Environment Canada 2011)

The Executive Committee agrees with Environment Canada's conclusion that as remote areas becomes increasingly accessible and development activities increase, it is important to better understand the population and health of the herd and key habitat areas the herd relies upon. The Executive Committee has recommended increased monitoring and development of adaptive management plans of the caribou herds, as well as moose, Dall sheep and bear populations using the area as a term and condition to mitigate significant adverse environmental effects.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on wildlife. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on wildlife.

9.0 HEALTH AND SAFETY

This section addresses potential effects of the Project on health and safety. An understanding of the environmental and socio-economic setting for health and safety is provided, and potential adverse effects are characterized and discussed in the context of the proposal, stakeholder comments, relevant legislation and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on health and safety.

9.1 OVERVIEW

This section addresses potential effects of the mine site and the use of the North Canol Road on health and safety of employees, contractors and the public. The section is made up of five parts.

- Mine site terrain hazards
- Geotechnical stability of dry-stacked tailings facility (DSTF) and reservoir dam
- Health and safety related to mine infrastructure and activities
- Health and safety related to camps
- Transportation health and safety

9.2 MINE SITE TERRAIN HAZARDS

Terrain hazards or geomorphological processes that might affect the Project include rockfalls, debris slides, gully erosion and avalanches. North American Tungsten Corporation Ltd. (NTC) provided terrain and geomorphological process descriptions and mapping as part of their project proposal (YOR 2008-0304-032-2 and 2008-0304-099-1). NTC identified five geomorphological processes that are active in the study areas including: rockfalls, debris slides, debris flows, avalanches, and gully erosion. The mine site area has been identified as typical of northern alpine mountainous terrains.

Gully erosion is active in thick moraine deposits and most active during spring runoff. Gully erosion is indicative of the presence of erodible material such as till, colluviums and weathered bedrock. Debris slides may occur when a mass of glacial drift or colluviums become detached from hillsides and move rapidly downslope by sliding along a shear plane. A debris flow may be created as a result of a debris slide entering a stream channel and becoming a viscous material consisting of mud, sand stones and or organic debris. Rockfalls result from rapidly drained bedrock of steep (i.e. greater than 70 percent) to moderately steep (i.e. 50 to 70 percent) slopes. Slopes prone to rockfall are also prone to avalanching.

Terrain hazards introduce stability risks to transportation and mine site infrastructure such as the Mactung Spur Road, mill, accommodations complex, DSTF, and reservoir dam. The destabilization of transportation and mine site infrastructure also introduces safety risks to mine site workers by:

- constricting supply routes, personnel travel routes and emergency access to the mine site;
- damaging mine site infrastructure that supports the health and safety of staff; and

- damaging mine site infrastructure that causes the release of materials into the environment that may be hazardous to mine staff (e.g. hydrocarbon spill due to rockfall).

The Executive Committee acknowledges commitments made by the Proponent to minimize terrain hazard risks to human health and safety including providing an Emergency Response Plan as part of the proposal (YOR 2008-0304-070-2) and commitment to develop an avalanche safety program. The Executive Committee also notes that terrain hazards and their effects on human health and safety are regulated through:

- *Quartz Mining Act*
- *Territorial Land Use Regulation*, *Territorial Lands (Yukon) Act; and,*
- *Highways Act*.

The Executive Committee notes that although NTC provides a commitment to develop an avalanche safety program, the plan does not account for the management of other terrain hazards that might be present. The Executive Committee has expanded the requirements of the avalanche safety program to include all terrain hazards that may require management and has also included recommendations to manage periods when the road may be closed as a result of terrain hazards and/or hazard management rendering the road impassable.

The Executive Committee has determined that the Project will result in significant adverse effects to health and safety due to terrain hazards. The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent, compliance with non-discretionary legislation and implementation of the mitigative measures specified by the Executive Committee will effectively eliminate, reduce or control significant adverse effects to human health and safety resulting from terrain hazards.

9.2.1 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental and socio-economic effects of the Project on human health and safety resulting from terrain hazards.

To minimize the risks associated with terrain hazards:

47) The Proponent shall develop a reporting system for users of the access roads to report potential terrain hazard areas (e.g. avalanche, rock fall, debris slide) and actual geomorphologic processes that have the potential to affect human safety. Reports of such observations shall result in appropriate action being taken to limit terrain hazard risks to road users.

48) The Proponent shall provide annual avalanche training and other terrain hazard training to emergency response workers at the Mactung Mine. Contractors utilizing the access road during winter months shall be required to undertake avalanche hazard training and to ensure that vehicles traveling the road have the appropriate radio frequencies.

49) The Proponent shall develop and complete a terrain hazard management plan prior to the start of construction. The terrain hazard management plan for the Mactung Mine shall include:

a) A terrain hazard path atlas for the access road and mine site area detailing the location of rock slide, debris slide, and avalanche paths. This atlas shall also be used to record natural geomorphologic activity on a path by path basis in addition to recording the results of geomorphologic control activities at the site;

b) Establishment of a snow safety program for snow stability assessment;

c) Establishment of a terrain hazard reporting protocol to assist with forecasting efforts;

d) Avalanche, rock slide, and debris slide hazard signage along the access road and signage indicating safe turnout areas;

e) A detailed Emergency Response Procedure for avalanche and other terrain hazards including a list of external specialists (RCMP, SAR, avalanche specialists) that may be contacted to provide additional support during avalanche and other terrain hazard responses;

f) Details on recommended amount and type of avalanche response equipment that should be maintained for an emergency situation;

g) Annual avalanche hazard and response training for emergency response team members; and,

h) Development of road closure and avalanche and other terrain hazard control protocols for avalanche blasting activities and other terrain hazard management activities associated with the Project. Control work will be performed by qualified technicians.

50) The Proponent shall update its Emergency Management Plan, in consultation with Government of Yukon, to include consideration that the access road may be closed for terrain hazard maintenance and/or terrain hazards causing the road to be impassable. The following additional measures shall be included in the finalized Emergency Management Plan:

a) Identification of an alternate method(s) of evacuation if an injury occurs on-site while the access road is not passable;

b) Identification of the storage of and/or alternative modes of transportation for critical supplies used for the maintenance of the camp; and

c) Identification of operational changes that might be required as a result of supplies and/or personnel not being able to be transported during road closure.

9.3 GEOTECHNICAL STABILITY OF DSTF AND RESERVOIR DAM

The Proponent proposes to construct a DSTF for the disposal of tailings. The DSTF will be constructed from compacted tailings on currently sloping ground. The facility will have an overall slope angle of 4 H: 1 V and will be up to 50 m in height. The top of the DSTF will be approximately 600 m long and 250 m wide.

The tailings will be placed in 600 mm lifts and compacted to 95 percent Standard Proctor maximum dry density. Placement methods will ensure that the tailings are unfrozen during the life of the mine. The DSTF will be designed to withstand a 1:500 year seismic event. (YOR 2008-0304-018-2)

In its adaptive management plan, NTC identifies that should underground backfilling not be undertaken, the DSTF can be redesigned to accommodate 4.5 million cubic metres of material. The expanded DSTF would maintain the same overall 4 H: 1 V slope angles, however additional benches up to 10 m high would be constructed. (YOR 2008-0304-300-1)

NTC proposes to construct the reservoir dam to maintain the reservoir for water management purposes. The reservoir dam will be approximately 315 m long, 35 m high and will have a 25 m wide crest. The upstream face will be 3 H: 1 V with a 5 m wide toe buttress and a 4 H: 1 V slope below the buttress. The downstream face will be 2.5 H: 1 V. There will be an upstream geosynthetic liner with a collection system. The dam will have a superstructure comprised of sand and gravel. The reservoir dam has been classified by NTC as a "Significant" hazard based on the Canadian Dam Safety Guidelines.

NTC provided three geotechnical reports outlining geotechnical aspects of the reservoir dam and DSTF titled:

- "Mactung Preliminary Geotechnical Investigation" prepared by EBA Engineering Consultants Ltd. dated January 2008; and
- "Mactung Supplemental Geotechnical Investigation Near MacMillan Pass, Yukon" prepared by EBA Engineering Consultants Ltd., dated June 2009.
- "Mactung December 2, 2013 YESAB Supplementary Information Request Response to R 4a Through e" prepared by EBA Engineering Consultants Ltd., dated December 6, 2013

NTC conducted a reservoir dam stability analysis based on the preliminary design using the commercially available two-dimensional, limit equilibrium software SLOPE/W. (GEO-SLOPE International Ltd. version 7.22) and concluded that:

> *The preliminary design meets the minimum recommended factors of safety presented in the CDA Guidelines; however, further analyses will be required during the detailed design phase. In particular, seepage and rapid drawdown analyses have not been completed. These cases may impact construction and/or operational practices, but should not be determining factors in overall stability of the dam.*
>
> (YOR 2008-0304-323-1)

NTC also conducted a DSTF stability analysis based on the preliminary design in a similar manner as the reservoir dam. The *British Columbia Interim Guidelines for Investigation and Design of Mine Dumps* (Waste Rock Design Manual) recommended factors of safety were adopted for the analysis. NTC found that the preliminary design meets the minimum recommended factors of safety.

To assist the Executive Committee in its assessment, EcoMetrix and Terraprobe reviewed the geotechnical stability analysis of the reservoir dam and DSTF. Terraprobe confirmed in the Technical Meeting held December 12, 2013 that the preliminary analysis was reasonable and that they were satisfied with the approach described (YOR 2008-0304-313-1).

The Executive Committee concludes that geotechnical stability of the reservoir dam and DSTF will not result in significant adverse effects. However, the Executive Committee recognizes that this analysis is preliminary in nature and that the analysis will be updated when site-specific data is available during detailed design. Due to the conservative nature of the preliminary analysis assumptions, it is likely that the final design will meet or exceed the minimum recommended factors of safety.

9.4 HEALTH AND SAFETY RELATED TO MINE INFRASTRUCTURE AND ACTIVITIES

The Project involves activities and infrastructure that have inherent health and safety risks to on-site workers. Explosives, large transportation equipment, large rock processing machinery as well as hazardous materials will be used during project construction and operations. Potential effects to health and safety are related to accidents and malfunctions and can range from minor injuries, injuries with long-term recovery, disability, or death. These could result from unsafe practices by mine site workers, poor emergency response, inadequate monitoring of facilities and infrastructure as well as failure of major mine components.

Although potential health and safety effects due to site hazards are considered significant, the Proponent has developed measures to address the safety of on-site workers and has developed an Emergency Response Plan. These measures are consistent with best management practices and regulated through various legislation. In determining the significance of the above noted effects, the Executive Committee has considered the following non-discretionary legislation:

- *Occupational Health and Safety Act, Occupational Health and Safety Regulations*;
- *Public Health and Safety Act and Regulations*;
- *Quartz Mining Act* and *Quartz Mining Land Use Regulations.*

The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent and compliance with non-discretionary legislation will effectively eliminate, reduce or control significant adverse effects to health and safety related to mine infrastructure.

9.5 HEALTH AND SAFETY RELATED TO CAMPS

This section addresses concerns related to health and safety associated with the use and daily operation of the camps. Safety issues related to wildlife conflicts are addressed in section 8.0 Wildlife.

A temporary camp at the Macmillan Pass Aerodrome staging area will accommodate 49 workers during the construction phase of the Project. The buildings and equipment used at the temporary camp will be moved to the mine site camp upon completion of construction. The mine site accommodations complex will hold up to 250 people during construction of the mine site and approximately 150 people during the operations phase of the Project.

NTC proposes to use modular units to construct a kitchen, dining room, dorms, washrooms with showers, a sewage treatment plant, a potable water treatment facility and distribution system, and a recreation complex. Potable water, sewage treatment and power systems will be designed to accommodate the maximum camp capacity. During construction, water will be trucked to the potable water treatment facility until the fresh water intake pumps and pipeline are operational. The treated

sewage at the main camp will be discharged into the reservoir. Heat for the accommodations complex will be generated using propane furnaces. Solid waste will be incinerated using a propane furnace.

NTC has indicated that fuel, equipment, explosives and other chemicals will be staged at various locations during the lifetime of the Project and that security measures are planned and addressed in the Emergency Response Plan. NTC has also identified a number of mitigations to address some of those concerns such as fencing the staging areas and camps, as well as gating the access to the mine site.

Government of Yukon, Department of Health and Social Services noted that prior to camp construction an approval is required from Environmental Health on all aspects of the camp. In the Government of Yukon submission, Health and Social Services states:

> *What is needed now are comprehensive plans for all the planned camps that include all the details of the following:*
>
> 1. *Sewage disposal systems and which require water license and which require approval under the Sewage Disposal Regulations of the Public Health and Safety Act.*
> 2. *Bunkhouses*
> 3. *Kitchen/ dining areas*
> 4. *Recreational facilities*
> 5. *Potable water system to include source, distribution, treatment and quality monitoring.*
>
> (YOR 2008-0304-131-1)

Government of Yukon identified the following regulations and approvals that the camp must be in accordance with including:

- *Occupational Health and Safety Act, Occupational Health and Safety Regulations*
- *Environment Act*
  - *Sewage Disposal Regulations*
  - *Camp Sanitation Regulations*
- *Canadian Drinking Water Guidelines*

The Executive Committee recognizes that NTC will, prior to construction of the camp, be required to submit comprehensive plans for camp infrastructure in accordance with the *Sewage Disposal Regulations, Camp Sanitation Regulations*, and *Canadian Drinking Water Guidelines*.

The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent and compliance with non-discretionary legislation will effectively eliminate, reduce or control significant adverse effects to health and safety related to camps.

9.6 TRANSPORTATION HEALTH AND SAFETY

The North Canol Road is used by a variety of users during the summer months who may not be aware of the operation of a new active mine in the area. The Project will require large trucks to transport materials,

ore and fuel to and from the mine site on the North Canol Road, Campbell Highway and Alaska Highway. NTC has indicated that up to 10 round-trips per day are expected during the construction phase and approximately four round-trips per day during the operation phase.

As most of the trips will involve large trucks typically loaded with construction material, equipment, fuel and ore, it is expected that maneuverability will be limited. In addition to these limitations, the increase in traffic from the Project will also result in an increase to the risk of accidents and collisions with users who may not expect increased traffic in remote areas.

Common factors contributing to single vehicle accidents include the avoidance of wildlife and debris, excessive vehicle speed for the road conditions, driver fatigue, weather, poor drainage/glaciation, narrow lanes and shoulders and sharp curves. Multi-vehicle accidents are likely to have the greatest adverse effect on health and safety. These accidents can be decreased by driver knowledge of other vehicles on the access roads (e.g. through radio use), improved line of sight, reduced vehicle speeds, increased pull-outs and better road design /conditions.

Government of Yukon has indicated that, as the body responsible for Yukon highways, the maintenance of the North Canol Road will be performed to the appropriate standards.

The Executive Committee acknowledges commitments made by the Proponent to minimize risks to public use of the North Canol Road. The Executive Committee also notes that the use of the North Canol Road and the effects on public health and safety are regulated through the following legislation:

- *Territorial Land Use Regulation, Territorial Lands (Yukon) Act*
- *Highways Act*
- *Transportation of Dangerous Goods Act*

The North Canol Road is used by several users and will be open year-round due to the Project. While the likelihood of accidents happening is low to moderate, the effects could be significant for those involved.

The Executive Committee has determined that the Project will result in significant adverse effects to health and safety due to transportation on the North Canol Road. The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent, compliance with non-discretionary legislation, and implementation of the mitigative measures specified by the Executive Committee will effectively eliminate, reduce or control significant adverse effects on health and safety related to transportation.

9.6.1 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse socio-economic effects of the Project on public health and safety.

To reduce the risk of collision between vehicles and to inform traveling public of current activities:

51) The Proponent shall install signs, approved by Government of Yukon, Department of Highways and Public Works, that indicate the period of mining activities, including truck traffic, on the North Canol Road.

52) The Proponent shall locate the signs, at a minimum, at the beginning of the North Canol Road, possibly at the ferry crossing and at the Yukon/NWT border.

53) The Proponent shall implement radio communication protocols between its vehicles to inform each other of oncoming traffic. This includes posting the radio frequency used so that other users can monitor traffic.

9.7 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after enacting mitigation measures. The potential of residual effects of the Project on health and safety include risks of terrain hazards, mine site hazards, camp health and safety, and transportation health and safety. Cumulative effects are any residual project effects in combination with the effects of other existing or proposed projects. Figure 26 and Figure 27 in section 5.6 describe existing projects and infrastructure within a 20 km radius of the Project. Generally activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance of the North Canol Road.

Health and safety effects due to terrain hazards, mine site hazards, and camp health and safety are distinct to the mine site and transportation infrastructure and personnel as other projects do not change the inherent risk of terrain hazards, mine site hazards and camp health and safety. The consideration of transportation health and safety has taken into account other road users and, as a result, has already accounted for cumulative effects of other road users.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on health and safety. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on health and safety.

10.0 ENVIRONMENTAL QUALITY

This section addresses potential effects of the Project on environmental quality. An understanding of the environmental and socio-economic setting for environmental quality is provided, and potential adverse effects are characterized and discussed in the context of the proposal, stakeholder comments, relevant legislation and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on environmental quality.

10.1 OVERVIEW

The use of the North Canol Road, the construction and operation of a mine site, staging areas, road to the Hess River South Tributary, and the extension of the Macmillan Pass Aerodrome will result in various effects on the environmental quality of the area for the duration of the Project.

This section will address the effects of the Project on the environmental quality of the project area, specifically:

- Air quality due to air emissions and dust;
- Environmental contamination due to the release of deleterious substances from accidents and/or waste disposal; and,
- Soil erosion and vegetation loss and contamination due to construction and operation of the mine site, the road to the Hess River South Tributary and use of the North Canol Road.

10.2 AIR QUALITY

There are no baseline studies of air quality at the Mactung Mine site. North American Tungsten Corporation Ltd. (NTC) has estimated that air quality at the project area is better than air quality in Whitehorse, the only location in Yukon where air quality is regularly monitored. Air quality in Whitehorse is generally considered good and rarely exceeds levels specified in the National Air Quality Objectives (YOR 2008-0304-019-2).

NTC identified that ambient air quality may be impacted by the Project as a result of:

- developing roads and surface structures through blasting and clearing;
- quarrying and borrowing for construction/foundation materials;
- operations at the mine site, such as crushing, blasting and hauling;
- using diesel and propane fuel for power production and heating;
- burning of waste using a solid waste incinerator;
- transporting equipment and supplies along the Robert Campbell Highway, the North Canol Road and mine access road; and
- transporting equipment, supplies and personnel via air from Whitehorse International Airport to the Macmillan Pass Aerodrome.

The Executive Committee is of the opinion that the concentrated effects on air quality will be caused primarily by mine site construction and operations. Emissions will be produced through the operation of power generators, the use of machinery, the transport of equipment, supplies and personnel and the burning of waste. Dust generation may occur during quarrying, construction and operation of roads, and mine site infrastructure. These activities can reduce ambient air quality and could potentially affect the health of employees and the natural environment if emissions are produced in sufficient quantity.

NTC has included commitments to minimize effects to air quality such as adhering to an air emissions permit, efficient use of ground transportation and the application of dust suppressants during dry conditions or high activity periods. NTC concludes that, the effects to air quality will be mitigated so they are not significant because of the small scale of the Project, the relative isolation from other source pollutants, adherence to regulations, and efficient use of transportation.

The Government of Northwest Territories (GNWT) noted in their comments on the proposal that "no quantitative values have been presented to indicate anticipated volumes of diesel to be consumed for transport and power generation, or figures of anticipated traffic volume on the haul roads, or the type of incinerators and associated emission projections, it is an unsubstantiated conclusion" (YOR 2008-0304-145-1).

10.2.1 Significance Determination

Effects to air quality as a result of waste incineration and fuel emissions from power generators and transport could result in health and safety hazards to employees, wildlife and the environment. Poor incineration practices or the open burning of waste can produce and increase the release of numerous toxic pollutants to the air, such as dioxins and furans, that lead to direct and indirect hazards to human and environmental health. Contaminants in the air can be inhaled by those closest or downwind from the source and can be deposited on land and water. Dioxins accumulate in animal fat and fish, which are then passed through meat to humans and wildlife that consume them.

The duration of effects to air quality will generally be limited to active operation such as vehicle traffic and burning of waste for the duration of the Project.

These effects will be observable and noticeable due to smell and/or smoke around camps, roads and mine site. The effects will be generally localised near the activities although windy conditions may spread the effects further.

The Executive Committee has determined that the Project will result in significant adverse effects to environmental quality due to Project air emissions. There is some uncertainty about the effects of the Project on air quality given the unknown quantities of fuel consumption and methods of waste incineration. As a result, the Executive Committee has determined that additional mitigation measures are necessary to mitigate significant adverse effects.

10.2.2 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on air quality.

To minimize the effects of the Project on air quality:

54) The Proponent shall develop an Air Quality Management Plan and receive regulatory approval prior to commencement of site works. The Air Quality Management Plan shall include:

    a) A quantification of projected emissions presented and modeled using an established air quality model to predict local and regional dispersion, resulting ambient concentrations, and deposition of pollutants;

    b) A description of specific mitigation and adaptive management strategies and monitoring methods to be used and a plan for implementation to minimize emissions;

    c) Details regarding the anticipated dust deposition range so that suppression mechanisms can be appropriately established. An estimate of calcium chloride (CaCl) or alternative product usage should be presented in order to determine potential adverse effects to the soil, vegetation, surface and groundwater;

    d) Quantification of any potential links between predicted air quality and subsequent impacts to other valued components such as water quality, fish, wildlife and human health;

    e) Potential sources and quantities of contaminants from the handling and transport of ore and concentrate, and their expected deposition range; and

    f) Description of specific mitigation and adaptive management strategies, and monitoring methods to minimize contamination by fugitive dust from the handling and transport of raw ore and concentrate, the dry-stacked tailings facility, and the processing operations.

55) The Proponent shall develop and implement a plan for the monitoring of plant metal uptake and toxicity. The sampling locations should take into account prevailing winds and water flows.

10.3 ENVIRONMENTAL CONTAMINATION

Chemical contaminants associated with the Project include diesel as well as coolants, lubricants, solvents and cleansers. Hydrocarbons could be released into the environment, contaminating the surrounding environment due to spills, leaks, accidents, malfunctions, and normal use of equipment throughout the duration of the Project. These activities may result in fuel and other contaminants entering the environment, which could persist for years.

Deleterious substances, specifically chemical contaminants, can cause immediate death of vegetation, fish and wildlife. Chemical contaminants in a sub-lethal dose can affect the long-term survival and/or reproductive success of organisms. Biomagnification of chemical contaminants can result in effects that may take a long time to be observed and affect organisms throughout the food web, including humans. Waste petroleum products have the potential for environmental degradation through unauthorized dumping or burning, improper transportation, inadequate reprocessing or through spillage/leakage.

10.3.1 Significance Determination

Due to the long-term use of camps, there is potential for environmental contamination from waste, if not disposed of properly. NTC has indicated that camp waste will be disposed of by incineration. The

Executive Committee also notes that most effects on the environment as defined in this section are regulated through the following legislation:

- *Environment Act*
    - *Special Waste Regulations*, Part 9 (Release of Contaminants) and Part 11 (Spills);
    - *Solid Waste Regulations*; and
    - *Spills Regulations* sections 2 through 4, respecting spills of substances.

NTC and its contractors will be storing thousands of litres of petroleum products at various locations during the Project's lifetime. The storage of petroleum products is a common occurrence in Yukon that has had varied degrees of success over the years. This practice is legislated and monitored more consistently today, which ensures safer results regarding environmental protection. Even though the volume of petroleum products and chemicals is considered high, best management practices and mitigations identified by the Proponent in combination with the existing legislation is considered sufficient to control the potential adverse effects from petroleum storage.

The project proposal indicates that large waste items will be buried in the DSTF (YOR 2008-0304-019-2). The Executive Committee notes that the DSTF is not designed for the disposal of waste other than tailings, therefore the inclusion of other type of waste could destabilize the facility and have unintended consequences. The Executive Committee has determined that the Project will result in significant adverse effects to environmental quality due to waste disposal and that additional mitigation measures are necessary.

10.3.2 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse environmental effects of the Project on environmental quality resulting from the disposal of waste.

To minimize risks of compromising the DSTF:

56) The Proponent shall only dispose tailings and waste rock into the dry-stacked tailings facility.

10.4 Soil Erosion and Vegetation Loss

Vegetation clearing will occur primarily during the construction phase of the Project. NTC states that the total area to be cleared for the mine footprint is approximately 53 ha overall with 3.0 ha for buildings, 10.3 ha for the reservoir dam and reservoir, and 29.2 ha for the DSTF and borrow area. Expansion of the Macmillan Pass Aerodrome (approximately 5 ha) and clearing for the three staging areas along the North Canol Road (approximately 90 ha total) will result in an additional 95 hectares of land to be cleared. Due to the proximity of creeks and streams to several project activities (i.e., the use of the North Canol Road, the construction of a mine site, staging areas and road to Hess River South Tributary, and the extension of the Macmillan Pass Aerodrome) adverse effects to aquatic resources may occur as a result of soil erosion.

Tetra Tech EBA Engineering Consultants Ltd (EBA) conducted three vegetation baseline studies during the years 2006-2008 within the local study area (LSA) that includes the entire mine site and surrounding area. EBA completed ecosystem land classification surveys, rare plant surveys and trace element concentration surveys as part of the baseline studies. For more information about these baseline studies see section 4.10 of this report. RRDC has identified in its comments that the project area is used to harvest medicinal plants and the quality of the medicine is reduced by the presence of contaminants (YOR 2008-0304-0264-1).

NTC considered the following valued components in the project proposal as part of the project effects on vegetation.

- Rare and endangered plant species and communities;
- Wetlands and riparian ecosystems;
- Old growth forest ecosystems; and
- Sensitive alpine ecosystems.

NTC considered the effects of the Project on vegetation communities taking into account clearing and construction, operation, and decommissioning of each of the mine components including mine infrastructure, DSTF, borrow area, reservoir dam, reservoir and aerodrome.

Clearing and development of the staging areas require the removal and storage of the vegetative mat for future reclamation of the site. Such earthworks may alter surficial geology and change existing drainage and runoff patterns. Land clearing and construction activities may result in increased soil slumping and erosion, particularly if activities are occurring on steep slopes, near watercourses or in areas containing permafrost. Melting and degradation of existing permafrost may lead to soil clumping and/or retrogressive thaw slides. Exposed root and seed stocks may be damaged by seasonal freezing and thawing which can deteriorate the quality of seed stocks as well as degrade soil stability.

NTC has indicated that the Macmillan Pass Aerodrome expansion will require stabilization work to the south-west corner of the aerodrome. This work will consist of engineered erosion control measures within the high-water mark, including the use of rip-rap, and will be designed to withstand a 200-year event.

Areas susceptible to compaction of vegetation by personnel include lichen dominated alpine habitat. Winter road maintenance activities such as the application of salts and piling snow will have effects on those vegetated areas immediately adjacent to the mining roads and mine site. NTC assumed that a 200 m disturbance buffer may be affected by dust deposition.

10.4.1 Significance Determination

Certain effects on soil and vegetation, such as dust deposition due to traffic, will occur for the duration of the Project. Other effects, like melting permafrost due to clearing, have the potential to persist for a longer period. Project effects such as soil erosion and dusty conditions are generally observable. These effects also occur naturally in the project area but will be enhanced by project activities if not mitigated.

The extent of the effects on soil and vegetation includes the 200 m buffer along the North Canol Road and around the mine site, staging areas, the road to the Hess River South Tributary and the Macmillan Pass Aerodrome. These effects are more likely to be adverse during the summer months or when the ground is not frozen.

NTC commits to use best practices to control sediment-related effects on the environment. The Executive Committee acknowledges commitments made by the Proponent to minimize effects to environmental quality. The Executive Committee also notes that effects on the environment as defined in this section are regulated through the following legislation:

- *Quartz Mining Act, Quartz Mining Land Use Regulation*, Schedule 1, Operating Conditions:
    - Parts A and B, respecting the removal and re-establishment of the vegetative mat;
    - Part C, regarding erosion control and permafrost and prohibiting impacts that result in long-term erosion.

The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent and compliance with non-discretionary legislation will effectively eliminate, reduce or control significant adverse effects on environmental quality due to soil erosion and vegetation loss.

10.5 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after implementing mitigation measures. Cumulative effects are any residual project effects in combination with the effects of other existing or proposed projects. The potential residual effects of the Project on environmental quality include air quality emissions from other projects, spills from other projects and soil and vegetation loss due to clearing from other projects. Figure 26 and Figure 27 in section 5.6 describe existing projects and infrastructure within a 20 km radius of the Project. Generally, activities include mining exploration work, infrastructure development to support exploration, and the ongoing maintenance of the North Canol Road. While the level of quartz exploration has risen in recent years (four exploration proposals in the area since 2011), the activities are widely dispersed within the 20 km radius. Exploration activities have a local residual effect on environmental quality as generally they have a small footprint, have a short duration, and only occur seasonally.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on environmental quality. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on environmental quality.

11.0 HERITAGE RESOURCES AND TRADITIONAL LAND USE

This section addresses potential effects of the Project on heritage resources and traditional land use. A description of the environmental and socio-economic setting for heritage is provided. Potential adverse effects are characterized and discussed in the context of the proposal information, stakeholder comments, relevant legislation, and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on heritage resources and traditional land use.

11.1 OVERVIEW

YESAA defines heritage resources as:

a) a moveable work or assembly of works of people or of nature, other than a record only, that is of scientific or cultural value for its archaeological, paleontological, ethnological, prehistoric, historic, or aesthetic features;

b) a record, regardless of its physical form or characteristics, that is of scientific or cultural value for its archaeological, paleontological, ethnological, prehistoric, historic or aesthetic features, or;

c) an area of land that contains a work or assembly of works referred to in (a) or an area that is of aesthetic or cultural value, including a human burial site outside a recognized cemetery.

The *Historic Resources Act* defines historic resources as:

- a historic site;
- a historic object; and
- any work or assembly of works of nature or of human endeavour that is of value for its archaeological, paleontological, pre-historic, historic, scientific, or aesthetic features.

This section will consider the effects of the Project on heritage resources near the mine site, the road to the Hess River South Tributary, the proposed staging areas, and the aerodrome. This section will also consider heritage resources related to traditional land use.

The local area surrounding the Project is rich in historical and cultural significance and this contributes to the potential for heritage resources as defined above. The Project is located within the Ross River Dena Council (RRDC), Liard First Nation and First Nation of Nacho Nyak Dun traditional territories. Natural resources in this region have been used for thousands of years. Dena people continue to use traditional camps, trails, hunting and fishing areas, berry patches, and rivers in the area.

Land-based activities and ground disturbance may unintentionally encounter heritage resources and cause adverse effects. The footprint of the mine site will undergo substantial ground disturbance during the initial construction period and any heritage resources not identified prior to construction may be disturbed, damaged or destroyed.

11.2 HERITAGE RESOURCES – MINE SITE AND ROAD TO HESS RIVER SOUTH TRIBUTARY

11.2.1 Evaluation of Baseline Information

The Proponent has made reasonable efforts to understand the presence and potential for heritage resources in relation to the project area. Points West Heritage Ltd. (PWH) conducted heritage studies in 2007 and 2008 on behalf of North American Tungsten Corporation Ltd. (NTC). The studies considered the archeological potential at the mine site. PWH also conducted heritage impact assessments in areas of moderate or high archeological potential that overlap with the proposed mine site footprint. PWH concluded that the mine site footprint would not have significant adverse effects to archeological resources (YOR 2008-0304-063-2, 2008-0304-064-2 and 2008-0304-65-2).

The Ross River Elders Oversight Committee has identified that the mine site and road to the Hess River South Tributary have been historically used by the Dena. The Keele and Itsi Peaks have been described as “sacred landmarks” (YOR 2008-0304-264-1). The Ross River Elders Oversight Committee has identified that archeology studies along the Yukon-NWT border near the mine site have identified significant artifacts. It is the Executive Committee’s opinion that the archeological studies conducted by PWH at the mine and the Hess River South Tributary access road may not consider all aspects of heritage resources as defined under YESAA, particularly areas with cultural values.

NTC indicated interest in working with RRDC to develop a Traditional Knowledge Protocol during consultations in February 19, 2008 (YOR 2008-0304-005-2). However, letters received prior to the completion of the Draft Screening Report from the Ross River Elders Oversight Committee indicate that NTC and RRDC had not entered into a Traditional Knowledge Protocol (YOR 2008-0304-230-1, 2008-0304-169-1, 2008-0304-146-1). The Executive Committee recognizes that a member of the Kaska was a participant in the PWH archeological studies. However the role of the participant in the archeological studies is not defined, nor should it be expected that one participant will inform an archeological investigation of all culturally important areas. Finally, in the 2006 study, PWH concludes that:

> *It is recommended that consultation with interested or knowledgeable First Nations be conducted. Consultation and any traditional knowledge that may be collected should be incorporated into future studies to assist in the discovery and assessment of archaeological resources.*
>
> (YOR 2008-0304-063-2)

In October 2012, NTC and RRDC entered into a Traditional Knowledge Protocol Agreement (YOR 2008-0304-284-1). The Executive Committee understands a draft traditional knowledge report was shared with NTC, however, RRDC indicated in October 2013 that issues raised by RRDC in the Ross River community meeting held November 2012 and in the draft traditional knowledge report were not addressed by NTC (YOR 2008-0304-308-1).

At the Ross River community meeting held October 29, 2013, NTC requested a delay in the Executive Committee’s determination of the adequacy of the supplemental information provided by NTC on October 15, 2013. The purpose of the delay was to allow NTC and RRDC to have further discussions to develop a “traditional knowledge implementation document”. On November 20, 2013 a joint NTC RRDC

letter stated that an arrangement had been made to incorporate the concerns of the Ross River Elders Oversight Committee in the design of NTC's Mactung Mine (YOR 2008-0304-319-1). The joint letter explains that the arrangement includes a series of initiatives to give force to recommendations based on traditional knowledge. A follow-up letter received from RRDC on December 19, 2013 indicated that RRDC does not support the withdrawal of water from the Hess River South Tributary nor the location of the camp (YOR 2008-0304-339-1). The opposition to the water source and camp location were based on traditional land use as well as values that may be present at the mine site and along the road to the Hess River South Tributary.

The Executive Committee is encouraged with the ongoing discussions and working relationship between NTC and the RRDC. The relationship may be a tool to resolve outstanding issues related to the project effects to physical heritage resources and traditional land uses. The Executive Committee also recognizes that the Government of Yukon has the responsibility to manage heritage resources under the *Historic Resource Act* and to consult with First Nations regarding heritage resources discovered.

11.2.2 Effects Characterization

Land clearing and earthworks for the construction of the mine site and the road to the Hess River South Tributary, may result in disturbance, damage, or destruction of items of historical or heritage value. Accessing an area with elevated potential for heritage resources increases the probability of activities adversely affecting a heritage resource.

The Executive Committee recognizes there is an increased potential for discovering heritage resources along the Hess River South Tributary as it is an area identified by RRDC as having high heritage value.

The Executive Committee has considered commitments made by the Proponent to mitigate adverse effects of the Project to heritage resources. In relation to the heritage resources, the Proponent has committed to implementing the following mitigation measures which are also included in the comprehensive Proponent Commitment List in Appendix C:

- *Assessment of areas not previously identified for clearing and excavating.*
- *If the footprint of the project should change to require land-altering activities outside of the previously assessed area, a qualified professional will be retained to conduct an assessment for archaeological resources. The results of this assessment will be submitted for review and approval to the Government of Yukon, Heritage Resources.*
- *Heritage resources encountered will be protected and reported to authorities.*
- *If heritage resources are discovered during operations, NATC will mark and protect the site from disturbance. NATC will contact the appropriate authorities to report the discovery, and will not carry out any activities in the vicinity of the heritage resource until permission to resume activities has been granted.*
- *NATC will communicate heritage resource terms and conditions listed in authorizations to employees and contractors.*

- *If at any point during the construction and operation of the mine and its accessory projects a heritage site is discovered or disturbed, NATC will immediately cease work in the immediate vicinity and contact both the Ross River Dena Council and the Yukon Heritage Branch. No work in the immediate vicinity will resume until the site is assessed.*

Implementing these measures will ensure that physical heritage resources are properly documented prior to any disturbance, damage, destruction or removal from the area. However, there remains a potential that undiscovered physical heritage resources may be disturbed, damaged, or destroyed during construction before realizing the value of the site.

The Executive Committee has considered the requirements of:

- the *Historic Resources Act* – specifically s. 64 (Destruction of historic objects or human remains) and s.71 (Report of findings);
- the *Archaeological Sites Regulation* (O.I.C. 2003-73) under the *Historic Resources Act* – specifically s. 4, regarding historic resources; and
- the *Land Use Regulation* under the *Territorial Lands (Yukon) Act* – specifically s. 9 (Prohibitions).

Adhering to the provisions of the legislation referenced above reinforces the mitigation measures committed to by the Proponent.

The Ross River Dena Council and its members have outlined that the proposed mine site and access road to the Hess River South Tributary have important value and are opposed to the road construction and camp location.

The Executive Committee has determined that the Project will have significant adverse socio-economic effects to heritage resources at the mine site and road to the Hess River South Tributary. These socio-economic effects can be eliminated, reduced or controlled by the application of specified terms and conditions.

11.2.3 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse socio-economic effects of the Project on heritage resources.

To minimize project effects on heritage resources in the mine site area:

57) Prior to construction of the proposed Hess River South Access Road and water pipeline and mine site development, the Proponent shall conduct a detailed heritage resource assessment of the area to be disturbed. The Proponent shall provide the results of the detailed heritage resource assessment to Ross River Dena Council and YG Heritage Resources Branch.

58) The Proponent shall work with Ross River Dena Council and YG Heritage Resources Branch to avoid, and/or minimize effects to any heritage resource of value identified in the heritage resource assessment and/or discovered during all phases of the Project.

59) The Proponent shall engage Ross River Dena Council and Government of Yukon Heritage Resources Branch in all further heritage assessment work that may be required at the project site to ensure that heritage resources of value to the Ross River Dena are clearly understood.

11.3 HERITAGE RESOURCES STAGING AREAS AND AERODROME EXPANSION

11.3.1 Evaluation of Baseline Information

The Project involves the clearing of 95 hectares of land at four different locations to build staging areas, a temporary 49-worker camp and to expand the Macmillan Pass Aerodrome. The use of heavy equipment to conduct the above activities may result in the destruction, disruption or alteration to heritage resources.

Figure 35, Figure 36 and Figure 37 below provided by the Proponent show the proposed locations of the staging areas. The temporary 49-people camp will be located within the staging area near the Macmillan Pass Aerodrome. During the course of the screening, NTC changed the location of one of the staging areas further east from the location of the old village of Ross River to an area of lesser heritage potential.

NTC indicates in its proposal that the staging area at the Macmillan Pass Aerodrome has a low heritage resources potential (YOR 2008-0304-012-2). NTC also states that Government of Yukon confirmed that the aerodrome area has a low potential for heritage resources and that as a result, a heritage assessment would not be required at that location (YOR 2008-0304-084-2). NTC has committed to conduct a heritage assessment for the two staging areas near Ross River before beginning construction (YOR 2008-0304-084-2).

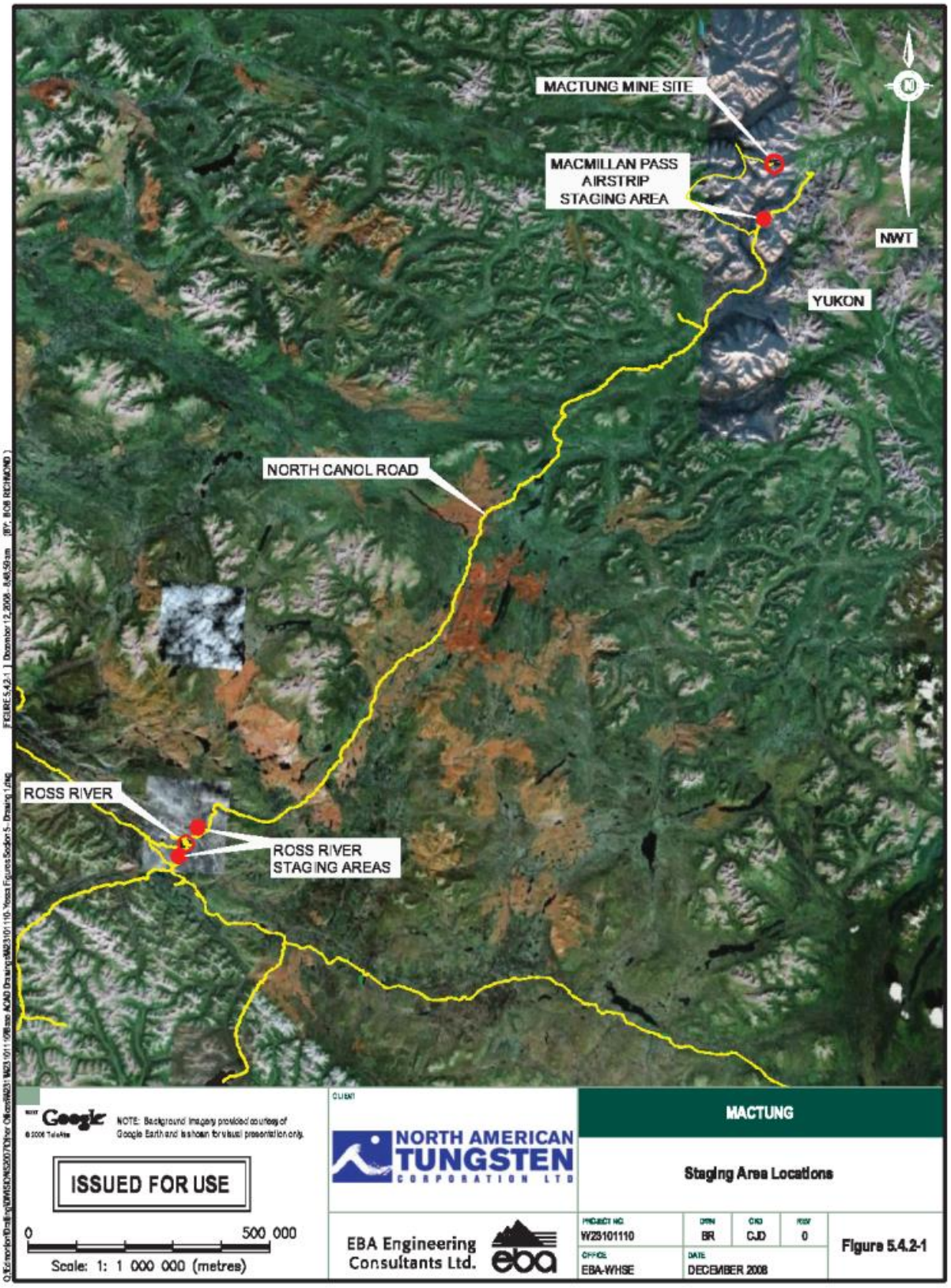

Figure 35 Staging area locations. (YOR 2008-0304-084-2)

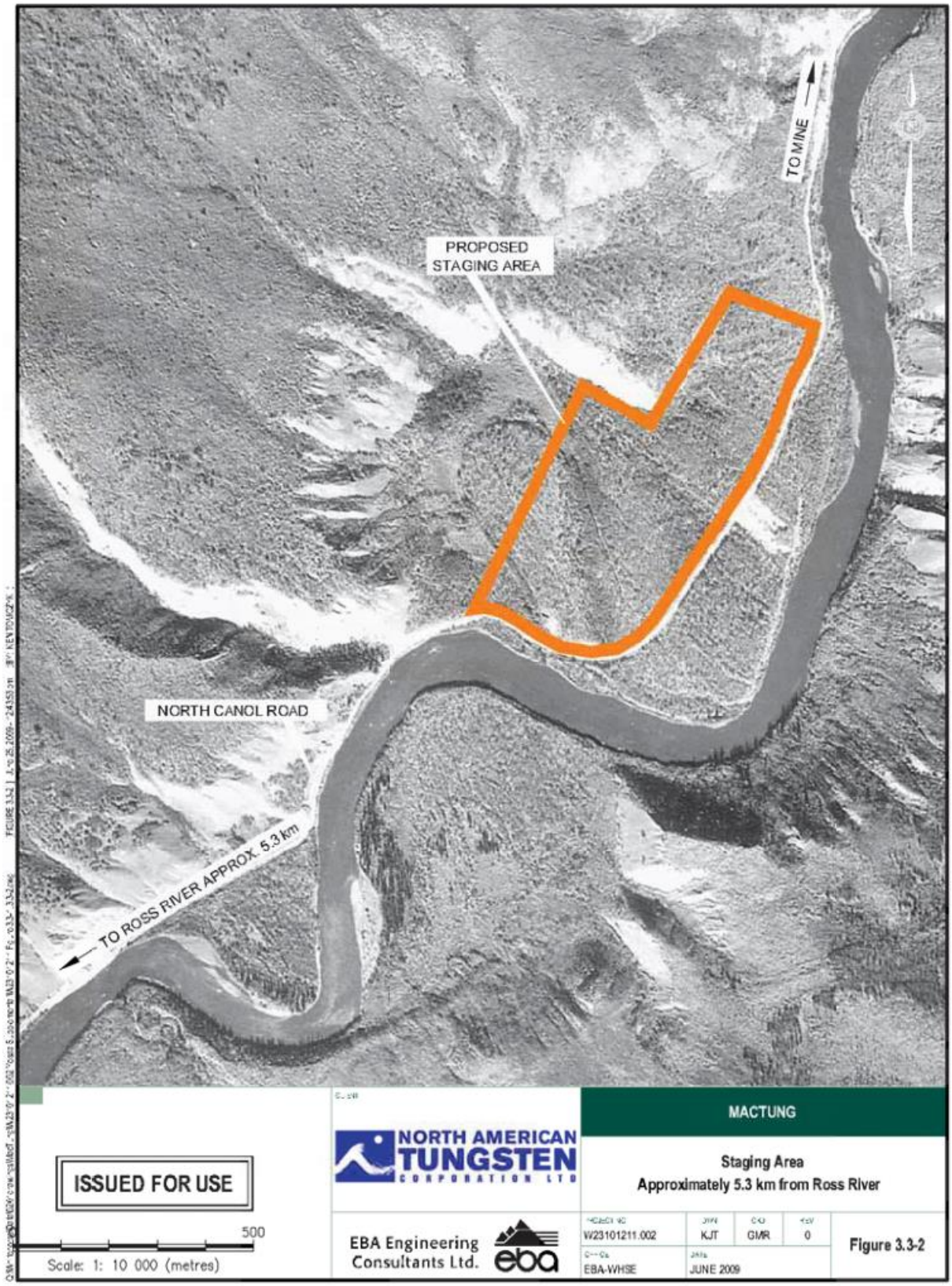

Figure 36 Staging area, approximately 5.3 km from Ross River. (YOR 2008-0304-084-2)

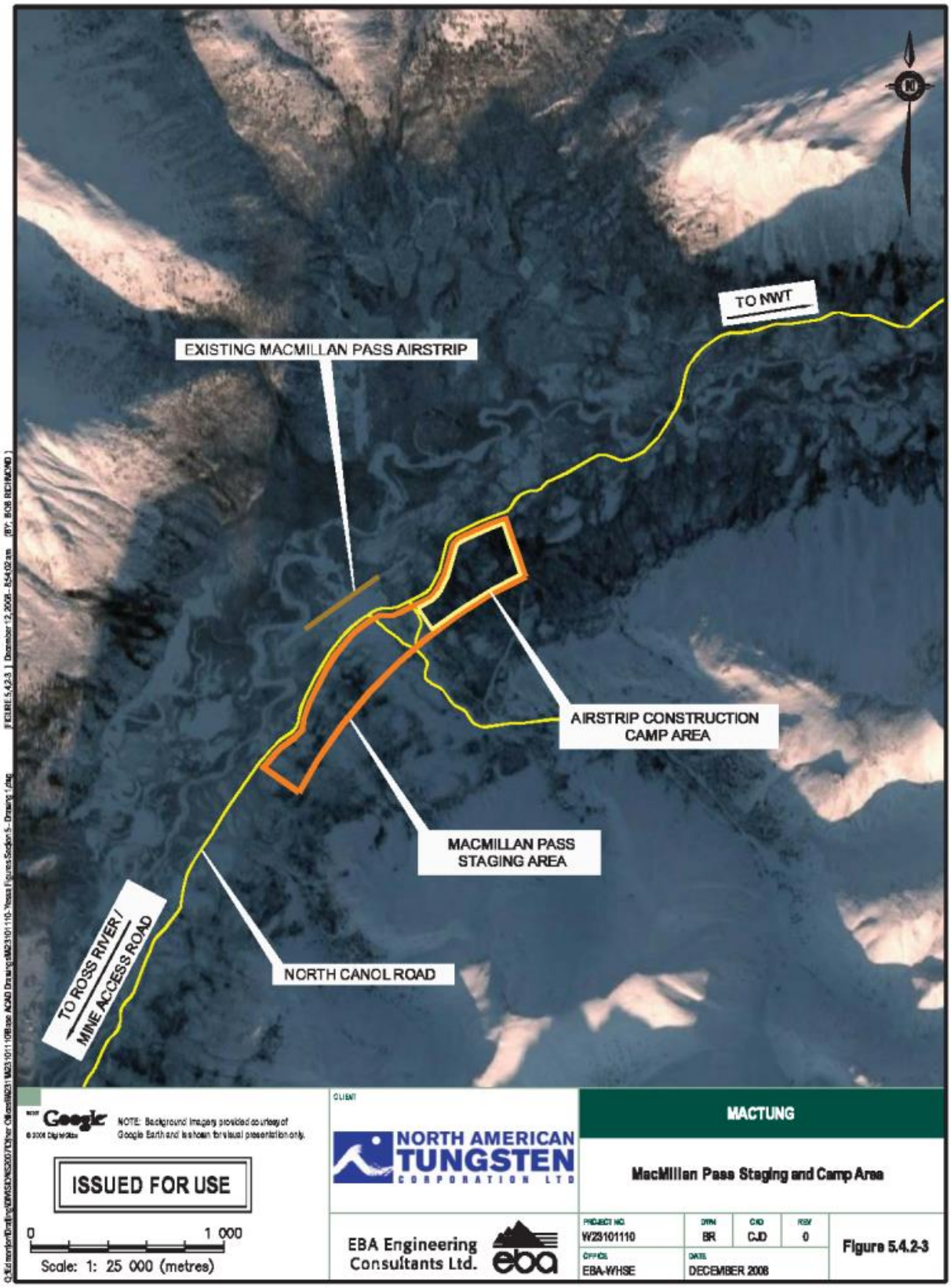

Figure 37 Macmillan Pass staging and camp area. (YOR 2008-0304-014-2)

11.3.2 Effects Characterization

Land clearing and earthworks for the staging areas and expansion of the Macmillan Pass Aerodrome may result in disturbance, damage, or destruction of items of heritage value should they be present within the construction areas. Accessing an area with elevated potential for heritage resources increases the probability of activities adversely affecting a heritage resource.

The aerodrome expansion has been identified as having a low potential for heritage resources. While the staging areas have not been identified as having any specific heritage value or heritage potential, these sites are located adjacent to the North Canol Road and the areas may have some disturbance due to human activity. The Executive Committee is concerned with the unknown heritage resource potential of the staging area sites.

The Executive Committee has considered commitments made by the Proponent to mitigate adverse effects of the Project to heritage resources. The Proponent commitments were listed in the previous section and are included in the comprehensive Proponent Commitment List in Appendix C.

The Executive Committee has considered the requirements of:

- the *Historic Resources Act* – specifically s. 64 (Destruction of historic objects or human remains) and s.71 (Report of findings);
- the *Archaeological Sites Regulation* (O.I.C. 2003-73) under the *Historic Resources Act* – specifically s. 4, regarding historic resources; and
- the *Land Use Regulation* under the *Territorial Lands (Yukon) Act* – specifically s. 9 (Prohibitions).

Adhering to the provisions of the above referenced legislation reinforces the mitigation measures committed to by the Proponent. There remains, however, a potential that undiscovered physical heritage resources may be disturbed or destroyed during construction before realizing the value of the site.

The Executive Committee has determined that the Project may result in significant adverse effects to heritage resources due to the low level of understanding of heritage resources potential at the staging area sites, aerodrome expansion area, lay-down areas, and gravel resource areas. These adverse socio-economic effects can be eliminated, reduced or controlled by the application of a specified term and condition.

11.3.3 Terms and Conditions

The following term and condition is specified by the Executive Committee to mitigate significant adverse socio-economic effects of the Project on heritage resources:

To minimize the effects of the Project on heritage resources along the North Canol Road:

60) The Proponent shall conduct heritage resource assessments of the aerodrome expansion area, lay-down areas, gravel resources, or other areas that require land clearing. The heritage resource assessments shall identify mitigation options for heritage resources discovered and/or areas of increased heritage resource potential. NTC shall provide the results of the heritage resource assessments to Ross River Dena Council and YG Heritage Resources Branch.

11.4 TRADITIONAL LAND USE – MINE SITE, ROAD TO HESS RIVER SOUTH TRIBUTARY AND YEAR-ROUND USE OF NORTH CANOL ROAD

All stages of the Project include activities that may adversely affect traditional land use. During construction, the presence of personnel, use of machinery and the associated noise and disturbance of establishing mine site infrastructure may overlap with land use in the area. Specific portions of the property will have restricted access due to concerns for public safety as well as the protection of mine infrastructure. This overlap continues through the operational life of the mine and during closure and reclamation. Overlap continues to a lesser extent through the post-closure period, depending on the level of activity required to monitor and adaptively manage the site and any remaining limitations to public access.

NTC will have up to 10 round-trips per day using the North Canol Road, a considerable increase to the amount of traffic that the North Canol Road has experienced in recent history.

11.4.1 Evaluation of Baseline Information

The Project is located within the traditional territories of the Ross River Dena Council, Liard First Nation and the First Nation of Na-Cho Nyak Dun. The Ross River Dena have identified traditional use activities such as hunting, trapping and gathering, and have indicated having interests in the entire area overlapped by the proposed project (YOR 2008-0304-019-2, 2008-0304-230-1, 2008-0304-169-1, 2008-0304-146-1).

The Chu Ta Dena/Mountain Slavey people in RRDC were identified as the “traditional land stewards” of the Mactung area (YOR 2008-0304-005-2).

The ecoregion displays the highest diversity of mammals in the Taiga Cordillera of Yukon and encompasses habitat for the following species: woodland caribou, moose, mountain goats, Dall sheep, black and grizzly bears, porcupines, squirrels, hoary marmots, wolves, foxes, lynx, otter, wolverines, martens, weasels, minks and numerous rodent species (Smith, Meikle and Roots 2004).

The North Canol Road area overlaps Registered Trapping Concessions (RTC) #112, and Group Trapping Concessions #405 and #415. The proposed activities also overlap with Game Management Subzones (GMS) #435, 436, 439, 440, 449, 450, 1101, 1102, 1106, 1107 and 1108.

In its proposal, NTC identifies subsistence harvest in the project area, stating:

> *The traditional economic activities VSEC is of particular importance to the Ross River Dena Council, the Liard First Nation, the traditional land stewards of the area, the Ross River group trappers, and the registered owners of Trapping Concessions 111 and 112.*
>
> (YOR 2008-0304-019-2)

The proposal recognizes the traditional land use of the project area. However, there is little information in the proposal regarding project effects on subsistence harvest and other traditional land use pursuits. NTC indicated interest in working with RRDC to develop a Traditional Knowledge Protocol during consultation in February 19, 2008 (YOR 2008-0304-005-2).

A traditional land use study , “Just Like People Get Lost: A retrospective Assessment of the Impacts of the Faro Mining Development on the Land Use of the Ross River Indian People” (Weinstein 1992), provides an assessment of land use by the Ross River Dena people after the construction, operation, and closure of the Faro Mine. The study was conducted to provide information about the nature of impacts to land use experienced as a result of the Faro development. While the focus of the study was on Mount Mye, the location of the Faro mine site, the land use study region included the the North Canol Road. The study found that there was an increase of land use along the North Canol and South Canol roads partially as a result of being displaced from the Mount Mye area (Weinstein 1992). The report is consistent with the statements from the Ross River Elders Oversight Committee about the use of the area for subsistence harvest.

Ross River Dena Council and its members have identified traditional land use values in and around the mine site. One elder stated during the October 2013 community meeting “The headwaters of the Hess River are very sacred to the First Nation as this is where life begins”. (2008-0304-317-1)NND and RRDC have identified the area as a travel route that historically facilitated travel through the Macmillan Pass. The area continues to be a route to access hunting and fishing grounds (YOR 2008-0304-285-1, 2008-0304-261-1, 2008-0304-271-1). Important mineral licks have been identified near the proposed project and the road to the Hess River South Tributary (YOR 2008-0304-271-1).

The Executive Committee received a Traditional Knowledge Map from the RRDC that provided additional details of traditional land uses based on knowledge of RRDC elders. The information remains confidential and the specific details of the map are not summarized in this screening report. The map does reinforce the values and traditional land use activities near the mine site and along the Hess River South Tributary.

11.4.2 Effects Characterization

The Executive Committee considered the following potential effects on traditional land use.

- Certain portions of the mine site and associated infrastructure will limit access for traditional land use activities.
- Year-round noise and disturbance during mine construction and operation may disrupt traditional land use along the North Canol Road and at the mine site.
- Water extraction and effluent discharge may cause adverse effects to fish and aquatic environments; affecting local populations on which traditional land use depends.
- Effects to wildlife (such as increased hunting and animal disturbance) may reduce local populations on which traditional land use depends.

Ross River Dena Council summarized their concerns on the impacts the Project may have on the traditional land use of the areas around the mine site in a letter dated December 9, 2013. In the letter RRDC states:

> *Firstly, as we have indicated to the company time and time again throughout this process that, we do not want to see the Hess River Tributary as the water source for the proposed mine. We have many concerns with the company drawing water from this source. Our concerns with this are*

> *broader than the impacts to wildlife and to the mineral lick. We continue to encourage the company to look elsewhere for water, and we cannot support their YESAB application until this option is replaced with a different water source that we agree with.*
>
> *Our second major concern is in regard to the location of the camp that is proposed in the current submission. We do not want to see a camp of the proposed size at the headwaters on Mt. Allan. Again we have encouraged the company to investigate other options for camp locations, and we remain unsupportive to the current submission so long as the camp location is to be on Mt. Allan.*
>
> (YOR 2008-0304-339-1)

Project effects to water resources and aquatic resources are discussed in sections 6.0 and 7.0 of this screening report. These sections conclude that the Project will result in significant adverse effects to these particular values that can be mitigated by recommended terms and conditions. Implementation of these terms and conditions will ensure that the Project does not result in significant effects to the water resources and aquatic resources of the Hess River tributaries. Therefore the water resources and aquatic resources associated with this river system will be maintained and be available for traditional use.

Project effects to wildlife and wildlife habitat are discussed in section 8.0 of this screening report. This section concludes that the Project will not result in significant adverse effects. The Executive Committee acknowledges that the Project will result in a certain amount of habitat loss and potential displacement of wildlife from areas where hunting occurs. Given the conclusion arrived at in section 11.2, it is unlikely that traditional use of wildlife (i.e. hunting, trapping) will be significantly affected.

The Executive Committee has considered an alternative camp location for the Project at the Macmillan Pass Aerodrome. A relocated camp away from the mine site would result in mine personnel being transported to and from the mine site. It would increase the amount of traffic along the North Canol Road and access road to the mine site. Personnel would continue to be present at the mine site; however personnel would be transported between the camp and mine site. The Executive Committee is of the opinion that this may increase the effects to traditional land use values in and around the mine site.

The Executive Committee requested NTC to consider alternative sources of water for camp and milling purposes. NTC responded that the Hess River South Tributary was the closest source of water that could be used for milling and potable water with sufficient flow. NTC pointed out that water from the Tsichu River and Dale Creek a tributary to Tsichu would be from a different watershed than the Hess River which would introduce additional complexities to consider. The Tsichu is also located in the Northwest Territories which would require a different jurisdictional review (YOR 2008-0304-322-1).

The Executive Committee is of the opinion that transferring water from one watershed to another may have significant adverse effects which may result in transfer of foreign species, changes to watershed flows and water quality. The Executive Committee has also determined that there are suitable terms and conditions to mitigate significant adverse effects resulting from the withdrawal of water from the Hess River South Tributary (section 7.0 Aquatic Resources).

The Executive Committee recognizes that traditional land use activities near the project area will be impacted and that the RRDC is opposed to both the camp location and water extraction from the Hess

River South Tributary. NTC and the RRDC have committed to work together on the remaining outstanding issues that RRDC has with the Project. NTC has committed to work with RRDC to:

- *Identify, avoid, minimize and/or mitigate the effects of the Mactung Project on Mount Allan, Yukon, and the lands that surround it.*
- *Protect and maintain environmental quality and heritage resources.*
- *Ensure that the Mactung Project is undertaken in accordance with principles that foster beneficial socio-economic change without undermining the ecological and social systems on which communities and their residents, and societies in general, depend.*
- *Recognize and, to the extent practicable, enhance the traditional economy of Ross River Dena and their special relationship with the wilderness environment.*
- *Guarantee opportunities for the participation of Ross River Dena and make use of their knowledge and experience in the Mactung Project.*
- *Ensure that the traditional knowledge of the Ross River Dena will help to inform NTC's decisions during all of the Mactung Project's phases.*
- *North American Tungsten will work collaboratively with the Ross River Dena in the following areas:*
    - *Traditional Knowledge and Heritage Resources;*
    - *Environmental Monitoring;*
    - *Fish and Wildlife Monitoring and Management;*
    - *Water Management; and*
    - *Linear Development*.

(Appendix C)

Presently, the North Canol Road is used mainly during the summer months and is not maintained in the winter. Opening the North Canol Road year-round will increase traffic resulting in the displacement and disturbance of larger wildlife species that do not tolerate human activities. Moose, grizzly bear and caribou are more likely to avoid an area that is constantly disturbed. NTC indicated that up to 10 trucks per day (each way) as well as other motorized traffic would be using the North Canol Road, Campbell Highway as well as the Alaska Highway for the duration of the Project. This increase in activity can affect traditional land use activities.

The effects along the North Canol Road will be further compounded by increased hunting pressures as a result of the year-round maintenance of the road. The Executive Committee notes that although the opening of the North Canol Road in winter may be more attractive to users in general, the hunting season for licensed hunters ends on October 31 for the large game species hunted in the area. Therefore, it is unlikely that the opening of the North Canol Road in the winter will result in significant effects to licensed hunters. However, without additional restrictions, traditional harvesting may increase due to year-round maintenance of the road.

The Executive Committee has determined that the Project will have a significant adverse effect on traditional land use and that these socio-economic effects can be eliminated, reduced or controlled by the application of specified terms and conditions.

11.4.3 Terms and Conditions

The following terms and conditions are specified by the Executive Committee to mitigate significant adverse socio-economic effects of the Project to heritage resources and traditional land use:

To minimize the effects of the Project on traditional land use:

61) Prior to construction of the Project, the Proponent shall complete a traditional land use study of the area potentially affected by the proposed project. The traditional knowledge study may form a part of or be the required traditional land use study. The traditional land use study shall outline potential impacts the Project may have on traditional land use. The Proponent shall make best efforts to involve RRDC in the design and conduct of the study.

62) The Proponent shall enter into discussions with the Ross River Dena Council and Government of Yukon to establish additional mitigation, if necessary, for the construction of the mine and road to the Hess River South Tributary. The completed traditional land use study shall be taken into account in these discussions.

63) The Proponent shall enter into discussions with the Ross River Dena Council and Government of Yukon to establish additional mitigation, if necessary, for the year-round access of the North Canol Road.

64) The Proponent shall enter into discussions with representatives of the Ross River Dena group trapline to establish additional mitigation/compensation, if necessary, for the expected disruption to trapping that will result from the construction of the new access road, the winter maintenance of North Canol Road, and the increase in traffic through all phases of the Project.

11.5 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after implementing mitigation measures. Cumulative effects are those effects that remain from project activities after implementing mitigation measures in addition to the effects of other existing or proposed projects. When considering heritage resources, the effects assessment has taken into account the activities and uses of the area in combination with the project activities and uses. In this case, the effects assessment is a cumulative effects assessment.

The Executive Committee is aware that a number of quartz exploration programs use the North Canol Road to access camps and claims. The compounded effects of these activities have a combined impact to the traditional land use along the North Canol Road. While the level of quartz exploration has risen in recent years, the activities are dispersed along the North Canol road. Exploration activities have a lower residual effect on wildlife and traditional land use as they generally have a small footprint, have a short duration, and occur seasonally.

The Executive Committee agrees with the conclusion that as the remote area becomes increasingly accessible and development activities increase, it becomes important to better understand the population and health of the herds and key habitat areas that the herds relies upon. The Executive Committee has recommended increased monitoring of wildlife species using the area as part of the effects assessment of the Project.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on heritage resources. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on heritage resources and traditional land use.

12.0 LAND AND RESOURCE USE

This section addresses potential effects of the Project on land and resource use. An understanding of the environmental and socio-economic setting for land and resource use is provided and potential adverse effects are characterized and discussed in the context of the proposal, comments received, relevant legislation and proposed mitigation strategies. Traditional land use is discussed in section 11.0 Heritage Resources and Traditional Land Use. The Executive Committee concludes that compliance with relevant legislation, proposed mitigation strategies and specified terms and conditions will effectively eliminate, reduce or control significant adverse effects on land and resource use.

12.1 OVERVIEW

The mine site, water intake infrastructure at the Hess River South Tributary, road and pipeline to the Hess River South Tributary, and Macmillan Pass Aerodrome overlaps with Outfitting Concession #9, owned by Jarrett Deuling of Deuling Stone Outfitters (DSO). In his submission for the evaluation of another project in the same area titled “Nidd Road Upgrade/Camp Re-location – Oro Property Quartz,” Mr. Deuling indicated that five camps are located in in his outfitting concession from which hunts are staged. One of the camps is located on the north side of Mt. Allan along the Hess River South Tributary. Mr. Deuling stated that the operations in the Keele Peak region provide for approximately 50 percent of DSO’s income (YOR 2012-0060-034-1). In his submission to this assessment Mr. Deuling indicated that “I have camps at Ollie Lake, Keele Peak and spike camps along the Hess River which will be in jeopardy from activities proposed for the Mactung Project” (YOR 2008-0304-136-1).

The mine site, water intake infrastructure at Hess River South Tributary, road and pipeline to the Hess River South Tributary, and Macmillan Pass Aerodrome overlap with Registered Trapping Concession (RTC) #112. RTC #112, which is registered under Neilson Sisson, is delimited to the north by the Hess River South Tributary, to the east by the Yukon–NWT border, to the southeast by the North Canol Road and to the west-southwest by another tributary of the Hess River. Mr. Sisson uses the existing Nidd Road (also referred to as the Cominco Road) as a trapline.

The North Canol Road and staging areas overlap with Group Trapping Concessions #405 and #415. Trappers from the Group Trapping Concessions #405 and #415 use the North Canol Road and surrounding area as a trapline and as access. North American Tungsten Corporation Ltd. (NTC) stated in its proposal that data from Government of Yukon, Department of Environment indicates that the region around the project area has been actively trapped in each of the past 10 years (YOR 2008-0304-019-2).

The North Canol Road and staging areas from Ross River to the Yukon-NWT border overlap with Game Management Subzones (GMS) #435, 436, 439, 440, 449, 450, 1101, 1102, 1106, 1107 and 1108. The hunting season occurs from August 1 to October 31, with a spring bear hunt from April 15 to June 21. The North Canol Road and adjacent area are used extensively by resident moose hunters.

In addition to Class 1 mineral exploration activities in the region, several exploration projects have been submitted and assessed by YESAB. As in other regions of the Yukon, the North Canol region was recently subject to intense mineral staking, particularly in 2010. Several camps supporting these activities are located in the area, particularly along the North Canol Road. The Macmillan Pass

Aerodrome is used by companies accessing the general area. Further description of activities in the region is in section 5.6, with respect to cumulative effects assessment.

12.2 EFFECTS TO LAND USERS FROM YEAR-ROUND USE OF THE AREA

The Executive Committee considered the following effects on trappers, the outfitter and other users of the area as a result of:

- loss of areas for trapping, hunting and other uses due to road development and mine activity; and,
- reduction of local wildlife populations due to increased wildlife mortality and animal disturbance.

The mine site and road to the Hess River South Tributary is located within Outfitting Concession #9. The concession holder has indicated that he has interests in the Hess River and Keele Peak areas. Noise and activity from the construction and use of the road to the Hess River South Tributary is likely to affect the wilderness experience preferred by the outfitter's clients on the Hess River South Tributary. However the mine site does not appear to overlap with any preferred outfitting use.

Mr. Deuling also identified that aircraft activity may impact the wilderness experience and have impacts on wildlife behavior and patterns. NTC indicated that the Macmillan Pass Aerodrome will be expanded to accommodate 19-passenger aircrafts and that up to three flights a week will be conducted from there. This aircraft use may have a negative effect to the outfitter's clients and may disturb wildlife.

The Executive Committee notes that Mr. Deuling stated that NTC has had good communications with regards to their aircraft activity near the mine site and suggested that such communications remain open. The Executive Committee has determined that additional terms and conditions are required to minimize significant adverse effects to the outfitter.

The mine site and road to the Hess River South Tributary is located within RTC #112. Mr. Sisson, the operator of the trapline, indicated that his "prime line" extends along the Cominco Road also called the Nidd Road (YOR 2008-0304-125-1). The Executive Committee notes that NTC has removed the proposed access road that followed the Nidd Road from the scope of the Project. As a result the trapline will not be directly impacted by the Project.

Presently, the North Canol Road is used mainly during the summer months and is not maintained in the winter. According to Mr. Sisson, only a few snowmobiles travel up the North Canol Road in winter and almost none go further than his own trail. The Executive Committee recognizes that opening the North Canol Road year-round is likely to displace the use of the North Canol Road as a trapline for users of Group Trapping Concessions #405 and #415. However, opening the North Canol Road year-round may also improve access to other areas along the North Canol Road within the Group Trapping Concessions # 405 and #415.

NTC has committed to enter into talks with representatives of the users of the Ross River group trapline and with the registered owners of RTC #112 to establish a level of compensation for the expected disruption of trapping that will result from the construction of roads, the winter maintenance of North Canol Road, and the increase in traffic through all phases of the Project (Appendix C). The Executive Committee is satisfied that with the commitment of NTC to enter into talks with representatives of Group

Trapline holders #405 and #415 and RTC #112 that the Project will not result in significant adverse effects to trapping.

Opening the North Canol Road year-round will result in increased access to all areas along the North Canol Road. Increased access by other users to the area may decrease the quality of hunting in the area. Animals like moose, grizzly bear and caribou are more likely to avoid an area that is constantly disturbed. Further consideration of the effects of the Project on wildlife is discussed in section 8.0 Wildlife.

The Executive Committee acknowledges commitments made by NTC to minimize impacts on current land users. NTC has committed to a strictly enforced policy forbidding employees to bring firearms into camp and will have a no hunting rule for employees (Appendix C). This, combined with the fly-in nature of the Project, will ensure that no employees will be hunting in the region during their rotations.

The Executive Committee notes that although the opening of the North Canol Road in winter may be more attractive to users in general, the hunting season for licensed hunters ends on October 31 for the large game species hunted in the area. Therefore, it is unlikely that the opening of the North Canol Road in the winter will result in significant effects to local hunters.

The Executive Committee has determined the Project will result in significant adverse effects to land and resource users and that the application of the mitigation measures proposed by the Proponent and implementation of a mitigative measure specified by the Executive Committee will effectively eliminate, reduce or control significant adverse effects to land and resource use.

12.2.1 Terms and Conditions

The following term and condition is specified by the Executive Committee to mitigate significant adverse environmental and socio-economic effects of the Project to land use due to project activities.

To minimize the effects of the Project on the holder of Outfitting Concession #9:

65) The Proponent shall continue communications with the holder of Outfitting Concession #9 to establish additional mitigation measures, if necessary, for the expected disruption of outfitting that will result from the construction and use of the new road to the Hess River South Tributary and the increase in air traffic through all phases of the Project.

12.3 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after implementing mitigation measures. Cumulative effects are those effects that remain from project activities after implementing mitigation measures in combination with the effects of other existing or proposed projects. When considering land and resource values, the effects assessment has taken into account the activities and uses of the area in combination with the project activities (Figure 26 and Figure 27 in section 5.6). In this case, the effects assessment is a cumulative effects assessment.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as

adequate to address potential cumulative effects on land and resource use. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on land and resource use.

13.0 CULTURAL AND COMMUNITY WELL-BEING

This section addresses potential project-related effects on cultural and community well-being. An understanding of the socio-economic setting for cultural and community well-being is provided and potential adverse effects are characterized and discussed in the context of the proposal, comments received, relevant legislation and proposed mitigation strategies. The Executive Committee concludes that compliance with relevant legislation and proposed mitigation strategies will effectively eliminate, reduce or control significant adverse effects on cultural and community well-being.

13.1 OVERVIEW

The Project could affect directly and/or indirectly several First Nations and communities including Ross River Dena Council, Ross River, Faro, the Liard First Nation and First Nation of Na-Cho Nyak Dun due to its impact on socio-economic factors.

Cultural and community dynamics are influenced by factors such as demographics, individual and community health and wellness, family stability, community cohesion, cultural well-being, and social contexts. The ability of a community to cope with changes to its structure and dynamics brought on by development is determined in part by its vulnerability and resilience/adaptability. Some characteristics that contribute to a community's resilience and adaptability include:

- Social capital (e.g. social networking, community associations, and volunteers);
- Health/wellness and social infrastructure (e.g. recreational facilities and social services);
- Experience and engagement with industrial development projects;
- Strong cultural connections within the community;
- Skilled/educated labour force;
- Diversified economy; and,
- Strong connection to the community (e.g. many long-term residents).

Aspects of a community that may contribute to its vulnerability include:

- Existing social problems (e.g. substance abuse and family violence);
- Negative experiences with industrial development projects;
- Compromised population health status;
- Low-skilled/uneducated labour force;
- Small population;
- High unemployment;
- High crime rates;
- Narrow economic base; and,

- Frayed social fabric.

The Executive Committee considered three groupings of valued environmental and socio-economic components (VESECs): sustainable livelihood, community vitality and health, and socio-cultural well-being. The Executive Committee has also considered the effects of employment of local residents on individual well-being, family dynamics and community interactions. The Proponent considered several sub-components for each of the three groupings in their proposal (YOR 2008-0304-019-2).

13.2 EFFECTS CHARACTERIZATION

The Proponent provides a description of socio-economic baseline studies and interviews used in the consideration of socio-economic effects of the Project. Baseline information related to employment and economic opportunities, community vitality, and human health and well-being are summarized by the Proponent. Additional information is provided in Appendix J of the project proposal (YOR 2008-0304-062-2).

13.2.1 Sustainable Livelihood

Sustainable livelihood includes VESECs associated with economic benefits. These include traditional economic activities, employment, education, training and experience, infrastructure, economic development and diversification and healthy business sector.

Traditional Economic Activities

Activities that will affect the valued component include the use of the North Canol Road, the construction of a mine site, staging areas and road to the Hess River South Tributary, and the extension of the Macmillan Pass Aerodrome.

The area of the Project is important to the Ross River Dena Council, the Liard First Nation, the Ross River group trappers, holders of the Registered Trapping Concessions #111 and #112, recreational users and the holder of outfitting concession #9. Negative effects revolve around impacts to local hunters due to an increase in hunting pressure and activities on the North Canol Road. The Project is not expected to affect the trapping concessions negatively. A detailed description of the direct and indirect effects of the Project on this valued component can be found in the proposal (YOR 2008-0304-019-2).

The Proponent has committed to enforce a no-hunting policy for its employees in addition to forbidding employees of bringing firearms to camp. NTC also committed to a three-week in, three-week out schedule that will allow local First Nations people to pursue traditional activities during their time off (Appendix C). Effects to traditional land use are considered further in section 11.0 Heritage Resources and Traditional Land Use. Effects to other land users are considered further in section 12.0 Land and Resource Use.

Employment

The Project is expected to provide employment opportunities during the construction, operation and decommissioning phases. The workforce requirement is 250 during construction, 150 during operations, and approximately 20 during decommissioning. The anticipated workforce requirements will be a

combination of NTC employees, contractors and skilled and unskilled local labour. The operations phase will likely see the highest level of opportunity for local hire. The decommissioning phase will require approximately 20 people, most of which could be local workers.

The Proponent has committed to:

> *To facilitate employee career advancement, NATC will implement its policy of initially posting all employment positions internally, and, with a particular focus on First Nation candidates, help create individual training and succession plans.*
>
> (Appendix C)

NTC indicates in the proposal that the construction contracting strategy will be designed to hire local companies and create a sustainable relationship with nearby communities, Ross River Dena Council and the Liard First Nation. NTC provides a list of sectors and contracting opportunities, by project phase, to illustrate this commitment. NTC has also committed to explore ways of maximizing First Nations business opportunities in the Project's operation phase.

The creation of employment opportunities for local residents may be considered a positive effect of the Project. However, the increase in income associated with higher salaries may also create negative social issues. These issues are discussed further in the health and socio-cultural well-being section.

Education and Training

As air access at the Macmillan Pass Aerodrome will be provided, employees will not be required to live in close-by communities. Few families are anticipated to move to the nearest communities as a result of the Project. Therefore, the Project is not anticipated to have a significant impact on the local education system or infrastructure.

NTC has indicated that they will offer an annual scholarship to a qualified student(s) from Ross River, Faro, Watson Lake or Mayo. NTC also indicated they provide a range of training for employees of their Cantung mine and that they intend to provide similar programs to the Mactung mine employees. The project proposal lists the following categories of training offered:

- Life skills/literacy/language;
- Basic training;
- Health and safety training;
- Training in equipment operations; and
- Training for surface and underground mine work.

The Proponent committed to:

> *Upon opening of the mine, NATC will offer an annual scholarship to a qualified student(s) from Ross River, Faro, Watson Lake or Mayo who are pursuing a post-secondary education, particularly in a mining related field.*
>
> *NATC will implement the training programs currently used at Cantung, especially its underground training in partnership with the Yukon Mine Training Association.*

(Appendix C)

Infrastructure

The Project will directly affect the North Canol Road, the municipal roads and the ferry at Ross River as well as the Campbell Highway due to an increase in traffic. NTC provided traffic data indicating that between 1993 and 2007 an average of 28 vehicles per day used the ferry at Ross River during the 145-day season. The Project will add another 10 round-trips per day during the construction phase to these numbers, which is approximately a 35 percent increase from the average. The NTC proposal indicates that the number of trips will decrease to four round-trips per day during the operation phase and less than one round-trip per day during the decommissioning phase.

The proposal indicates that Government of Yukon, Department of Highways and Public Works has committed to provide the required maintenance for both summer and winter use of the North Canol Road including adequate ferry service and ice bridge (YOR 2008-0304-029-2).

NTC indicates that the Project will generate its own power using diesel generators and will utilize satellite communication systems, which should limit the effects of the Project on Yukon's power and communication infrastructure.

The Project is not anticipated to have significant adverse effects on the municipal infrastructure of Ross River or Faro since the camp will be self-contained. Increased traffic through Ross River may contribute to the degradation of municipal roads. The Proponent has committed to prepare a traffic plan for Ross River with input from the community to minimize the adverse effects. As indicated in the proposal, garbage will be incinerated on-site. Disposition of waste is addressed in section 10.0 Environmental Quality.

Economic Development

The Project will contribute to Yukon's economy during construction, operation and decommissioning phases. NTC indicates that the forecasted average annual gross production value will translate into an annual input of $140.1 million or nine percent of the Yukon's GDP. This contribution to the Yukon's GDP is considered a potential positive effect of the Project. NTC provided the following rationale for this determination in the proposal.

> *In 2006, the Yukon's GDP was $1.55 Billion. Statistics Canada's 2003 Input-Output model for the Yukon (the latest available gives a multiplier of 0.77 for calculating the effect of metal mining on the Yukon's GDP. Mactung's average annual gross production value of $180.0 million translates into an annual effect of $140.1 million on the Yukon's GDP. The mine can therefore be expected to increase the size of the economy by a significant 9.0%*
>
> (YOR 2008-0304-019-2)

Project royalties are required under the 2010 *Quartz Mining Act Royalty Regulation*; the annual royalty payment is made on a sliding scale based on the mine profit. The rate ranges from three percent on annual profit greater than $10,000 to a rate of 12 percent on profits greater than $35 million. The amount retained by Government of Yukon will vary annually based on the *Quartz Mining Act Royalty Regulation*. The amount of royalties retained by Government of Yukon will be in accordance with overall royalty provisions agreed to with the Government of Canada.

The Proponent estimated total federal income tax to be approximately US $38 million and territorial income tax to be approximately US $6.5 million generated as a result of the Project. NTC concluded that no mitigation or enhancement measures are required for the Project with respect to royalties and taxes.

The Executive Committee generally agrees with the Proponent's conclusion. Government of Yukon, Department of Economic Development stated that it would be helpful to do a sensitivity analysis of taxes generated based on scenarios with variable income. However, they are not concerned with any adverse effects as a result of royalties and taxes collected for the Project. (YOR 2008-0304-131-1)

Impact to community from Boom and Bust Cycle

Large projects such as the Mactung Mine can result in boom and bust cycles that affect small remote communities. NTC has considered various scenarios regarding the duration of the different phases of the Project. This exercise helped in the determination of whether or not it would be beneficial to extend the life of the mine to incur additional positive socio-economic effects.

NTC determined that the 27-month construction phase was optimal to ensure that the financial needs to complete construction as fast as possible were met. NTC also considered reducing the mining rate from 2 000 tonnes of ore per day to 1 500 tonnes per day which would extend the production period from 11.2 years to 14 years. However, NTC determined that this rate would cause the Project to not be financially viable.

The Project will be self-contained with components such as camps at the mine site and air transportation to employees. The work schedule of a three week in and three week out along with the air transportation would minimize negative impacts to the community of Ross River. The Proponent has also committed to have relocation incentives for employees for the town of Faro. These factors should help reduce the impact of population fluctuations in Ross River.

The Executive Committee has determined the Project will not result in significant adverse effects to sustainable livelihood as the application of the mitigation measures proposed by the Proponent will effectively eliminate, reduce or control significant adverse effects to cultural and community well-being.

13.2.2 Community Vitality

Community Vitality addresses factors negatively affecting or improving the life in the community. The Project is expected to affect First Nations and communities involved with the Project. The Project may create opportunities in the communities, which enhance quality of life. NTC considered community population, safety and security, social cohesion, quality of life, community infrastructure and aesthetics and governance/political structure.

NTC indicated that both Faro and Ross River identified community population as a VESEC for different reasons. Faro is interested in increasing its population to support, enhance and develop services to keep the community vibrant. NTC indicated that Faro has the capacity to house new residents immediately while Ross River does not due to the limited availability of lots or houses for sale. NTC indicated that it recognizes the value of hiring locally however it estimates that some of the new employees may not be local but could become Yukon residents. The influx of people on Faro's local infrastructure is not expected to be detrimental due to the community presently operating below its capacity. NTC committed

to promoting relocation incentives for new employees in collaboration with the Town of Faro to help them move to the community.

NTC concluded that adverse effects to the community of Ross River are expected to be minimal with training for personnel (e.g. life skills), and the limited in-migration due to the fly-in fly-out nature of the camp. NTC has also made a number of additional commitments to improve community vitality including sponsoring community events in Ross River and in Faro.

The Executive Committee has determined the Project will not result in significant adverse effects to community vitality as the application of the mitigation measures proposed by the Proponent will effectively eliminate, reduce or control significant adverse effects to cultural and community well-being.

13.2.3 Health and Socio-cultural Well Being

Health and socio-cultural well-being covers a broad range of issues that are more complex and challenging to measure. VESECs includes individual and family health, reducing alcohol and drug abuse, reducing domestic abuse, public health and safety, workplace health and safety, family resilience and self-sufficiency and cultural continuity. The public and workplace health and safety components are addressed in section 9 Health and Safety.

Individual and Family Health

The Proponent identifies that in general, steady employment and higher income can result in higher sense of self-worth, improved individual health and better family stability and health. NTC refers to a Statistics Canada study that shows the correlation between an increase in individual and family health associated with higher income as a positive effect of the Project. To improve family health, NTC has committed to the following enhancement measure:

- *To help employees and their families maintain good health, NATC will be offering a dental and extended health plan to all employees at Mactung, as they currently do at Cantung.*

  (Appendix C)

NTC also refers to another study conducted in the Northwest Territories that indicates the potential negative impact on families of one member being absent for long durations such as the three-week work rotation. These conditions combined with communities already under stress could result in other in social problems such as substance abuse, behavioural issues for children and sometimes family violence.

To assist in addressing these issues, NTC has committed to provide incentives to reduce negative effects such as discouraging substance abuse by adopting a dry camp policy where no alcohol or drugs will be allowed on-site during any phase of the Project. NTC will also be conducting drug testing to ensure a safe worksite.

Public and Workplace Health and Safety

The three main effects to public health and safety associated with the Project are traffic accidents, spills or major accidents, and concerns around the disposal of solid waste and sewage at the mine site. Effects related to traffic are addressed in section 8.0 Wildlife and section 9.0 Health and Safety.

NTC has committed to prepare a traffic plan with input from the community of Ross River to minimize negative effects. The potential effects from spills and disposal of waste are addressed in the section 10.0 Environmental Quality. NTC has committed to train an emergency response team to respond to spills and similar emergencies. NTC will develop a protocol with Government of Yukon Emergency Measures Organization to outline roles and responsibilities in the event of an accident or spills.

NTC has committed to follow all applicable laws and regulations in all aspects of its operations related to safety, potable water, food safety and the disposal of sewage and garbage. All employees will receive safety training required by their position. A fully trained emergency medical technician (EMT) will be on-site with medical supplies and equipment at all times.

Cultural Continuity

Cultural continuity includes the effects of the Project on the culture of First Nations on whose traditional territories the Project is located. Cultural aspects that could be affected by the Project include heritage sites, land-based social and cultural activities, language preservation and restoration, and sharing traditional knowledge.

The proposed activities could result in effects to cultural continuity by altering or destroying heritage sites. Effects to heritage sites and traditional land use are addressed in section 11.0 Heritage Resources and Traditional Land Use. NTC does not anticipate the Project to affect land-based social and cultural activities. The three-week work rotation should provide sufficient time off to allow employees to pursue traditional activities.

The Executive Committee has determined that the Project will not result in significant adverse effects to health and socio-cultural well-being as the application of the mitigation measures proposed by the Proponent will effectively eliminate, reduce or control significant adverse effects to cultural and community well-being.

13.3 CONCLUSION

The Executive Committee has considered the VESECs identified above as well as the effects assessment conducted by NTC on these values. The Executive Committee agrees with NTC that the effects of the Project on these values can affect employees and residents of the area and acknowledges the commitments made by the Proponent to minimize effects to cultural and community well-being. The complete list of proponent commitments can be found in Appendix C.

The Executive Committee also recognizes that NTC has begun negotiating a socio-economic participation agreement with RRDC. The following excerpt from NTC provides further detail:

> *Over the past few months, NTC deepened its engagement with the Ross River Dena Council ("RRDC") – the community within the Kaska Nation that is closest to Mactung and the one that, under the Kaska Collaboration Agreement, has been tasked as the lead for Mactung. NTC and the RRDC have been negotiating a Social and Economic Participation Agreement ("SEPA") to govern their relationship. Still under negotiations, the SEPA is intended by both parties to support long-term collaboration and provide economic benefits, preferentially but not exclusively to Kaska youth, in partial exchange for NTC's licence to mine the property. It is NTC's hope to*

> *create a form of substantive, long-term partnership with the RRDC that will reflect both parties' financial and social investments at Mactung.*
>
> (YOR 2008-0304-298-1)

Health and safety, heritage resources and land and resources use, have been addressed in other sections of this screening report.

The Executive Committee concludes that the application of the mitigation measures proposed by the Proponent will effectively eliminate, reduce or control significant adverse effects to cultural and community well-being.

13.4 CUMULATIVE EFFECTS

Residual effects are those effects that remain from project activities after implementing mitigation measures. Cumulative effects are those effects that remain from project activities after implementing mitigation measures in combination with the effects of other existing or proposed projects. When considering cultural and community well-being, the effects assessment has taken into account the activities and uses of the area in combination with the project activities (Figure 26 and Figure 27 in section 5.6). In this case, the effects assessment is a cumulative effects assessment.

The commitments proposed by the Proponent, compliance with non-discretionary legislation, and the mitigative measures recommended in this report, are considered by the Executive Committee as adequate to address potential cumulative effects on cultural and community well-being. As a result, the Executive Committee is satisfied that the residual effects of the Project, in combination with the effects of other projects or activities will not result in significant adverse cumulative effects on cultural and community well-being.

PART III ASSESSMENT RECOMMENDATION

14.0 RECOMMENDATION

Pursuant to paragraph 58 (1) (b) of YESAA the Executive Committee recommends to the Decision Bodies that the Mactung Mine Project be allowed to proceed without a review, subject to the terms and conditions specified below; as the Executive Committee has determined that the Project will have significant adverse environmental and/or socio-economic effects in Yukon that can be mitigated by these terms and conditions.

15.0 TERMS AND CONDITIONS OF RECOMMENDATION

In order to reduce uncertainties associated with the precipitation scenario and water balance model, as well as provide sufficient basis for future monitoring:

1) The Proponent shall incorporate precipitation monitoring at the Mactung Mine site as part of the meteorological monitoring program. Daily site-specific rainfall and snowfall data shall be collected. The precipitation data shall be collected to allow a determination of crucial flow periods and site hydraulic responses such as during freshet and transition from rainfall to snowfall. This information shall be provided to the appropriate regulators during the regulatory approval process.
2) The Proponent shall review and update the runoff coefficient using on-site rainfall, snowfall, and Tributary C streamflow data collected or update the model in a way that will account for site-specific precipitation data. Should changes to predictions from the model result, the Proponent shall ensure appropriate measures are in place and update the water management plan to account for changes. This information shall be provided to the appropriate regulators during the regulatory approval process.

In order to reduce uncertainties associated with the Tributary C hydrology and water balance model, as well as provide a sufficient basis for future monitoring:

3) The Proponent shall update flow rates for Tributary C to include a minimum two years of continuous data and use this data to update the water balance model. The updated flow data and water balance model shall be provided to the appropriate regulators during the regulatory approval process.

In order to reduce uncertainties associated with the groundwater estimates and the water balance model as well as provide sufficient basis for future monitoring:

4) The Proponent shall validate hydraulic conductivity for the overburden aquifer by on-site in-situ tests in order to refine the hydrogeological model. This information shall be provided to the appropriate regulators during the regulatory approval process.

To reduce the uncertainties of the water balance model:

5) The Proponent shall update the water balance model assumptions, incorporating the most recent environmental data and rerun scenarios. Should the updated predictions indicate that changes to the design of water management structures or to the water management plan are warranted, the Proponent shall ensure these are incorporated in

the final designs for the Project. The Proponent shall provide an updated water balance model to the appropriate regulators.

6) During operations, the Proponent shall monitor inputs to the reservoir and report total monthly inputs from the different mine components. This information should be used to validate the water balance model and to identify follow-up programs that should be conducted to improve the accuracy of the model should discrepancies be found between the measured data and the model assumptions and/or predictions.

To minimize the risk of discharging untreated water with constituents of potential concern to Tributary C:

7) The Proponent shall develop additional management options in the event the reservoir volume exceeds the operational capacity of 540 000 m^3. Management options to meet discharge criteria must consider the potential that water treatment at a described rate is required to meet discharge targets. Management options must be provided to the appropriate regulators for consideration and, if necessary, approval prior to operation.

To minimize the risk of reservoir overtopping and discharge channel washout during severe weather events:

8) The Proponent shall design the reservoir dam to a minimum IDF 1:250 year flood event. The design standard will account for variability and uncertainties as a result of flood event predictions, higher unit peak floods in smaller basins in steep high gradient areas, and climate change.

9) The Proponent shall design the discharge channels around the DSTF and on the north slope of the valley to an IDF equivalent as the reservoir dam. This will prevent a washout scenario for the DSTF and will ensure non-contact water from the north slope of the valley is successfully diverted around the reservoir during severe weather events.

10) The Proponent shall ensure that discharge channels are lined in a manner that is stable.

11) The Proponent shall update the Hess River South Tributary hydrograph based on additional data collected from Hess River during the low-flow winter period and high flow periods. The monitoring results will include at least two years of continuous flow measurements. The monitoring results will be provided to the appropriate regulators.

12) The Proponent shall not withdraw more than 10 percent surficial flow of Hess River South Tributary.

13) The Proponent shall develop an adaptive management plan to accommodate periods when 10 percent of the Hess River South Tributary flows is insufficient for the mine and camp water requirements.

To minimize the uncertainties with respect to the geochemical characterization of waste rock and tailings:

14) The Proponent shall provide the results of geochemical characterization of geologic units that make up the waste rock including a minimum 40 weeks of kinetic testing results to the appropriate regulators as part of the licensing process. The geochemical characterization shall be consistent with the MEND Report 1.20.1 “Prediction Manual Drainage Chemistry from Sulphidic Geologic Materials” (Price 2009).

To minimize the uncertainties associated with water quality predictions:

15) The Proponent shall update the water quality prediction model providing an interpretation based on loadings (e.g. mg-constituents of potential concern per time per mass of

material or mg/kg/wk) and results of the waste rock humidity cell tests. In addition, the time to acid generation in the waste rock will be estimated from the humidity cell test results. This information shall be provided to appropriate regulators during the licensing process.

To minimize effects from the DSTF and underground disposal below the water table:

16) The Proponent shall account for the costs of temporary mine closure including those costs related to the transfer of all waste rock and tailings that is not characterized as NAG to the DSTF as part of the mine security.
17) The Proponent shall inspect the DSTF cover system at a frequency to be determined by appropriate regulators.
18) The Proponent shall account for the costs of DSTF inspection and DSTF discharge monitoring after closure for the duration to be determined by the appropriate regulators as part of the mine security.
19) The Proponent shall not dispose tailings or waste rock into any stope above a level that will be above the water table after closure with the exception of one stope should the Proponent proceed with its proposed stope monitoring program.
20) The Proponent shall put in place management controls prior to proceeding with co-disposal of waste rock and tailings below the water table to ensure that waste rock will be completely encapsulated within the tailings during co-disposal.
21) During operations, the Proponent shall monitor drainage in the mine and in the backfilled waste to demonstrate that metal leaching effects are acceptable for water quality in the mine, and measures such as pumping and treating non-compliant mine waters are a part of a Water Quality Management Plan in order to avoid inputs of poor water quality to groundwater and conditions down gradient of the backfilled material.
22) As the water table rises during mine decommissioning, the Proponent shall monitor flooded backfilled waste is required to demonstrate how soluble products that form prior to flooding are affecting water quality in the mine. Measures such as pumping and treating non-compliant mine waters are required as part of a Water Quality Management Plan in order to avoid inputs of poor water quality to groundwater and conditions down gradient of the flooded backfilled material.

To improve the reliability of water quality model predictions leading to a decreased likelihood of effects on water resources:

23) To account for the uncertainty associated with the water quantity and quality predictions, in advance of their Water Licence Application, the Proponent shall ensure that the proposed water treatment plant is designed to provide for:
    a) the range of possible water quality predictions to remain below appropriate threshold values for COPCs in the receiving environment;
    b) water treatment approaches that are readily adaptable should the quality of COPCs at risk of being above threshold water be different from that predicted;
    c) redundancies in pump design and power supply; and,
    d) maintaining sufficient water treatment plant reagent supplies on-site to allow the plant to function for 30 days.

24) The Proponent shall monitor quantity and quality of contact waters during operations, closure and post-closure in order to characterize contact waters from the different sources, verify assumptions and inform the mine closure plan. The monitoring program shall, at a minimum, specify routine surface water monitoring from temporary waste rock storage areas, the DSTF, mill and reservoir. The data shall be reviewed periodically to update loading assumptions for COPCs in the site water balance and water quality models.

25) The Proponent shall implement follow-up programs to verify the assumptions and conclusions of geochemical predictions and effectiveness of the resulting mitigation measures.

26) The Proponent shall ensure that contact water discharged by the mine during post-closure meets discharge criteria established by the regulators.

27) At closure, the Proponent shall ensure that active mine water treatment is in operation until water quality meets discharge criteria established by the regulators.

28) The Proponent shall conduct ABA characterization on blasted or milled rock that is intended for construction of mine infrastructure. If indicated by ABA results, kinetic testing should be completed to assess metal leaching potential of those materials. Only rock that is classified as non-acid generating and non-metal leaching shall be used for construction purposes.

To improve the understanding of the western barrier on Tributary C:

29) The Proponent shall develop a program using appropriate professionals with suitable experience to determine the extent of fish distribution within Tributary C.

30) If Tributary C above the western barrier is fish bearing, the Proponent shall submit the new information to the appropriate regulators for consideration and appropriate approvals. Should it be found that approvals pursuant to the Federal *Fisheries Act* are required; the Proponent will be required to develop plans to offset any losses to fisheries productivity.

To improve the understanding of fish and fish habitat in Tributary C and in the Hess River South Tributary:

31) The Proponent shall conduct additional studies for fish presence and fish habitat along Hess River South Tributary and provide additional information to appropriate regulators describing the extent of fish habitat loss as a result 10 percent reduction of flows during low flow periods. The studies shall be conducted by appropriate professionals with suitable experience.

32) The Proponent shall conduct additional studies for fish presence and fish habitat along Tributary C and provide additional information to appropriate regulators describing the extent of fish habitat loss as a result of a reduction of flows during low flow periods. The studies shall be conducted by appropriate professionals with suitable experience.

33) The Proponent shall predict potential impacts to fish and fish habitat due to the reduction of flow in Tributary C and Hess River South Tributary resulting from the construction of the reservoir and seepage dams and water intake. This prediction will include an analysis of the amount and type of fish habitat likely to be affected in both Tributary C

and the Hess River South Tributary. The Proponent shall submit the prediction to appropriate regulators.

34) The Proponent shall conduct benthic invertebrate monitoring and fisheries investigations on an annual basis at water quality sampling locations on the Hess River South Tributary and Tributary C. Annual reports detailing the result of the monitoring and investigations shall be submitted to appropriate regulators.

To ensure the conformance point on Tributary C protects fish and fish habitat:

35) If the western barrier does not prevent fish passage, the Proponent shall identify an appropriate conformance point that protects fish and fish habitat to the satisfaction of appropriate regulators.

To minimize the effects of erosion and sedimentation on fish and fish habitat:

36) The Proponent shall develop and implement an effective sediment and erosion control plan designed by appropriate professionals with suitable experience.

37) The Proponent shall conduct in-stream works during the time of year that poses the least risk to the fish species that use the watercourse. When it is not possible to conduct works during the period of least risk, the work should be conducted in a manner that prevents fish mortality.

To minimize the effects of entrainment or impingement on fish and fish habitat:

38) The Proponent shall use fish screens according to DFO's "Freshwater Intake End-of-Pipe Screen Guidelines".

To improve the understanding of baseline information for woodland caribou, moose, Dall sheep and grizzly bear and minimize the effects of the Project on these species:

39) The Proponent shall establish a Wildlife Monitoring Program prior to project initiation. For this program the Proponent shall:

a) monitor at least woodland caribou, moose, Dall sheep and grizzly bear to establish baseline information of these species;

b) develop the program in consultation with appropriate Government of Yukon agencies, Northwest Territories Government agencies, RRDC, Sahtu Dene and communities;

c) analyze the monitoring data and report annually to Government of Yukon and other wildlife management agencies involved. If determined to be required by a management agency, the Proponent shall develop an Adaptive Management Plan within one year after the project initiation; and

d) establish an appropriate buffer around the mineral licks identified by RRDC and Government of Yukon to reduce the zone of influence to wildlife species using the mineral lick. The appropriate buffer zone shall be determined in consultation with a qualified biologist.

To minimize the effects of the Project on migratory birds:

40) The Proponent shall avoid clearing vegetation during the migratory bird nesting season (approximately May 1st to July 31st). If clearing must occur during this period, the Proponent shall ensure nest surveys are conducted by qualified and experienced personnel prior to clearing. If active nests or migratory birds are discovered, the

Proponent shall record these locations and postpone activities in the nesting area until nesting is completed.

To minimize conflicts with wildlife:

41) The Proponent shall develop a Wildlife Conflict Prevention Plan (the Plan) that includes:
   a) details of a worker education program;
   b) attractant management procedures;
   c) site containment details;
   d) aversive conditioning of bears procedures;
   e) a description of investment dedicated to bear management resources and personnel; and
   f) the Guidelines for Industrial Activity in Bear Country (MPERG, 2008).

42) The Proponent shall provide the Plan to Government of Yukon for review prior to commencing activities.

43) The Proponent shall designate a wildlife monitor on-site to:
   a) ensure that the Plan is implemented;
   b) ensure that electric fences and other related systems are operational;
   c) ensure that attractants are contained and out of reach by bears and other wildlife;
   d) monitor and report bear activity, sightings and incidents to Government of Yukon.

44) Prior to any clearing and construction of undisturbed areas, qualified personnel shall conduct a thorough search of the area to identify and record the location of bear dens. Where a bear den is found, the Proponent shall record the location and establish a one to 1.6 km no-development buffer around the den while active. Clearing and construction activities around identified active dens shall not occur between November and mid-June or until two weeks after den emergence. This accommodates the needs of family groups that must remain close to their dens up to two weeks after den emergence.

45) The Proponent shall use bear-proof or electric fences around camps and all areas considered a potential attractant, including but not limited to food, waste and petroleum products storage areas.

To minimize the risk of vehicle-wildlife collisions:

46) During the winter months, the Proponent shall create breaks in the snow banks created by snow plowing along the North Canol Road to allow moose, and other wildlife, egress off the road to avoid vehicle-wildlife collisions and undue stress.

47) The Proponent shall develop a reporting system for users of the access roads to report potential terrain hazard areas (e.g. avalanche, rock fall, debris slide) and actual geomorphologic processes that have the potential to affect human safety. Reports of such observations shall result in appropriate action being taken to limit terrain hazard risks to road users.

48) The Proponent shall provide annual avalanche training and other terrain hazard training to emergency response workers at the Mactung Mine. Contractors utilizing the access road during winter months shall be required to undertake avalanche hazard training and to ensure that vehicles traveling the road have the appropriate radio frequencies.

49) The Proponent shall develop and complete a terrain hazard management plan prior to the start of construction. The terrain hazard management plan for the Mactung Mine shall include:
   a) A terrain hazard path atlas for the access road and mine site area detailing the location of rock slide, debris slide, and avalanche paths. This atlas shall also be used to record natural geomorphologic activity on a path by path basis in addition to recording the results of geomorphologic control activities at the site;
   b) Establishment of a snow safety program for snow stability assessment;
   c) Establishment of a terrain hazard reporting protocol to assist with forecasting efforts;
   d) Avalanche, rock slide, and debris slide hazard signage along the access road and signage indicating safe turnout areas;
   e) A detailed Emergency Response Procedure for avalanche and other terrain hazards including a list of external specialists (RCMP, SAR, avalanche specialists) that may be contacted to provide additional support during avalanche and other terrain hazard responses;
   f) Details on recommended amount and type of avalanche response equipment that should be maintained for an emergency situation;
   g) Annual avalanche hazard and response training for emergency response team members; and,
   h) Development of road closure and avalanche and other terrain hazard control protocols for avalanche blasting activities and other terrain hazard management activities associated with the Project. Control work will be performed by qualified technicians.

50) The Proponent shall update its Emergency Management Plan, in consultation with Government of Yukon, to include consideration that the access road may be closed for terrain hazard maintenance and/or terrain hazards causing the road to be impassable. The following additional measures shall be included in the finalized Emergency Management Plan:
   a) Identification of an alternate method(s) of evacuation if an injury occurs on-site while the access road is not passable;
   b) Identification of the storage of and/or alternative modes of transportation for critical supplies used for the maintenance of the camp; and
   c) Identification of operational changes that might be required as a result of supplies and/or personnel not being able to be transported during road closure.

51) The Proponent shall install signs, approved by Government of Yukon, Department of Highways and Public Works, that indicate the period of mining activities, including truck traffic, on the North Canol Road.

52) The Proponent shall locate the signs, at a minimum, at the beginning of the North Canol Road, possibly at the ferry crossing and at the Yukon/NWT border.

53) The Proponent shall implement radio communication protocols between its vehicles to inform each other of oncoming traffic. This includes posting the radio frequency used so that other users can monitor traffic.

To minimize the effects of the Project on air quality:

54) The Proponent shall develop an Air Quality Management Plan and receive regulatory approval prior to commencement of site works. The Air Quality Management Plan shall include:
   a) A quantification of projected emissions presented and modeled using an established air quality model to predict local and regional dispersion, resulting ambient concentrations, and deposition of pollutants;
   b) A description of specific mitigation and adaptive management strategies and monitoring methods to be used and a plan for implementation to minimize emissions;
   c) Details regarding the anticipated dust deposition range so that suppression mechanisms can be appropriately established. An estimate of calcium chloride (CaCl) or alternative product usage should be presented in order to determine potential adverse effects to the soil, vegetation, surface and groundwater;
   d) Quantification of any potential links between predicted air quality and subsequent impacts to other valued components such as water quality, fish, wildlife and human health;
   e) Potential sources and quantities of contaminants from the handling and transport of ore and concentrate, and their expected deposition range; and
   f) Description of specific mitigation and adaptive management strategies, and monitoring methods to minimize contamination by fugitive dust from the handling and transport of raw ore and concentrate, the dry-stacked tailings facility, and the processing operations.

55) The Proponent shall develop and implement a plan for the monitoring of plant metal uptake and toxicity. The sampling locations should take into account prevailing winds and water flows.

56) The Proponent shall only dispose tailings and waste rock into the dry-stacked tailings facility.

To minimize project effects on heritage resources in the mine site area:

57) Prior to construction of the proposed Hess River South Access Road and water pipeline and mine site development, the Proponent shall conduct a detailed heritage resource assessment of the area to be disturbed. The Proponent shall provide the results of the detailed heritage resource assessment to Ross River Dena Council and YG Heritage Resources Branch.

58) The Proponent shall work with Ross River Dena Council and YG Heritage Resources Branch to avoid, and/or minimize effects to any heritage resource of value identified in the heritage resource assessment and/or discovered during all phases of the Project.

59) The Proponent shall engage Ross River Dena Council and Government of Yukon Heritage Resources Branch in all further heritage assessment work that may be required at the project site to ensure that heritage resources of value to the Ross River Dena are clearly understood.

To minimize the effects of the Project on heritage resources along the North Canol Road:

60) The Proponent shall conduct heritage resource assessments of the aerodrome expansion area, lay-down areas, gravel resources, or other areas that require land

clearing. The heritage resource assessments shall identify mitigation options for heritage resources discovered and/or areas of increased heritage resource potential. NTC shall provide the results of the heritage resource assessments to Ross River Dena Council and YG Heritage Resources Branch.

To minimize the effects of the Project on traditional land use:

61) Prior to construction of the Project, the Proponent shall complete a traditional land use study of the area potentially affected by the proposed project. The traditional knowledge study may form a part of or be the required traditional land use study. The traditional land use study shall outline potential impacts the Project may have on traditional land use. The Proponent shall make best efforts to involve RRDC in the design and conduct of the study.

62) The Proponent shall enter into discussions with the Ross River Dena Council and Government of Yukon to establish additional mitigation, if necessary, for the construction of the mine and road to the Hess River South Tributary. The completed traditional land use study shall be taken into account in these discussions.

63) The Proponent shall enter into discussions with the Ross River Dena Council and Government of Yukon to establish additional mitigation, if necessary, for the year-round access of the North Canol Road.

64) The Proponent shall enter into discussions with representatives of the Ross River Dena group trapline to establish additional mitigation/compensation, if necessary, for the expected disruption to trapping that will result from the construction of the new access road, the winter maintenance of North Canol Road, and the increase in traffic through all phases of the Project.

To minimize the effects of the Project on the holder of Outfitting Concession #9:

65) The Proponent shall continue communications with the holder of Outfitting Concession #9 to establish additional mitigation measures, if necessary, for the expected disruption of outfitting that will result from the construction and use of the new road to the Hess River South Tributary and the increase in air traffic through all phases of the Project.

16.0 SIGNATORY PAGE

March 10, 2014

Stephen J. Mills — Date

Chair

March 10, 2014

Ken McKinnon — Date

Executive Committee Member

March 10, 2014

Dave Keenan — Date

Executive Committee Member

APPENDICES

Appendix A BIBLIOGRAPHY

Anderson, Sean, C., Farmer R.G., Ferretti, F., Houde, A.S. and Hutchings, J. A. Correlates of Vertebrate (2011). Extinction Risk in Canada. *BioScience* 61(7): 528 – 549

Canadian Endangered Species Conservation Council (CESCC). 2006. Wild Species 2005: The General Status of Species in Canada. Web access: http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e&sec=1

COSEWIC (2002). COSEWIC Assessment and Update Status Report on the Grizzly Bear (Ursus arctos) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 91 pp.

COSEWIC (2003). COSEWIC assessment and update status report on the wolverine (Gulo gulo) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 41 pp.

Davies, B.R., Thoms, M., and Meador, M., 1992., An Assessment of the Ecological Impacts of Inter-basin Water Transfers, and Their Threats to River Basin Integrity and Conservation, Aquatic Conservation: Marine and Freshwater Ecosystems. 2: 325-349.

Dyer, S.J., O'Neill, J.P., Wasel, S.M., and Boutin, S., 2001, Avoidance of Industrial Development By Woodland Caribou, Journal of Wildlife Management. 65(3):531-542.

Environment Canada. 2011 Management Plan for the Northern Mountain Population of Woodland Caribou (*Rangifer tarandus caribou*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Environment Canada, Ottawa. vii + 80 pp.

Government of Northwest Territoires, 2011, http://nwtspeciesatrisk.ca/tiki/tiki-index.php?page=GrizzlyBear, Accessed May 13, 2012.

Government of Yukon, Yukon Water An Assessment of Climate Change Vulnerabilities, 2011

Hammarstrom, J. (2004). Environmental Geochemistry of Skarn and Polymetallic Carbonate-Replacement Deposit Models. In R. Seal, & N. Foley, *Progress on Geoenvironmental Models for Selected Mineral Deposit Types. Open-File Report 02-195.* U.S. Geological Survey.

Heginbottom, J. (1984). The Mapping of Permafrost, The Canadian Geographer, *28* (1): 78-83.

Mining and Petroleum Environmental Research Group and Yukon Government, 2008, Industrial Activity in Bear Country

Natural Resources Canada, 2005 National Building Code of Canada Seismic Hazard Values.

Price, W.A., 2009, Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials.: MEND Report 1.20.1.

Polfus, J. L., M. Hebblewhite, and K. Heinemeyer. 2011. Identifying indirect habitat loss and avoidance of human infrastructure by northern mountain woodland caribou. Biological Conservation 144:2637-2646.

Resource Inventory Group, Government of British Colombia, 1998, Black Bear (Ursus americanus) M-URAM, http://www.ilmb.gov.bc.ca/risc/pubs/tebiodiv/bears/bearml20-02.htm, accessed March 12, 2012.

Ross. P.I. (2002). Update COSEWIC status report on the grizzly bear Ursus arctos in Canada, in COSEWIC assessment and update status report on the Grizzly Bear Ursus arctos in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-91 pp.

Skookum, Kelly. Coordinator, Dune'na Zra Sunch'I Ku Daycare. Personal communication. November 16, 2007.

Smith, C.A.S., J.C. Meikle and C.F. Roots 2004. Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes.

Swotalski, T.A., and Nelson, and C.R. (2011). Efficacy of road removal for restoring wildlife habitat: Black bear in the Northern Rocky Mountains, USA. *Biological Conservation* 144 (11): 2666 – 2673

Theobald, D.M., Miller, J. R., and Thompson Hobbs, N. (1997) Estimating the cumulative effects of development on wildlife habitat. *Landscape and Urban Planning*. 39 (1): 25 – 36

Wardrop, 2009, Amended Technical Report on the Mactung Property, http://www.natungsten.com/i/pdf/Tech-Report-Mactung.pdf, Accessed February 3, 2012.

Wang, T**.,** Hamann, A., Spittlehouse, D.L., and Aitken, S.N. 2006. Development of scale-free climate data for western Canada for use in resource management. Intl. J. Climatology 26(3): 383-397.

Wang, T**.**, Hamann, A., Spittlehouse, D.L., Murdock, T., 2012. ClimateWNA - High-Resolution Spatial Climate Data for Western North America. Journal of Applied Meteorology and Climatology, 51: 16-29.

Weinstein, M.S., 1992. Just Like People Get Lost: A Retrospective Assessment of the Impacts of the Faro Mining Development on the Land Use of the Ross River Indian People.

YEWG (1992) Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes. Smith, C.A.S., Meikle, J.C., & Roots, C.F.(editors). (2004). Yukon Ecoregions Working Group. Summerland British Columbia; Agricultural and Agri- Food Canada, PARC Technical Bulletin No. 04-01.

Yukon Fish and Wildlife Co-management, http://www.yfwcm.ca/species/caribou/redstone.php, Accessed May 11, 2012

Government of Yukon, 2011 Yukon Water: An Assessment of Climate Change Vulnerabilities, http://www.env.gov.yk.ca/mapspublications/documents/yukonwater_climatechange_summaryreport.pdf , accessed May 2, 2012.

Yukon Government, 2012, Yukon Government News Release, #12-007, January 23, 2012, Regulation Changes Will Help Protect Sheep and Caribou Populations, accessed: http://www.gov.yk.ca/news/2011/files/12-007.pdf, September 4, 2012.

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Appendix B COMMENTS ON THE PROPOSAL

YOR Document Number	Name of Person or Party	Date Posted
2008-0304-115-1	Deuling Stone Outfitters, Jarrett Deuling	November 4, 2009
2008-0304-118-1	YFN Government—Na-cho Nyak Dun, Jody Linklater	November 12,2009
2008-0304-120-1	Yasmine Djabri	November 13, 2009
2008-0304-121-1	Yukon Conservation Society, Lewis Rifkind	November 14, 2009
2008-0304-122-1	Government of Northwest Territories, Loretta Ransom	November 16, 2009
2008-0304-123-1	Government of Yukon, ECO-DAP Branch	November 17, 2009
2008-0304-125-1	Yukon Trapping Concession Holder #112, Neil Sisson	November 19, 2009
2008-0304-127-1	YFN Government—Ross River Dene Council, Greg McLeod	November 23, 2009
2008-0304-128-1	HudBay Minerals	November 30, 2009
2008-0304-130-1	Yukon Outfitting Concession Holder #9, Jarrett Deuling	December 3, 2009
2008-0304-131-1	Government of Yukon, ECO-DAP Branch Community Services Energy, Mines & Resources – Land Use Energy, Mines & Resources – Mineral Resources Branch	December 3, 2009

YOR Document Number	Name of Person or Party	Date Posted
	Environment Yukon – Environmental Affairs Health & Social Services – Environmental Health Services Health & Social Services – Policy & Program Development Tourism & Culture – Heritage Tourism & Culture – Tourism	
2008-0304-132-1	Natural Resources Canada, Shelley Ball	December 4, 2009
2008-0304-133-1	Sahtu Renewable Resource Board, Andrea Hrynkiw	December 4, 2009
2008-0304-134-1	Kingmik Expeditions Yukon, Doug Hannah	December 4, 2009
2008-0304-135-1	Yukon Trapping Concession Holder #112, Neil Sisson	December 4, 2009
2008-0304-136-1	Deuling Stone Outfitters, Jarrett Deuling	December 7, 2009
2008-0304-137-1	Tesloa Smith	December 7, 2009
2008-0304-138-1	Yukon Conservation Society, Lewis Rifkind	December 7, 2009
2008-0304-140-1	Environment Canada—Environmental Protection Operations, Denis Lacroix	December 7, 2009
2008-0304-142-1	Yasmine Djabri	December 7, 2009
2008-0304-143-1	Tulita District Land	December 7, 2009

YOR Document Number	Name of Person or Party	Date Posted
	Corporation	
2008-0304-144-1	Department of Fisheries & Oceans, Nathan Richer	December 7, 2009
2008-0304-145-1	Government of Northwest Territories, Loretta Ransom	December 7, 2009
2008-0304-146-1	D. Shorty	December 7, 2009
2008-0304-147-1	Dechen la' Ltd.	December 7, 2009
2008-0304-148-1	Ross River Dene Council, and Liard First Nations	December 8, 2009
2008-0304-155-1	Woodward & Co	February 1, 2010
2008-0304-158-1	Indian and Northern Affairs Canada	February 10, 2010
2008-0304-159-1	Liard First Nations	February 17, 2010
2008-0304-165-1	Environment Canada	August 4, 2010
2008-0304-169-1	Ross River Dene Elders Oversight Committee	February 3, 2011
2008-0304-220-1	Deuling Stone Outfitters, Jarrett Deuling	April 26, 2012
2008-0304-221-1	D. Shorty & J. Froehling	April 26, 2012
2008-0304-225-1	Kaska First Nation Members, Henri Dick & James Dick	May 15, 2012
2008-0304-226-1	Mackay Range Development Corp., Danny McNeely	May 17, 2012
2008-0304-0227-1	Mackenzie Valley Land and Water Board, Rebecca	May 17, 2012

YOR Document Number	Name of Person or Party	Date Posted
	Chouinard	
2008-0304-230-1	Ross River Dene Elders Oversight Committee	May 23, 2012
2008-0304-231-1	Brian Ladue	May 23, 2012
2008-0304-233-1	Dechenla Ltd., Norman Barichello	May 31, 2012
2008-0304-234-1	Ross River Residents	June 4, 2012
2008-0304-237-1	Fisheries and Oceans Canada, Charlotte Haley	July 9, 2012
2008-0304-240-1	Fisheries and Oceans Canada	October 10, 2012
2008-0304-245-1	Environment Canada – Adequacy	March 13, 2009
2008-0304-246-1	Yukon Government – Adequacy	March 15, 2009
2008-0304-247-1	Environment Canada – Adequacy	July 31, 2009
2008-0304-248-1	Yukon Government – Adequacy	August 4, 2009
2008-0304-254-1	Yukon Government – Request to extend Public Review of DSR	October 31, 2012
2008-0304-2601-1	D. Dickson Shutah Dena Presentation	November 7, 2012
2008-0304-261-1	Ross River Dena Elders Oversight Committee – Letter from L. Catalan	November 7, 2012

YOR Document Number	Name of Person or Party	Date Posted
2008-0304-262-1	Y. Djabri Presentation Part 1	November 7, 2012
2008-0304-263-1	Y. Djabri Presentation Part 2	November 7, 2012
2008-0304-264-1	RRDC Elders Oversight Committee Presentation	November 7, 2012
2008-0304-267-1	Yukon Conservation Society	November 26, 2012
2008-0304-271-1	Ross River Dena Elders Oversight Committee Response to DSR	November 28, 2012
2008-0304-272-1	N. Barichello	November 28, 2012
2008-0304-273-1	L. Catalan	November 1, 2012
2008-0304-274-1	Liard First Nation	December 7, 2012
2008-0304-275-1	Y. Djabri and D. Hannah	December 12, 2012
2008-0304-276-1	Ross River Dena Council	December 12, 2012
2008-0304-277-1	Mayo RRC	December 12, 2012
2008-0304-278-1	Yukon Government	December 12, 2012
2008-0304-279-1	Natural Resources Canada	December 13, 2012
2008-0304-280-1	Transport Canada	December 13, 2012
2008-0304-281-1	Environment Canada	December 13, 2012
2008-0304-282-1	Department of Fisheries and Oceans	December 13, 2012
2008-0304-285-1	Nacho Nyak Dun First Nation	December 13, 2012
2008-0304-288-1	Yukon Government Department of Environment	January 4, 2013

YOR Document Number	Name of Person or Party	Date Posted
2008-0304-290-1	Ross River Dena Council	January 7, 2013
2008-0304-296-1	Ross River Dena Council	March 22, 2013
2008-0304-308-1	Ross River Dena Council	October 25, 2013
2008-0304-311-1	Ross River Elders Oversight Committee	October 29, 2013
2008-0304-312-1	L. Catalan	October 29, 2013
2008-0304-316-1	Yukon Government	November 15, 2013
2008-0304-317-1	Ross River Meeting Minutes	October 29, 2013
2008-0304-318-1	Fisheries and Oceans Canada	November 20, 2013
2008-0304-319-1	Ross River Dena Council and North American Tungsten Corporation joint letter	November 20, 2013
2008-0304-339-1	Ross River Dena Council	December 19, 2013
2008-0304-341-1	Technical Meeting Minutes	December 10, 2013
2008-0304-344-1	Ross River Dena Council	January 28, 2014
2008-0305-345-1	Department of Environment, Yukon Government	February 27, 2014

Appendix C PROPONENT COMMITMENTS

No	Proponent Commitment	Reference
Natural Landscape		
	To reduce the development footprint, road widths will be kept to a minimum and stripping for extraction of borrow materials will be limited to minimum requirements.	Section 6, p 422
	Where the probability of soil erosion is moderate or high, exposed soils will be revegetated with native species to enhance soil stability. Drainage will be assessed and managed to maintain natural drainage patterns where possible and ensure that new drainage patterns are directed to areas with stable soil and terrain.	Section 6, p 422
	Slope stability studies have been initiated and will be completed to aid road design and construction. If unstable slopes are identified, they will be avoided or suitable construction methods will be used to increase stability in these sections. Road maintenance inspections will be conducted throughout all project phases, which will allow for timely mitigation of any areas where slope instability is found to be an issue.	Section 6, p 422
	Aesthetics will be considered for borrow pit site selection.	Section 6, Table 6.2.1-2, p 424
	Minimum size borrow pits will be used.	Section 6, Table 6.2.1-2, p 424
Soil Stability		
	Road cutslopes will be finished at stable slope gradients. The actual finished slope gradient of cutslopes will depend on the characteristics of surficial material. Final cutslope gradient will be determined by an experienced professional following assessment of site specific soil texture.	Section 6, p 422

No	Proponent Commitment	Reference
	Fillslopes will generally be prepared by removing vegetation and organic soils prior to placement of fill material. If fillslopes are constructed in terrain with natural slopes greater than approximately 30 percent, fill material will be keyed-in to existing surficial material and compacted. Terrain at potential fillslopes will be assessed during pre-design geotechnical evaluation and if shallow bedrock or permafrost is detected, site-specific recommendations for road design in these sections will be developed by a qualified professional.	Section 6, p 423
	Ground-truthing of terrain along the existing exploration access road and proposed new section of access road to the Mactung mine site indicated that surficial materials were mostly well-drained to moderately well-drained. There were no drainage-related mass movement processes observed in the study area. Culverts will be placed at all natural watercourses. The diameter of the culverts will be at least 900 mm. Recommendations for culvert-spacing in areas with infrequent natural watercourses will be developed during assessment for final detailed design. Natural drainage micro-watersheds will be defined to avoid over-concentration of run-off to culverts. Outlets of culverts that are not placed at natural stream channels will be armoured to disperse the flow energy on to natural slopes and sumps will be installed when required at culvert entrances to help trap sediment.	Section 6, p 423
	Ditch filters and settling ponds/sumps at culvert inlets.	Section 6, Table 6.2.1-2, p 425
	Road maintenance will include monitoring and clearing of culverts, if required, to ensure maximum design function during periods of peak volume run-off.	Section 6, p 423
	If sections of permafrost are identified during geotechnical evaluation for detailed road design, recommendations will be developed for these areas to minimize potential degradation of permafrost, such as placement of geotextile over undisturbed	Section 6, p 423

No	Proponent Commitment	Reference
	ground and a minimum fill thickness of 1.4 m.	
	Standard mitigation measures will be used to reduce the potential for introduction of sediment to streams during construction. Sediment fences will be placed in ditches and other appropriate locations if intercepted run-off contains unacceptable levels of suspended sediment, as defined by the Government of Yukon Water Licence, which is required for this project. If necessary, construction will be suspended during periods of high precipitation to reduce the potential for the introduction of unacceptable levels of suspended sediment to streams.	Section 6, 423
	Upon completion of road construction, NATC will develop and implement a monitoring program and schedule to assess the ongoing condition of roads, culverts and stream crossings. The monitoring program will include stability, condition and erosion potential of road bed, cutslopes and fill slopes. The integrity and function of ditches and culverts and the integrity and stability of bridge abutments will also be monitored. Monitoring will be conducted to identify potential erosion processes that could result in unacceptable levels of suspended sediment in streams. If monitoring of potential erosion in streams indicates that action is required, then practical measures can be implemented such as adding sediment fences in key locations and the temporary diversion of run-off away from streams. Both the DFO and Government of Yukon regulators will be consulted regarding proposed mitigation measures.	Section 6, p 423
	Revegetate disturbed areas with native vegetation.	Section 6, Table 6.2.1-2, p 425
Human Safety		
	As no active or recent landslides were observed in the study area, no mitigation measures are suggested other than on-going monitoring of slopes as a component of	Section 6, p 424

No	Proponent Commitment	Reference
	other on-going field monitoring (e.g. road monitoring).	
	Scheduled inspections of access roads and diversion channel to allow for timely removal of snow.	Section 6, Table 6.2.1-2, p 426
	The probability of rockfalls affecting human safety is low. However, a reporting system will be in place for users of the access roads to report potential rockfall areas or actual fallen rocks that have the potential to affect human safety. Reports of such observations will result in action being taken to remove fallen rocks from roads.	Section 6, p 424
	Avalanche conditions will be assessed and avalanche frequency will be recorded to create a baseline for avalanche prediction before the construction phase begins. Avalanche hazards will be monitored when potential avalanche activity is determined to be moderate to high. Development activity in areas of high avalanche hazard will be limited and closely monitored during periods of high avalanche probability. An avalanche safety program will be developed and implemented, and the appropriate safety equipment will be available on-site during construction, operation and decommissioning.	Section 6, p 424
Water Quality		
	Geochemical characterization to minimize PAG volumes in waste extraction from underground and quarrying of borrow material for ravine dam construction.	Section 6, Table 6.2.2-1, p 438
	Any material that is classified as PAG will be disposed of underground as backfill during the initial mining stages. Underground disposal within frozen bedrock zone.	Section 6, p 430 & 437, Table 6.2.2-1, p 438
	Construction design to minimize drill and blast when undertaking rock cuts from	Section 6, Table 6.2.2-1, p 438

No	Proponent Commitment	Reference
	access road upgrades and new construction.	
	NATC will collect representative bulk samples of blended materials to establish field monitoring programs.	Section 6, p 435
	If blending is not feasible then materials segregation will be conducted with separate volumes of PAG and non-acid generating (NAG) materials being temporarily stored on the surface.	Section 6, p 435
	Encapsulation of PAG material.	Section 6, Table 6.2.2-1, p 438
	Where PAG volumes of fresh rock exposed in rock cuts are small (<50 m^3) NATC proposes to utilize the rock for sub-grade construction within the road near to the source location. The compacted running surface of the final access road should limit oxygen and water infiltration into the road thus limiting weathering processes.	Section 6, p 435
	Operation phase characterization of the PAG tailings materials disposed of within the DSTF will be carried out on monthly composites. The monthly composites will be analyzed for ABA and total metals content to provide information for use in final closure plan design, planning objectives and preliminary methods. Volumes of tailings placed into the facility will also be recorded on a monthly basis.	Section 6, p 437
	NATC will collect representative bulk samples of tailings from the initial years of the operation phase in order to establish a field monitoring program representative of the materials that may potentially become acidic prior to decommissioning.	Section 6, p 437
	Final encapsulation of materials. A cover system designed to encapsulate the materials and minimize the ability of oxygen and water to access the materials will be	Section 6, p 438

No	Proponent Commitment	Reference
	installed during decommissioning.	
	Underground workings will be sealed and underground materials will be isolated from oxygen.	Section 6, Table 6.2.2-1, p 440
	Monitoring wells located downstream of the ravine dam allow for pumping back of any groundwater seepage from the facility that is not in compliance with potential Water Licence discharge criteria.	Section 6, p 437
	Inspections of the DSTF cover system will be conducted at a frequency to be determined by Government of Yukon, Energy Mines and Resources; however, the duration of the inspection period is anticipated to extend to the initial three year post-closure period.	Section 6, p 437
	Mitigation of the potential for malfunction of the DSTF cover system will be provided in the form of Financial Security provided by NATC to allow for ongoing periodic inspections in addition to repairs to the cover system in the first 10 years following closure.	Section 6, p 437
Climate		
	NATC is committed to employing mitigation measures to minimize the project's contribution to greenhouse gas emissions: investigating the potential of using alternative energy sources, such as wind energy, at the site; using state-of-the-art power generators that are designed to produce fewer emissions; the efficient use of vehicles and machinery on-site.	Section 6, p 444
Air Quality		

No	Proponent Commitment	Reference
	Adherence to the Air Emissions Permit issued by Government of Yukon, Department of Environment, pursuant to the Air Emissions Regulations under the Yukon Environment Act (2002).	Section 6, p 447
	Efficient use of air and ground transportation to minimize fuel usage and therefore minimize emissions.	Section 6, p 447
	In areas of high activity and/or dry conditions, NATC will apply dust suppressants, such as water or calcium chloride, to minimize airborne dust.	Section 6, p 447
Noise		
	To minimize the effects of noise disruption within the Town of Ross River, NATC will ensure that hauling traffic and heavy equipment only moves through the community between the hours of 7:00 am and 8:00 pm.	Section 6, p 450
Vegetation		
	NTC and the Ross River Dena Council are jointly developing a land use and wildlife management plan that will address access issues such as restricting personnel activities to established roads and trails and limiting the recreational use of undisturbed areas.	Traditional Knowledge Implementation Document
	Three primary reclamation goals include: maintaining biodiversity of plant communities after reclamation by planting more than one species; ensuring persistent non-native invasive plant species (weeds) are not used during reclamation and are controlled if introduced on-site; and ensuring that exposed soil is seeded in a timely manner in order to exclude the colonization of persistent non-native invasive plant	Section 6, p 462 & p 463
	Adopt an adaptive management approach.	Section 6, p 463

No	Proponent Commitment	Reference
	Construction and clearing will attempt to overlap with previously disturbed areas, where possible.	Section 6, p 463
	Salvage of organic and mineral top soils and their associated seed stock for future reapplication during reclamation and revegetation of the project area.	Section 6, Table 6.2.6-6, p 455, p 463
	Dust suppression (water), during summer operation of roads and dry-stack tailings facility; monitoring accumulation.	Section 6, Table 6.2.6-6, p 456, p 463
	Restricting personnel activities to established roads and trails and limiting the recreational use of undisturbed areas at all times.	Section 6, Table 6.2.6-6, p 456, p 460
	Restrict off-road use of motorized vehicles and equipment.	Section 6, p 463
	Restrict the placement of snow and sand piles to areas that are less sensitive, and ensure that any potential salt and sand piles are removed each spring to ensure that build-up and run-off does not occur into adjacent vegetation.	Section 6, Table 6.2.6-6, p 456, p 460
	Ensure all exposed soil and reclamation areas are replanted.	Section 6, Table 6.2.6-6, p 456
	Implement ecosystem specific revegetation plans.	Section 6, Table 6.2.6-6, p 456
	Use native species mixes (preferably local stock) for revegetation.	Section 6, Table 6.2.6-6, p 456
	Educate employees about the sensitivity of removing any local plants or plant parts for consumption.	Section 6, p 463
	Educate employees regarding the sensitive nature of alpine areas with a substrate dominated by lichen cover and wetlands with a substrate dominated sphagnum	Section 6, p 463

No	Proponent Commitment	Reference
	species.	
	Monitor the levels of accumulation of metals in vegetation should take place as a precautionary approach to identify if bioaccumulation is taking place in vegetation, fish and wildlife habitat. Monitoring will include taking samples two years following the opening of the mine and every five years following this until the decommissioning of the mine.	Section 6, p 461
	Three primary reclamation goals include: maintaining biodiversity of plant communities after reclamation by planting more than one species; ensuring persistent non-native invasive plant species (weeds) are not used during reclamation and are controlled if introduced on-site; and ensuring that exposed soil is seeded in a timely manner in order to exclude the colonization of persistent non-native invasive plant species (weeds).	Section 6, p 462 & p 463
Ross River Dena Council		
	North American Tungsten will work with the RRDC to: • Identify, avoid, minimize and/or mitigate the effects of the Mactung Project on Mount Allan, Yukon, and the lands that surround it. • Protect and maintain environmental quality and heritage resources. • Ensure that the Mactung Project is undertaken in accordance with principles that foster beneficial socio-economic change without undermining the ecological and social systems on which communities and their residents, and societies in general, depend. • Recognize and, to the extent practicable, enhance the traditional economy of Ross River Dena and their special relationship with the wilderness environment. • Guarantee opportunities for the participation of Ross River Dena and make	Traditional Knowledge Implementation Document

No	Proponent Commitment	Reference
	use of their knowledge and experience in the Mactung Project. • Ensure that the traditional knowledge of the Ross River Dena will help to inform NTC's decisions during all of the Mactung Project's phases.	
	North American Tungsten will work collaboratively with the Ross River Dena in the following areas: • Traditional Knowledge and Heritage Resources; • Environmental Monitoring; • Fish and Wildlife Monitoring and Management; • Water Management; and • Linear Development.	Traditional Knowledge Implementation Document
Wildlife		
	A fish and wildlife plan will be developed to address the concerns identified in the Traditional Knowledge Report produced by the Ross River Elders for the Mactung Project area and may include: • Monitoring programs that may add to the knowledge of unique fish and wildlife in the Mactung Project area. • Mitigation and adaptive management practices identified in the Traditional Knowledge Report. • Identifying opportunities to work with the Government of Yukon to address overhunting and overfishing either through the joint development of a harvest management plan, special management areas, habitat protection, or regulations. • Mitigation measures and adaptive management practices that address temporal sensitivities for various fish and wildlife.	Traditional Knowledge Implementation Document
	Mactung operational policy will include specific mitigation and avoidance measures to ensure that wildlife are respected and potential disturbances are minimized.	

No	Proponent Commitment	Reference
	Specifically:	
	An employee training program will be conducted to describe and illustrate the importance of following all wildlife mitigation measures.	Section 6, p 472
	Speed limits, especially near sensitive wildlife areas, will be posted and enforced.	Section 6, p 472
	Post traffic signs in sensitive wildlife areas	Section 6, Table 6.2.7-1, p 476
	A wildlife right-of-way policy will be implemented for all mine related traffic.	Section 6, p 472
	A no hunting policy for all mine employees and contractors will be enforced while working at Mactung (i.e. no firearms will be allowed at camp).	Section 6, p 472
	Prohibit use of ATVs and snowmobiles at Mactung	Section 6, p 475
	An access gate will be installed near kilometre 17.5 of the access road for the duration of construction, operation and decommissioning.	Section 6, p 473
	A Wildlife Reporting Log will be implemented for all mine employees and contractors.	Section 6, p 473
	The harassment of wildlife, as defined under the Wildlife Act (Yukon), will be prohibited.	Section 6, p 473
	Roads and bridges will decommissioned and reclaimed to discourage access.	Section 6, p 475 & 513
	Infrastructure will be removed from the mine site and the footprint will be reclaimed to simulate the area's original habitat.	Section 6, p 475 & p 509
	Introduction of deleterious substances will be avoided, including road dust by use of	Section 6, p 524

No	Proponent Commitment	Reference
	Best Management Practices.	
	Implement Wildlife Monitoring Program to assess the effects of the Mactung development on wildlife. Evaluate the effectiveness of mitigation measures in avoiding or minimizing effects on wildlife; confirm compliance with regulatory requirements (e.g. Yukon Wildlife Act). Develop a framework to continually evaluate and adapt mitigation measures and best management practices.	Section 6, p 528
	For Birds: Precautions will be taken to ensure nesting on manmade infrastructure does not occur, to avoid threats to the birds and mine employees. A nest survey will be conducted within the direct footprint of the access road prior to clearing to document all nests, nesting habitat and locations, species, and eggs/fledglings. Active nests identified within the construction footprint must not be disturbed or destroyed. Under the Migratory Bird Convention Act (1994), it is illegal to disturb or destroy a migratory bird or its nest without appropriate permitting. Restrict vegetation clearing to outside of the breeding season.	Section 6, p 509, Table 6.2.7-10, p 510

No	Proponent Commitment	Reference
	For Caribou: Recovery of favoured caribou habitat following reclamation (short-term reversibility). Wildlife Monitoring Program – A survey program will be established to monitor caribou distribution and abundance relative to the project infrastructure and activities in order to document whether changes to local caribou habitat use occur in conjunction with the project. During clearing and construction of the ravine dam and dry-stacked tailings facility, the removal or clearing of vegetation will be limited through the efficient use of cleared land and careful planning. Cleared areas will be re-vegetated following mine closure.	Section 6, p 471, p 473 & p 477
	For Moose: Wildlife Monitoring Program- A survey program will be established to monitor moose distribution and abundance relative to the project infrastructure and activities in order to document whether changes to local moose habitat-use occurs in conjunction with the project. The removal or clearing of vegetation will be limited through the efficient use of cleared land and careful planning; Clearing and construction activities can be minimized during late winter when moose energy reserves are low and snow depth is high; cleared areas will be re-vegetated following mine closure; Limit snow bank height at known travel corridors.	Section 6, p 481, Table 6.2.7-3 p 486
	For Grizzly Bear: An employee training program will be conducted to describe and illustrate the importance of following all wildlife mitigation measures and review protocol for bear encounters.	Section 6, p 490, p 491 & p 493, Table 6.2.7-17, p 529

No	Proponent Commitment	Reference
	Include appropriate protocols for addressing bear issues/encounters in the Environmental Management Protocol. All camp and construction waste will be incinerated to prevent attracting wildlife, such as grizzly bears. Manage all camp and mine waste in accordance with the Yukon Wildlife Act, to prevent attracting dangerous and nuisance wildlife, such as grizzly bears. All worksites will be kept clean and free of garbage. The removal or clearing of vegetation will be limited through the efficient use of cleared land and careful planning and re-vegetation. Grizzly bear occurrence or mortalities in relation to the Mactung project will be monitored during the construction, operation, decommissioning, and reclamation project phases. Any cases of nuisance bears, injuries or other encounters of concern between employees and grizzly bears, as well as vehicle collisions with grizzly bears will immediately be reported to the local Conservation Officer.	
	For Wolverine: Decommission the road and remove water crossings upon completion of mining and decommissioning activities.	Section 6, p 499
	For Hoary Marmot: Decommission the road and remove water crossings upon completion of mining and decommissioning activities.	Section 6, p 515
	An employee training program will be conducted to describe and illustrate the importance of following all wildlife mitigation measures.	Section 6, p 472
Biodiversity		

No	Proponent Commitment	Reference
	Wherever possible, alterations to natural drainage patterns, topography and avalanches will be minimized to maintain natural physical processes.	Section 6, p 524
	Avoid introduction of invasive and alien species or deleterious substances.	Section 6, p 525
Hydrology		
	The period of water withdrawals for this project component will be from June to October. The withdrawal rate will be less than 1 percent of the total flow within the South Macmillan River during the period of the water withdrawals. Therefore the volume is within the natural variability for the local hydrological regime.	Section 6, p 532
	Withdrawals less than 6 percent for all but two months when withdrawing from Hess River Tributary during low flow periods.	Section 6, Table 6.2.8-3, p 548
	Use of Hess River Tributary to supplement un-diverted inflows while filling the reservoir to ensure quality of fish habitat is maintained.	Section 6, Table 6.2.8-3, p 548
	Construction sequencing to minimize flow interruptions.	Section 6, Table 6.2.8-3, p 548
	Water will be sourced from local streams close to the construction sites. Transportation of water will primarily be by water truck. The volume of water required for this component will be low but any potential downstream withdrawal related effects can be mitigated by controlling the rate of water withdrawal during each filling period.	Section 6, p 532
	Water withdrawals from the areas of the aerodrome, access road, and diverted portions of the Tributary C catchment will be managed to partially mitigate potential	Section 6, p 546

No	Proponent Commitment	Reference
	effects resulting from lowered streamflows.	
	Water withdrawals will not exceed 10 percent of the overall channel flow during the period of the withdrawal.	Section 6, p 546
	Water withdrawals will be sourced from the major streams where there are sufficient flow volumes to ensure that potential negative effects from lower water volumes do not occur. Water withdrawal station locations will be determined during the detailed design phase for the road with the locations included in the Water Licence application for the project.	Section 6, p 546
	Screening of water intakes will be conducted in accordance with appropriate legislated requirements to prevent fisheries effects.	Section 6, p 546
	Erosion control and sediment management practices during construction.	Section 6 Table 6.2.8-3, p 548
	Engineered design for all rip-rap and bank armouring designs.	Section 6, p 558
	Development of a water withdrawal strategy.	Section 6, Table 6.2.8-3, p 549
	Locate processing plant and other infrastructure within the undiverted reservoir catchment area, to prevent uncontrolled discharges to the receiving environment.	Section 6, p 558
	Seepage from Dry-Stack Tailings Facility will be collected in ravine dam and reservoir.	Section 6, Table 6.2.8-3, p 549
	Seepage from underground workings collected in reservoir.	Section 6, Table 6.2.8-3, p 549
	Discharges from the ravine dam will be regulated in order to prevent unwanted	Section 6, p 546

No	Proponent Commitment	Reference
	downstream channel erosion due to excessive flow volumes. The regulation of flows using gates or pumps will allow for the mimicking of natural flow conditions based on flows within the diversion channel. Flows will be monitored to assist in regulation of the ravine dam discharges.	
	Pump discharge scenarios involve a regulated discharge that is based on the total pumping capacity. The maximum pumping capacity considered for the ravine dam would be on the order of 8,000 USGPM (0.51 m^3/s) which is less than the estimated 10-year peak run-off (Q10) of 1.34 m^3/s for the ravine dam catchment. Downstream effects from pumping at this rate would not be expected to result in downstream channel changes from changes to the Tributary C water volumes. The maximum pumping capacity will only be in effect during large return period storm events and as a result there is not anticipated to be downstream effects from water volumes being discharged from the reservoir as they would be lower than natural flows.	Section 6, p 547
	A gated discharge system for the reservoir would be used in the same manner as a pumped discharge system.	Section 6, p 547
	The primary mitigation measure for accidents and malfunctions is the use of applicable design standards, which provide a factor of safety, and the use of industry best management practices. Mitigation of potential accidents and malfunctions during all project phases would be identified through the monitoring and inspection programs that form part of the operating procedures for mine related infrastructure like the ravine dam and diversion channel.	Section 6, 547
	The hydrological effects from accidents and malfunctions related to the diversion channel can be partially prevented. Equipment from the DSTF construction fleet can be used to respond to situations on the diversion channel.	Section 6, p 547

No	Proponent Commitment	Reference
	Failure of the ravine dam under an earthquake in exceedance of the design seismic event cannot be mitigated; however there would be other substantial environmental effects occurring as a result of an event of this magnitude. Failure of the ravine dam as a result of other potential failure mechanisms will be evaluated using instrumentation installed within the dam structure along with a schedule of regular inspections by qualified personnel under the direct supervision of a registered professional engineer.	Section 6, p 547
	Decommissioning plan for de-commissioning of Ravine dam (e.g. impermeable cover to isolate tailings).	Section 6, Table 6.2.8-3, p 549/ p 550
Water Quality		
	Comply with Water Licence criteria.	Section 6, p 558
	Development of site specific Water Quality Objectives based on natural exceedances.	Section 6, table 6.2.8-6, p 561
	Employ approved process treatment chemicals and operate the plant efficiently to minimize contaminants.	Section 6, p 558
	Treat reservoir discharge water if required.	Section 6, p 558
	Conduct environmental construction monitoring during activities, such as concrete pouring for the water intake facility, to ensure that the waste water from concrete mixing is disposed of in an acceptable manner	Section 6, p 558
	Maintain a minimum 30 m re-fuelling distance from watercourses, where possible. Where re-fuelling activities are to occur within 30 m of a watercourse, then a spill kit	Section 6, p 558

No	Proponent Commitment	Reference
	is required to be available at this location for the duration of the re-fuelling activities.	
	Properly design and maintain containment measures for bulk fuel storage facility.	Section 6, p 558
	Prepare, and have available, spill kits containing appropriate amount and type of materials where project activities occur in and around a water body.	Section 6, p 559
	Progressively remediate hydrocarbon contaminated soils in an on-site land treatment facility (LTF) during operation and into decommissioning.	Section 6, p 559
	Include LTF operations, Phase II Environmental Site Assessment (ESA), and Phase III ESA in decommissioning plan.	Section 6, p 559
	Water withdrawal station locations will be identified in the Water Licence application. These stations will be used for water withdrawal during the construction, operation and decommissioning phases.	
	Install sewage treatment system with qualified operations and maintenance personnel.	Section 6, Table 6.2.8-6, p 560
	Equipment, instream, earthworks best management practices and scheduling.	Section 6, Table 6.2.8-6, p 560
	Spill Contingency Plan	Section 6, Table 6.2.8-6, p 560
	Site water tank sized to provide some freshwater requirement for processing.	Section 6, Table 6.2.8-6, p 560
	Ravine dam operations manual to include a section on introduction of deleterious substances.	Section 6, Table 6.2.8-6, p 561

No	Proponent Commitment	Reference
	Pre-freshet inspections and snow clearing.	Section 6, Table 6.2.8-6, p 561
	No instream closure works required.	Section 6, Table 6.2.8-6, p 561
	No water discharge to environment unless it meets Water Licence criteria.	Section 6, Table 6.2.8-6, p 562
	Decommissioning this tailings area prior to ravine dam.	Section 6, Table 6.2.8-6, p 562
	Should oxidation by-products be observed (through recommended monitoring program), it is possible to accelerate placement of the waste rock underground.	Section 6, p 574
Groundwater		
	Bulkheads and concrete seals will prevent surface water entry and oxygen migration to the underground.	Section 6, p 575
	Dewatering of mine (from year five) and discharge of mine inflow into the reservoir.	Section 6, Table 6.2.8-8, p 579
	Seepage will be monitored in closed out portions of the backfilled workings in the lower portion of the mine during the later operating years.	Section 6, p 575
	After mine closure, the groundwater quality downstream of the underground workings will be monitored at groundwater observation wells to confirm that no degradation of water quality occurs due to acid mine drainage and/or metals leaching.	Section 6, p 575
	Dry-stack Tailings Facility: As a mitigation strategy to prevent the possibility of groundwater seepage through the tailings pile, the granular materials that are naturally present in the area will be left in place to serve as blanket underdrain to ensure that seepage from the tailings pile	Section 6, p 576

No	Proponent Commitment	Reference
	travels laterally downslope rather than mounding up into the tailings. Removal of borrow materials will be limited to ensure that an adequately thick (> 1 m) unsaturated natural blanket drain is maintained in this area. Grading will be done to encourage overland flow of any seepage from the DSTF directly to the reservoir dam, where water quality will be monitored and controlled, if necessary. During tailings placement at the DSTF (year 1 to 11), any lateral seepage from the seasonally active layer of the DSTF will be observed by weekly visual inspection of the tailings storage area. When seepage is observed, it will be directed overland (using swales and ditches) to the reservoir via Tributary C. The existing groundwater observation wells MW-MT-08-04, and MW-MT-08-04B downgradient of the DSTF will be monitored for groundwater quality during the operational phase to confirm groundwater chemistry in this area. Monitoring will continue post mine closure for five years to ensure that the geomembrane cover effectively prevents ongoing seepage through the DSTF. Groundwater samples should be collected annually for the first three years following mine closure and biannually thereafter if necessary. The samples should be analyzed for major ions and dissolved metals.	
	Keep PAG waste rock on surface less than five years. Monitor and accelerate disposal of waste rock underground if acidification is observed.	Section 6, Table 6.2.8-8, p 579
	If acidification of the waste rock occurs more rapidly than expected, then accelerated placement as mine backfill is the most prudent mitigative option to limit the exposure of the PAG source to oxygen and moisture.	Section 6, p 578

No	Proponent Commitment	Reference
	NATC will visually inspect and record the waste rock piles on a monthly basis. If the monthly visual inspection indicates the onset of acidification, monitoring of the shallow groundwater quality downgradient of the waste rock storage areas may become necessary.	Section 6, p 578
	Samples should be taken quarterly if necessary based on visual inspection from a shallow observation well to be installed approximately 10 m downgradient of any proposed PAG waste rock storage areas prior to mine construction, and any springs immediately downgradient of the waste rock storage area during spring, summer, and early fall when the active layer is unfrozen.	Section 6, p 578
	Groundwater seepage will be captured and controlled if the surface water quality in the reservoir is unsuitable for discharge to Tributary C. This will be achieved through the use of pumping wells to be situated downstream of the dam.	Section 6, p 578
	If reservoir water quality exceeds discharge standards, groundwater samples will be collected monthly from downstream pumping wells (located approximately 100 m downgradient of the toe of the dam) to determine groundwater quality downgradient of ravine dam.	Section 6, p 578
Fish		
	Conducting a permitting review with the Department of Fisheries and Oceans (DFO) prior to any works. All works will adhere to the terms of either the Fisheries Act. Authorization or Letter of Recommendation resulting from that review.	Section 6, p 594
	All instream works will be conducted in isolation from the active channel to reduce the potential risk to fish habitat; these activities will be monitored by environmental	Section 6, p 594

No	Proponent Commitment	Reference
	professionals.	
	An environmental management plan (EMP) will be developed and employed by NATC and its contractors for all works. This plan will outline best management practices for construction, control of activities on-site, site stabilization, environmental monitoring, and instream works, based on the following literature: − DFO Standard Operational Procedures; − Land Development Guidelines for the Protection of Aquatic Habitat (DFO and BCMOE 1993); − A Users' Guide to Working In and Around Water (BC Ministry of Land Water and Air Protection, 2005); − Standards and Best Management Practices for Instream Works (BC Ministry of Land Water and Air Protection, 2004)	Section 6, p 594
	Wherever possible, instream works and works in the vicinity of fish-bearing watercourses will be conducted at low flow periods.	Section 6, p 594
	Fords will not be installed or used as watercourse crossings due to the abundance of sediment fines and the high precipitation microclimate in the footprint area.	Section 6, p 595
	Mitigation measures will include installing educational materials, such as signage, at accessible watercourses to outline the sensitivity of local populations to over fishing.	Section 6, p 601
	Application of best management practices within riparian zones.	Section 6, Table 6.2.9-2, p 601
	When fish habitat loss may occur, NATC will obtain DFO permitting through Fisheries	Section 6, Table 6.2.9-2, p 602

No	Proponent Commitment	Reference
	Act Authorization or Letter of Advice.	
	Preparation of compensation plan.	Section 6, Table 6.2.9-2, p 602
	Fish passage in accordance with Fisheries Act Authorization or Letter of Advice.	Section 6, Table 6.2.9-2, p 602
	Instream works conducted in isolation from active channel.	Section 6, Table 6.2.9-2, p 602
	Developing an environmental management plan (EMP) for use by NATC and its contractors for all works. This plan will outline best management practices for construction, site control, soil stabilization, environmental monitoring, and instream works, based on the following literature: − DFO Standard Operational Procedures; − Land Development Guidelines for the Protection of Aquatic Habitat (DFO and BCMOE 1993); − A Users' Guide to Working In and Around Water (BC Ministry of Land Water and Air Protection, 2005); − Standards and Best Management Practices for Instream Works (BC Ministry of Land Water and Air Protection, 2004)	Section 6, p 605
	The release of excess water from the reservoir will be regulated under the Territorial Waters Act, the Fisheries Act, and MMER. As the precise makeup and effects of this process water will not be known until operation, process water release will only proceed according to allowable regulation.	Section 6, p 610
	A water release regime plan for the reservoir will be subjected to regulatory review by	Section 6, p 607

No	Proponent Commitment	Reference
	both the Yukon Water Board and DFO.	
	Discharges from the reservoir will be subject to the Metal Mining Effluent Regulations (MMER) and territorial Water Licence criteria. NATC is in the early stages of planning a fisheries and aquatic environment monitoring program (an anticipated requirement for MMER and the Water Licence).	Section 6, p 610
	NATC will work with regulatory agencies during the permitting process to develop site specific environmental standards for parameters such as water, sediments, nutrients, pH, and others.	Section 6, p 610
	Winter low flow levels in Tributary C will be maintained as necessary according to the terms of the Water Licence or other regulation.	Section 6, p 607
	Early summer discharges can be regulated if deemed necessary to approximate natural freshet flows.	Section 6, p 607
	Regulating and monitoring the use of hydrocarbons and other industrial substances under NATC's environmental management plan for the mine, and spill response will be conducted according to the spill contingency plan.	Section 6, p 610
	Incorporating educational material, such as signage, at accessible watercourses to describe the sensitivity of local populations to overfishing.	Section 6, p 611
	Installing a gate to prevent unauthorized access to Tributary E to limit fishing pressure at the Hess River Tributary.	Section 6, p 611
	Reclamation/Decommissioning:	Section 6, p 616/ p 617, Table 6.2.9-9, p 619

No	Proponent Commitment	Reference
	DFO will be consulted during preparation for reclamation. Watercourse crossings will be removed, returning fish passage characteristics to baseline levels at minimum. The access road will be decommissioned, unless the Government of Yukon agrees to take over management of the road. Decommissioning the road will remove all access capacity to the Hess River Tributary, and will limit access to Tributaries D3, D9, and D13 (the only fish-bearing watercourses on the road) to pre-development levels.	
Heritage Resources		
	Assessment of areas not previously identified for clearing and excavating.	Section 6, p 622
	If the footprint of the project should change to require land-altering activities outside of the previously assessed area, a qualified professional will be retained to conduct an assessment for archaeological resources. The results of this assessment will be submitted for review and approval to the Government of Yukon, Heritage Resources.	Section 6, p 623
	Heritage resources encountered will be protected and reported to authorities.	Section 6, p 622
	If heritage resources are discovered during operations, NATC will mark and protect the site from disturbance. NATC will contact the appropriate authorities to report the discovery, and will not carry out any activities in the vicinity of the heritage resource until permission to resume activities has been granted.	Section 6, p 623
	NATC will communicate heritage resource terms and conditions listed in authorizations to employees and contractors.	Section 6, p 622
	If at any point during the construction and operation of the mine and its accessory	Section 6, p 678

No	Proponent Commitment	Reference
	projects a heritage site is discovered or disturbed, NATC will immediately cease work in the immediate vicinity and contact both the Ross River Dena Council and the Yukon Heritage Branch. No work in the immediate vicinity will resume until the site is assessed.	
Sustainable Livelihoods		
	NATC plans a standard 3-week in, 3-week out rotation for all employees. It is anticipated that the three week period of time off will provide sufficient time for First Nation employees to pursue traditional activities, but the company will be open to considering other scheduling options that might be more accommodating to First Nations and local employees.	Section 6, p 656
	NATC will enter into talks with representatives of the users of the Ross River group trapline and with the registered owners of Trapline 112 to establish a level of compensation for the expected disruption of trapping that will result from the construction of the new access road, the winter maintenance of North Canol Road, and the increase in traffic through all phases of the project.	Section 6, p 657
Infrastructure		
	NATC is aware that the Mactung project will increase the volume of heavy truck traffic through Ross River, particularly during the construction phase of the project. The company will prepare a traffic plan, with input from the community, to minimize negative effects.	Section 6, p 664
	NATC is identifying the feasibility of reducing its reliance on diesel generators by using wind or geothermal generation. This may benefit the company through reducing its operational costs but will also have the wider benefit of reducing greenhouse gas	Section 6, p 665

No	Proponent Commitment	Reference
	emissions.	
Business		
	NTC is committed to create opportunities for members of the Ross River Dene Council and the Liard First Nation to benefit from business opportunities arising from the development of the Mactung Mine.	
Community		
	NATC will consider relocation incentives for new employees of Mactung who reside outside of the Yukon. The company will work with the Town of Faro and Faro Real Estate Ltd. to make Faro a preferred place for employees to relocate.	Section 6, p 673
	NATC, in consultation with each community, is planning to sponsor at least one community event in Ross River and Faro once the operation phase begins.	Section 6, p 674
	NATC will strictly enforce a workplace policy prohibiting any form of discrimination or racism in the workplace. Complaints will be treated seriously and dealt with immediately.	Section 6, p 674
	In addition to the regular rotation and annual holiday time, NATC will have a flexible time-off policy in place allowing all employees to book further unpaid time off assuming qualified replacement employees can be scheduled to cover the absence. This will further mitigate any negative effect the project may have on First Nation social and cultural activities.	Section 6, p 679
	Upon opening of the mine, NATC will offer an annual scholarship to a qualified student(s) from Ross River, Faro, Watson Lake or Mayo who are pursuing a post-secondary education, particularly in a mining related field.	Section 6, Table 6.3.6-1, p 681

No	Proponent Commitment	Reference
	NATC will implement the training programs currently used at Cantung, especially its underground training in partnership with the Yukon Mine Training Association.	Section 6, Table 6.3.6-1, p 682
	To facilitate employee career advancement, NATC will implement its policy of initially posting all employment positions internally, and, with a particular focus on First Nation candidates, help create individual training and succession plans.	Section 6, Table 6.3.6-1, p 682
Health		
	To help employees and their families maintain good health, NATC will be offering a dental and extended health plan to all employees at Mactung; these benefits are currently provided by NATC at its Cantung mine.	Section 6, p 675
	The camp will be dry through all phases of the project, no alcohol or non-prescription drugs will be permitted.	Section 6, p 675
	NATC will follow the industry standard and institute mandatory drug and alcohol testing for potential new employees and random testing thereafter.	Section 6, p 675
	Workplace safety is a priority for NATC. Employees will be terminated if found to be possessing or consuming drugs or alcohol on-site.	Section 6, p 675
	NATC is aware that the Mactung project will increase the volume of heavy truck traffic through Ross River, particularly during the construction phase of the project. The company will prepare a traffic plan, with input from the community, to minimize negative effects.	Section 6, p 676
	NATC will have a trained emergency response team, along with an assortment of relevant equipment available to respond to accidents and spills. Prior to commencing the project, the company expects to have completed a protocol with the Government	Section 6, p 677

No	Proponent Commitment	Reference
	of Yukon's Emergency Measures Organization that outlines roles and responsibilities in the event of an accident or spill.	
	Worker Health: NATC will follow all applicable safety laws and regulations in every aspect of its operations. NATC will provide every employee with the training required to safely do their work. NATC will have a fully qualified EMT on-site with all required medical supplies and equipment and have an on-call air medical evacuation service available at all times.	Section 6, p 678