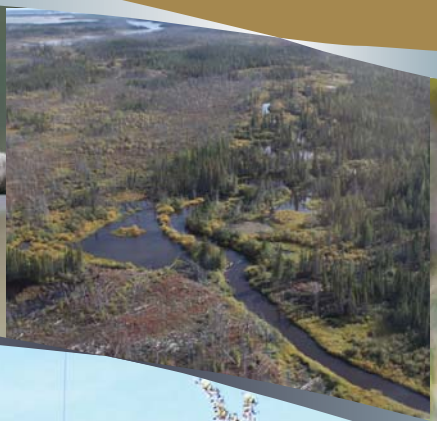
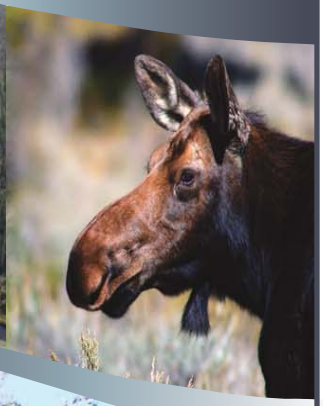
Keeyask Infrastructure Project
Environmental Assessment Report

Keeyask Hydropower Limited Partnership




JULY 2009

5900345 MANITOBA LTD.

3rd Floor 820 Taylor Avenue
Winnipeg, Manitoba R3M 3T1
Fax: (204) 474-4947

0221-A-91-110

July 31, 2009

Ms. Tracey Braun
Director of Environmental Approvals
Environmental Assessment and Licensing Branch
Manitoba Conservation
160-123 Main Street
Winnipeg, MB R3C 1A5

Dear Ms. Braun

RE: KEEYASK INFRASTRUCTURE PROJECT
– ENVIRONMENT ACT PROPOSAL FORM (EAPF)

The Keeyask Hydropower Limited Partnership, by its General Partner 5900345 Manitoba Ltd., submits this Environment Act Proposal Form for environmental approval for the Keeyask Infrastructure Project. The Partnership is a legal entity established by Manitoba Hydro and its Keeyask Cree Nation partners, who are:

- Tataskweyak Cree Nation (TCN) and War Lake First Nation (WLFN), acting together as the Cree Nation Partners (CNP);
- York Factory First Nation (YFFN); and
- Fox Lake Cree Nation (FLCN).

The Keeyask Infrastructure Project is being undertaken at this time to achieve the following objectives:

- To provide early business opportunities for the Keeyask Cree Nations.
- To provide early and more employment opportunities for First Nation members, northern Aboriginal people and other northern and Manitoba workers.
- To provide more time for Cree Nation businesses to develop their management capacities.
- To respond to present economic conditions to complete these works on a more cost-effective basis.
- To accelerate investment to support the promotion of sustainable growth in the Province of Manitoba.
- To provide for timely and efficient construction of the Keeyask Generating Station, should the Partnership decide to proceed with that project, and if and when an application is made and received for regulatory approval to construct and operate that project.

It is the Partnership's understanding that the proposed Project constitutes the following Class 2 developments under the Manitoba *Environment Act*:

- A 25-km all-weather gravel road in a new location (Manitoba Regulation 164/88).
- A wastewater treatment facility for a start-up construction camp with wastewater flows in excess of 10,000 L/d (Manitoba Regulation 164/88 and Manitoba Regulation 83/2003).

The Partnership further believes the *Canadian Environmental Assessment Act* (CEAA) does not apply to the Project. Formal confirmation of this premise is being determined with the appropriate federal departments.

We attach the following to support our application:

- A completed EAPF.
- An EA Report, including a description of the Project and the environmental assessment, as well as an Executive Summary and Access Management Plan
- A preliminary Environmental Protection Plan.
- Payment for Class 2 Development Review Fee ($5,000)

Because consultation with potentially affected parties, a heritage study of the camp area, and field tests related to the wastewater treatment facility are currently ongoing, we anticipate that a Supplemental Filing of the results these activities will be provided to you in the next month.

We trust this submission provides the necessary information for you to proceed with the environmental review of this proposed project.

Yours truly

5900345 Manitoba Ltd.
as general partner of the
Keeyask Hydropower Limited Partnership

Per:

K.R.F. Adams
President

Attachments

Environment Act Proposal Form

Manitoba Conservation

Name of the development: Keeyask Infrastructure Project	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): All-Weather Road (Class 2); Sewage-Treatment Plant (Class 2)	
Legal name of the proponent of the development: Keeyask Hydropower Limited Partnership, represented by the General Partner, 5900345 Manitoba Ltd.	
Location (street address, city, town, municipality, legal description) of the development: Located on Crown Lands approximately 180 km northeast of Thompson and approximately 40 km southwest of Gillam. It is expected the land required for the Project will be converted to private ownership.	
Name of proponent contact person for purposes of the environmental assessment: Ryan Kustra	
Phone: (204) 360-4334 Fax: (204) 360-6131	Mailing address: 360 Portage Avenue (15) Winnipeg, MB R3C 0G8
Email address: rkustra@hydro.mb.ca	
Webpage address:	
Date: July 31, 2009	Signature of proponent, or corporate principal of corporate proponent: Printed name: KRF Adams

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$500
Class 2 Developments	$5,000
Class 3 Developments:	
Transportation and Transmission Lines	$5,000
Water Developments	$50,000
Energy and Mining	$100,000

Submit the complete EAP to:

Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-7100
Fax: (204) 945-5229
Toll Free: 1-800-282-8069, ext. 7100
http://www.gov.mb.ca/conservation/eal

1.0 SUMMARY DESCRIPTION OF THE DEVELOPMENT AND ENVIRONMENT

1.1 CERTIFICATE OF TITLE

The lands involved in this Project are all provincial Crown lands. The intent of the proponent is to have these lands purchased and converted to private ownership.

1.2 MINERAL RIGHTS

The Province of Manitoba is the owner of the mineral rights.

1.3 DESCRIPTION OF EXISTING LAND USE

The proposed Project is located in the boreal forest region of northern Manitoba. The area involved is part of the Split Lake Resource Management Area. The Project area involved includes a portion of Trapline #15. There are several trapper cabins in the general area. The area is otherwise uninhabited and used mainly for the exercise of Aboriginal and Treaty rights. There are numerous trails that cross the Project footprint area that are used for snowmobiling access and resource harvesting activities. An existing winter trail generally follows the proposed road alignment on an existing esker.

1.4 THE PROPOSED DEVELOPMENT

The proposed Keeyask Infrastructure Project consists of the construction of a start-up camp capable of accommodating approximately 125 people, construction of an approximately 25-kilometre two-lane gravel road, and construction of a 500-person camp (the first phase of a main camp) on the north side of Gull Rapids. With the exception of the start-up camp, the proposed Project does not include the operation of the infrastructure. Limited maintenance will be performed on the facilities. There may be occasions where access to the facilities would be used on a limited basis for engineering and environmental studies. The start-up camp will be decommissioned at the end of the Project and most of the buildings will be removed. Selected buildings will remain to become a part of a maintenance yard upon completion of the road.

In summary, the three main components of the proposed Keeyask Infrastructure Project are the following:

- A temporary start-up camp, with associated wastewater treatment facility, to accommodate about 125 people (construction workers and staff).
- A 25-km two-lane all-weather gravel road from Kilometre 174 on PR 280 (about 185 km east-northeast from Thompson), extending to the north shore of Gull Lake.
- Phase One of a main camp where pre-engineered buildings, including prefabricated bunkhouses for future workforce accommodations, along with associated utilities and a fuel tank farm for future use. These facilities will not be operated.

It is the Partnership's understanding that the proposed Project constitutes the following Class 2 developments under *The Environment Act* (Manitoba):

- A 25-km all-weather gravel road in a new location (Manitoba Regulation 164/88).
- A wastewater treatment facility for a start-up construction camp with wastewater flows in excess of 10,000 L/d (Manitoba Regulation 164/88 and Manitoba Regulation 83/2003).

1.5 DESCRIPTION OF POTENTIAL EFFECTS

The Keeyask Hydropower Limited Partnership has conducted an Environmental Assessment (EA) of the proposed Project.
The attached EA contains the following:

Executive Summary
1.0 Introduction
- 1.1 Overview
- 1.2 Project Need And Purpose
- 1.3 Scope Of The Project
- 1.4 Scope Of The Asessment

2.0 Project Description
- 2.1 Overview
- 2.2 Project Components
- 2.3 Construction Activities
- 2.4 Operation And Maintenance
- 2.5 Contracts
- 2.6 Reclamation
- 2.7 Decommissioning

3.0 Environmental Setting
- 3.1 Overview
- 3.2 Physical Environment
- 3.3 Aquatic Habitat And Biota
- 3.4 Terrestrial Environment
- 3.5 Socio-Economic Environment
- 3.6 Heritage Resources

4.0 Public Involvement Program
- 4.1 Public Involvement

5.0 Potential Environmental Effects And Mitigation
- 5.1 Assessment Approach
- 5.2 Environmental Effects And Migitation
- 5.3 Analysis Of Alternatives
- 5.4 Physical Effects And Mitigation

As noted in our cover letter, the public consultation program, a heritage study, and field tests for the wastewater treatment facility are ongoing and a supplemental filing will be made to report on these results.

1.6 SCHEDULE

Depending on the timing of regulatory approvals, the Limited Partnership plans to initiate construction activities for the Infrastructure Project at the beginning of November, 2009. The early start to winter construction is important to allow construction of a coarse roadway to facilitate the construction of the proposed Looking Back Creek clear span bridge during winter conditions (to minimize environmental effects). With this construction start, it is expected that construction will be complete in 2012

1.7 FUNDING

Manitoba Hydro will fund this Infrastructure Project and will recover costs from the Keeyask Hydropower Limited Partnership.

KEEYASK INFRASTRUCTURE PROJECT

ENVIRONMENTAL ASSESSMENT REPORT

July 2009

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

Page

LIST OF FIGURES

EXECUTIVE SUMMARY

INTRODUCTION

This Environmental Assessment Report is in support of an application for regulatory approval to construct the proposed Keeyask Infrastructure Project (the Project). The Project proponent is the Keeyask Hydropower Limited Partnership (the Partnership), a legal entity established by Manitoba Hydro and its four First Nation partners: Tataskweyak Cree Nation; War Lake First Nation; York Factory First Nation; and Fox Lake Cree Nation. The Limited Partnership would also be the proponent for the Keeyask Generating Station, if in the future the Partnership decides to propose the Keeyask Generating Station (GS) Project for regulatory approval.

The scope of the proposed Keeyask Infrastructure Project includes construction and operation of a 125-person start-up camp with wastewater treatment, construction of a 25 km, two-lane gravel road, and construction of a 500-person main camp (phase one). Other than the start up camp and some post-construction maintenance activities, the Project involves only the construction, and not operation of the road and main camp. Construction of the proposed Project is planned to commence in early November 2009, with completion of construction of the facilities and services by May 2012. At this time no application has been made or is being made for regulatory review of the Keeyask GS project. If the Limited Partnership makes a decision not to proceed with the GS project, or if regulatory approval is not received, the Partnership will decommission the Project and reclaim the site.

PUBLIC INVOLVEMENT PROGRAM

The public involvement program for the proposed Project includes community and band member meetings with KCN First Nations in Split Lake, Ilford, Gillam, Bird, Churchill, Thompson, Winnipeg and York Landing. These meetings have all taken place except in York Landing where concerns regarding the H1N1 virus required rescheduling to early August. Public open houses are planned for August in Thompson and Gillam along with meetings in Winnipeg with environmental organizations. Results of the public involvement process will be incorporated in a supplemental submission.

ASSESSMENT SUMMARY

The Project is assessed as a Class II project under *The Environment Act, Classes of Development Regulation* and this report was prepared following Manitoba Conservation's Environment Act Proposal Report Guidelines. Potential environmental effects are identified, assessed and mitigated for site preparation, construction and initial maintenance of the road and associated infrastructure.

One of the primary methods of dealing with effects is mitigation and selecting alternatives for main infrastructure components based on a balance of feasibility, social and environmental factors. One of the primary aspects incorporating this process was the access road. A route selection committee was established in 2005 with participants including Manitoba Hydro and its consultants, First Nations in the vicinity of the road in their role as potential partners, and Manitoba Transportation and Government Services. Technical specialists in areas such as vegetation, wildlife, fisheries and

biodiversity cooperated with design engineers and local First Nation representatives to select a preferred route.

Another key method of addressing potential Project effects was through the development of a Preliminary Construction Environmental Protection Plan (EnvPP) for the construction phase of the Project, provided as a separate document. The EnvPP reflects the Partnership's commitment to environmental protection and implementing effective environmental protection and minimizing adverse effects associated with the Project. The Plan will be finalized after inclusion of Environment Act License terms and conditions. In recognition of the concerns regarding access issues, a Preliminary Access Management Plan (AMP) has also been developed to guide the Partnership in taking measures to manage access during Project construction.

In addition to the development of key reference documents that address primary potential Project effects, an assessment was undertaken on the various physical, biological and socio-economic environments, heritage resources and resource use. Assessment factors include the nature of effect, geographic extent, magnitude, frequency, duration and reversibility.

The assessment of the physical environment includes atmosphere, physiography, soils and permafrost, surface water and groundwater. Effects such as increased equipment and vehicle emissions and increased fugitive dust are considered to be small and not detectable outside of the local area, especially when dust control measures are applied. The Gull Esker will be affected, but efforts were made to minimize effects through the routing process. No residual effects are expected to the surface water regime after application of various protection guidelines. Elevated levels of suspended sediment and hydrocarbons in surface water, increased erosion in disturbed areas, and contamination of soils, surface water and groundwater from accidental spills are also not expected due to EnvPP measures.

No effects are anticipated on aquatic habitat and biota since the larger of two streams is being crossed by a clear span bridge and the smaller stream is assessed as having low sensitivity habitat with no potential to support large-bodied fish. Measures described in key Department of Fisheries and Oceans reference documents will be followed to avoid negative effects.

In terms of terrestrial ecosystems, after the road routing process it was estimated that there would be no substantial changes to vegetation composition, ecosystem diversity, wetland function or plant species of conservation concern. Less than 1% of all habitat types in the regional study area would be altered or lost. Measures described in the EnvPP, such as establishment of fire guards and avoidance of designated areas, serve to minimize negative effects on important habitat types to acceptable levels.

The EnvPP and AMP also address potential environmental effects on wildlife. Effects such as the removal/impairment of habitat, or fragmentation of breeding/over-wintering habitats, are expected to be small in comparison to available habitat in the region and were avoided where possible, through the routing process. Other measures, such as limiting clearing, establishing buffers, and revegetating disturbed areas are described in the EnvPP. This document also addresses avoidance of potential effects from the contamination of breeding ponds, through prescriptive erosion control and fuel storage measures. Potential effects on wildlife including modified movements and increased

stress, is addressed through the establishment of appropriate buffers for borrow sites, and if blasting activities occur, especially during sensitive periods such as spring breeding. Issues such as increased mortality from vehicle collisions are addressed in both the EnvPP and AMP through a commitment to educating drivers and posting and enforcing speed limits. The EnvPP also provides measures to deal with problem/nuisance wildlife, through proper garbage handling/disposal measures, and worker education on topics such as feeding wildlife. Potential increases in wildlife mortality from hunting or trapping is addressed in both the AMP and EnvPP, with measures including limiting road access and posting no hunting signs.

The assessment of the socio-economic environment includes local and regional employment and business opportunities, regional services, resource use, individual and community health, safety and wellness, traffic and access. The ability of residents and businesses in the four First Nation communities located in the vicinity of the Project to realize employment and business opportunities is likely to be the most important socio-economic effect. The majority of the construction employment opportunities and as many as 11 construction and support contracts could accrue to the four communities because of a combination of pre-project training programs delivered through these communities, preferential hiring provisions in the collective agreement and provisions of direct negotiated contracts to these First Nations under the Joint Keeyask Development Agreement. The high level of community participation on these opportunities would serve to reduce unemployment levels in these high unemployment communities, enhance the income and self esteem of job recipients and strengthen the capacity of local contractors. These opportunities would be accompanied by the challenges of Project workers having to be away from their home and community for extended periods, creating demands on family and community life and other social stresses.

Unwanted incidents could result from the inappropriate interaction of Project workers with community members, especially young women, during off-hours visits to Gillam and Thompson. A variety of measures including on site counselling, worker education and maintaining communication with surrounding communities will lessen these effects. Traffic levels are projected to increase up to 15% along PR 280 at various times during construction; however, an increase in the overall accident rate would not likely be detectable. Although there will be the potential for interference with local use of resources in the immediate vicinity of the infrastructure, these disruptions are expected to be offset by implementation of replacement resource use programs and agreements to be negotiated with directly affected commercial resource users. A major issue relating to the potential for unauthorized access to the area and the possible restriction of access to traditional area users will be addressed through access control measures set out in the AMP.

No heritage resources were discovered during field investigations in the area where the proposed infrastructure will be located; however, there is potential for heritage resources to exist as the road corridor may have been a pre-historic travel route for Aboriginal people. Potential effects of the Project on heritage resources are addressed through mitigation measures incorporated into the EnvPP. A pedestrian survey is currently being conducted at the site of the proposed main camp. Results of this survey will be presented in a supplemental filing.

CONCLUSION

Based on the information presented in the Environmental Assessment Report, the proposed Project is not likely to result in any substantial adverse effects with the implementation of proposed mitigation measures and follow-up actions contained in the EnvPP and AMP.

ACKNOWLEDGEMENTS

We would like to thank the numerous individuals and representatives of private and government organizations who have provided their time and knowledge to assist with the preparation of this document.

GOVERNANCE

The Partners' Regulatory and Licensing Committee (PRLC) is responsible for governance of environmental and regulatory matters for the Keeyask Hydropower Limited Partnership. The committee consists of three members of Tataskweyak Cree Nation, two members of each of War Lake First Nation, York Factory First Nation, and Fox Lake Cree Nation, and three employees of Manitoba Hydro. The EIS Coordination Team, reporting to the PRLC, is responsible for the coordination of the environmental assessment. Members of the EIS Coordination Team, along with advisers at the invitation of the Co-chairs, attend meetings of the PRLC. A study team with management and specialists in relevant disciplines works closely with the EIS Coordination Team in undertaking the environmental studies and assessment.

Partners' Regulatory and Licensing Committee:

- Tataskweyak Cree Nation: Tony Mayham (co-chair); Victor Spence, TCN Manager of Future Development; and Douglas Kitchekeesik; and advisers Joe Keeper and William Kennedy, P.Eng.
- War Lake First Nation: Chief Betsy Kennedy and Phillip Morris.
- York Factory First Nation: Roy Redhead and Flora Beardy.
- Fox Lake Cree Nation: Michael Lawrenchuk and Wesley Neepin.
- Manitoba Hydro: Ed Wojczynski (co-chair), Ryan Kustra and Shawna Pachal.

EIS Coordination Team:

- Tataskweyak Cree Nation and War Lake First Nation: John Whitaker, M.A., and Ian Dickson.
- York Factory First Nation: Jim Thomas, M.L.Arc.
- Fox Lake Cree Nation: Lorne Hanks, LL.B.
- Manitoba Hydro: Nick Barnes (chair), M.Sc., and Dick Stephens, B.A.

STUDY TEAM

Manitoba Hydro:	
Ryan Kustra, B.A.	Assessment Manager
Nick Barnes, M.Sc.	Assessment Coordinator
Glen Schick, P. Eng.	Project Engineer
Bryan Beyak, P. Eng.	Civil Engineer
Lindsay Zaborniak, C.E.T.	Project Technologist
Tetr*ES* Consultants Inc.:	
George Rempel, P.Eng.	Study Manager
Blair McMahon, M.Sc.	Study Coordinator
Roger Rempel, P.Eng.	Project Description
Mike Sweet, B.Sc.	Birds
Leane Wyenberg, M.Sc.	Birds
Angèle Watrin Prodaehl, B.Sc.	Amphibians
Shirley Bartz, M.Sc.	Invertebrates
George Kroupa, RFT	GIS
Jocelyn Hiebert, RFT	GIS
DFS Consultants:	
Dale Stewart, M.Sc.	Terrestrial Coordinator
ECOSTEM Ltd.:	
James Ehnes, Ph.D.	Physiography, Habitat, Plants and Ecosystems
Brock Epp, M.Sc.	Habitat and Ecosystems
Alanna Sutton, M.Sc.	Plants
Alex Snitowski, B.Sc.	GIS
Wildlife Resource Consultants:	
Robert Berger, M.N.R.M.	Mammals
Jason Kelly, M.N.R.M.	Mammals
Plus4 Consultants Inc.:	
John Dyck	Forestry
Calyx:	
Jackie Krindle, B.Sc.	Plants
North/South Consultants Inc.:	
Friederike Shneider-Viera, Ph.D.	Aquatics
Richard Remnant, M.N.R.M.	Aquatics
Kurt Mazur, M.Sc.	Aquatics

InterGroup Consultants Ltd.:

John Osler, MBA	Public Involvement
Denis De Pape, M.A.	Socio-economics
Nancy LeBlond, M.A.	Socio-economics
Andrew Mclaren, M.N.R.M.	Socio-economics

Northern Lights Heritage Services:

Virginia Petch, Ph.D.	Heritage

Falk Environmental Inc.:

Mel Falk, M.Sc.	Senior Editor

1.0 INTRODUCTION

1.1 OVERVIEW

This Environmental Assessment (EA) Report is for the proposed Keeyask Infrastructure Project (the Project) located in northern Manitoba (Figure 1.1-1). It is submitted in application for a Class 2 Development under *The Environment Act, Classes of Development Regulation*, specifically for a proposed all-weather road and wastewater disposal system for a temporary start-up camp used during Project construction. This EA report provides a description of the proposed Project and the existing environment, an assessment of the anticipated environmental effects, and measures identified to mitigate adverse effects.

The EA report is submitted by the Keeyask Hydropower Limited Partnership (the Partnership), represented by the General Partner, 59000345 Manitoba Ltd. The Partnership established by Manitoba Hydro and the Keeyask Cree Nations (KCN), consisting of Tataskweyak Cree Nation and War Lake First Nation (operating together as the Cree Nation Partners, or CNP); York Factory First Nation (YFFN); and Fox Lake Cree Nation (FLCN).

Throughout the EA Report, terms contained in the Glossary are in bolded text.

1.2 PROJECT NEED AND PURPOSE

The proposed Project is being undertaken at this time to achieve the following objectives:

- To provide early business opportunities for the Keeyask Cree Nations (KCN);
- To provide early, and potentially more, employment opportunities for First Nation members, northern Aboriginal people, and other northern and Manitoba workers;
- To provide more time for First Nation businesses to develop their management capacities;
- To provide more time for First Nation members and other northern Aboriginal people to develop their skills and capacities;
- To respond to present economic conditions and complete these works on a more cost-effective basis;
- To accelerate investment to support sustainable economic growth in the Province of Manitoba; and
- To provide for timely and efficient construction of the Keeyask Generating Station (GS) project, should the Partnership in the future decide to propose that project, and if and when an application is made and regulatory approvals are received to construct and operate that project.

1.3 SCOPE OF THE PROJECT

The proposed Project consists of construction and operation of a 125-person start-up camp (including wastewater treatment), construction of a 25 km all-weather gravel road from Provincial Road (PR) 280 to Gull Rapids, and construction of the first phase of a main camp (Figure 1.3-1). The scoping process to define the Project involved an analysis of a number of alternatives

(Appendix A-1). It is proposed to commence construction of the road in early November 2009 and complete the main camp (phase one) facilities by May 2012. Except for minor maintenance of the road and main camp (phase one), the Project scope does not include operation of these facilities, although there may be occasions when the facilities are used on a limited basis to provide access to the area for engineering and environmental studies. It should also be noted that at this time no decision has been or is being made to propose the GS project or to apply for regulatory review and approval. If the Limited Partnership decides in the future not to proceed with the GS project, or if regulatory approval is not received, the Partnership will decommission the Infrastructure Project and restore the site. Should this occur, a decommissioning plan will be submitted for regulatory approval.

1.4 SCOPE OF THE ASSESSMENT

1.4.1 Overview

The scope of the assessment covers all of the physical works and activities described in the scope of the Project, namely construction and operation of a start up camp with an engineered wastewater treatment plant, and construction of a road and main camp (phase one).

It is anticipated that regulatory approval will be in the form an Environment Act Licence for the Class 2 Development issued by the Director, Environmental Assessment and Licensing Branch of Manitoba Conservation. The Project is not expected to trigger the *Canadian Environmental Assessment Act* due to the nature and design of the Project as well as the mitigation measures and follow-up actions proposed.

1.4.2 Spatial and Temporal Scope

1.4.2.1 Spatial Scope

The proposed Keeyask Infrastructure Project is located in northern Manitoba, approximately 180 km northeast of Thompson and approximately 40 km southwest of Gillam (Figure 1.1-1). In order to conduct the assessment in an organized way, a number of Project study areas were established. Several were established for the biophysical environment and several for the socioeconomic environment. It was determined that the regional and local areas of influence for biophysical and socio-economic effects differ from one another in several ways and could not be accurately analyzed or portrayed utilizing the same boundaries. Therefore, the following five study area boundaries were established:

- Northern Manitoba Study Area (socioeconomics);
- KCN Community Study Area (socioeconomics);
- Regional Study Area (biophysical);
- Local Study Area (biophysical); and
- Project Footprint.

Northern Manitoba Study Area (Socio-economic)

The broadest spatial scope used for this assessment (other than very occasional references to provincial and broader regions) is the **Northern Manitoba Study Area**. This area was determined to be unnecessary for the more quantitative biophysical assessments. For the purposes of the socio-economic assessment, this area is defined as Statistics Canada Census Divisions 22 and 23 (Figure 1.4-1). The key focus of the assessment is on Thompson and Gillam as they are the major service centers within the Northern Manitoba Study Area.

KCN Community Study Area (Socio-economic)

The **KCN Community Study Area** includes the four First Nation communities in the vicinity of the proposed Project: Tataskweyak Cree Nation at Split Lake; York Factory First Nation at York Landing; War Lake First Nation at Ilford; and Fox Lake Cree Nation at Bird and Gillam (Figure 1.4-2). These First Nation communities were included in this study area for the following reasons:

- They have areas used for traditional activities such as hunting or trapping that could be affected by the proposed Project facilities;
- They have populations who will be eligible for employment under **Directly Negotiated Contracts** (DNCs) during the construction; and
- They are parties to the **Joint Keeyask Development Agreement** (JKDA) and will be partners in the proposed Project.

Regional Study Area (Biophysical)

The ecologically appropriate area to assess the effects of the proposed Project on habitat composition is one that is large enough to capture natural variability in habitat composition over time and is referred to as the **Regional Study Area** (Figure 1.4-3). One of the causes of large scale natural variability is fire, and an analysis of fire history data indicated that an area of approximately 14,000 km^2 would therefore be needed to capture natural variability. Terrestrial habitat was described and priority habitats were identified from habitat mapping developed for the central 1,502 km^2 (referred to as the **Habitat Mapping Area**) of the Regional Study Area (see Appendix B2-1 for methods).

Local Study Area (Biophysical)

A 7,870-ha (78.7-km^2) **Local Study Area** was established to include the spatial area immediately adjacent to the proposed Project where some direct and indirect environmental effects may occur. The Local Study Area includes the Project Footprint as well as a 1.15-km buffer around these areas (Figure 1.4-3). Potential local effects on biophysical components are captured by the Local Study Area.

Project Footprint

The **Project Footprint** includes the physical works and associated activities where direct physical environmental effects are expected to occur (Figure 1.4-3). This 2,597-ha (26-km^2) area includes the proposed road, **borrow area zone**s, camp areas and associated infrastructure footprints (Figure 1.4-3).

1.4.2.2 Temporal Scope

Subject to regulatory approval, construction of the proposed Project is anticipated to commence in November of 2009, with completion of construction of the facilities and services by May 2012. Clearing for the start-up camp would be the initial Project activity in November 2009, ending in March 2010, with start-up camp construction completion scheduled for July 2010. Road construction is also scheduled to start in November 2009 with clearing activities and establishment of a bridge crossing prior to April 2010. Road construction would continue until October 2010, with the main camp then starting in that month and finishing in May 2012.

1.4.3 Assessment Approach

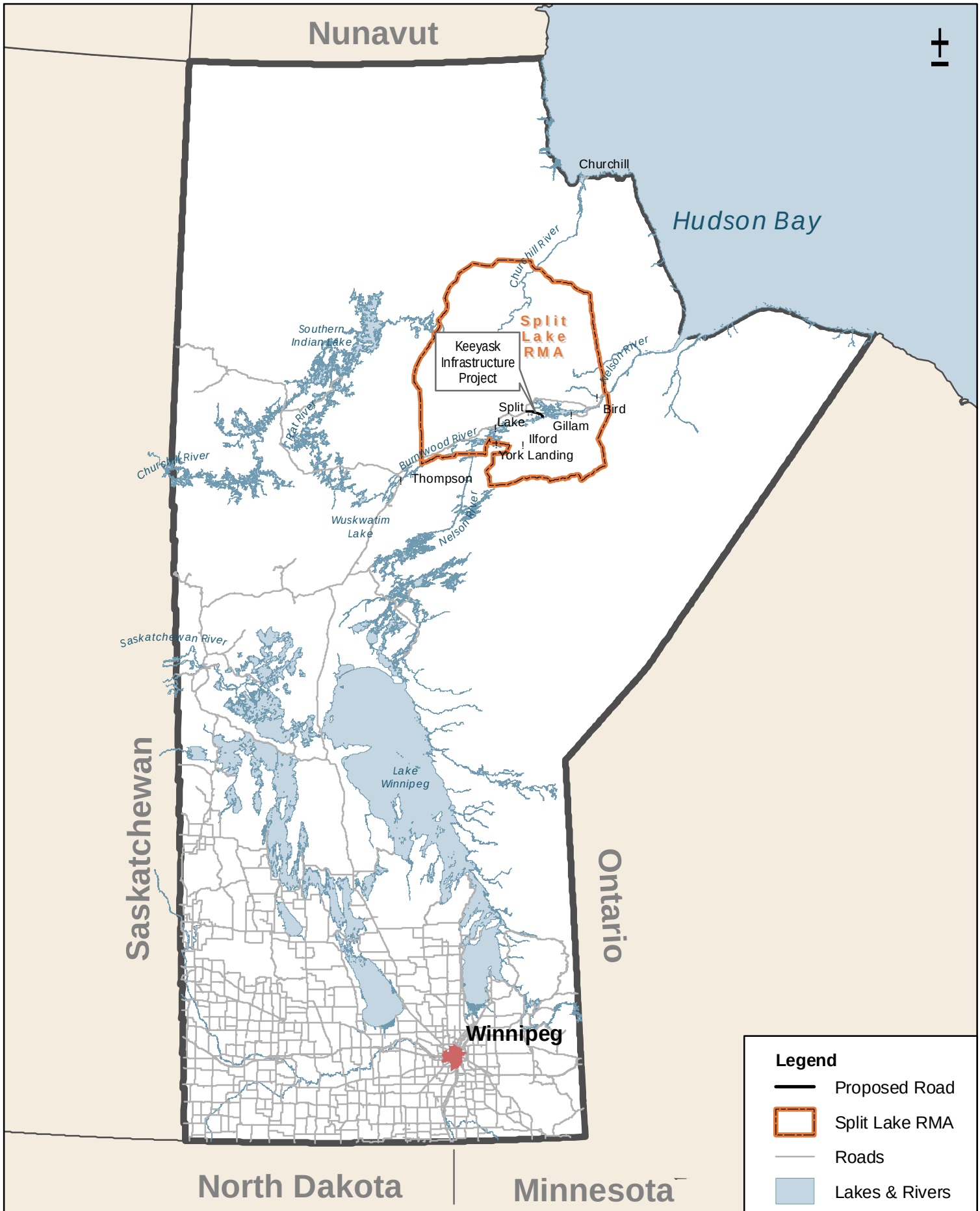
Both provincial and federal environmental assessment guidance documents were followed for this EA. The Guidelines for an Environment Act Proposal Report (Manitoba Conservation 2009) were followed. Canadian Environmental Assessment Agency (CEAA) reference documents included: How to Determine if the Act Applies; Addressing Need For, Alternatives To, and Alternative Means; and Follow-up Programs under the *Canadian Environmental Assessment Act* (CEAA 1994). Key Department of Fisheries and Oceans Canada (DFO) reference documents included the Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff, Version 1 (Fisheries and Oceans Canada 2007a), Operational Statement for Clear-Span Bridges, Version 3 Fisheries and Oceans Canada (2007b), and Operational Statement for Temporary Stream Crossing (Fisheries and Oceans Canada 2007c). The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Fisheries and Oceans Canada and Manitoba Natural Resources 1996) was a key document assisting in the design and mitigation of stream crossings.

In addition to Manitoba Hydro's Corporate Environmental Management Policy (Appendix C1), key guidance to avoid or reduce adverse effects in the design of the project was obtained through the Keeyask Cree Nations Principles Regarding Respect for the Land and measures that would comply with these principles (Appendix C2).

The scoping process for the proposed Project was used to identify environmental issues as well as First Nation and stakeholder issues and concerns. The process also facilitated the delineation of spatial and temporal boundaries for the assessment of the environmental effects. Potentially affected environmental components were then identified for the physical, aquatic, terrestrial, and socio-economic environments and for heritage resources.

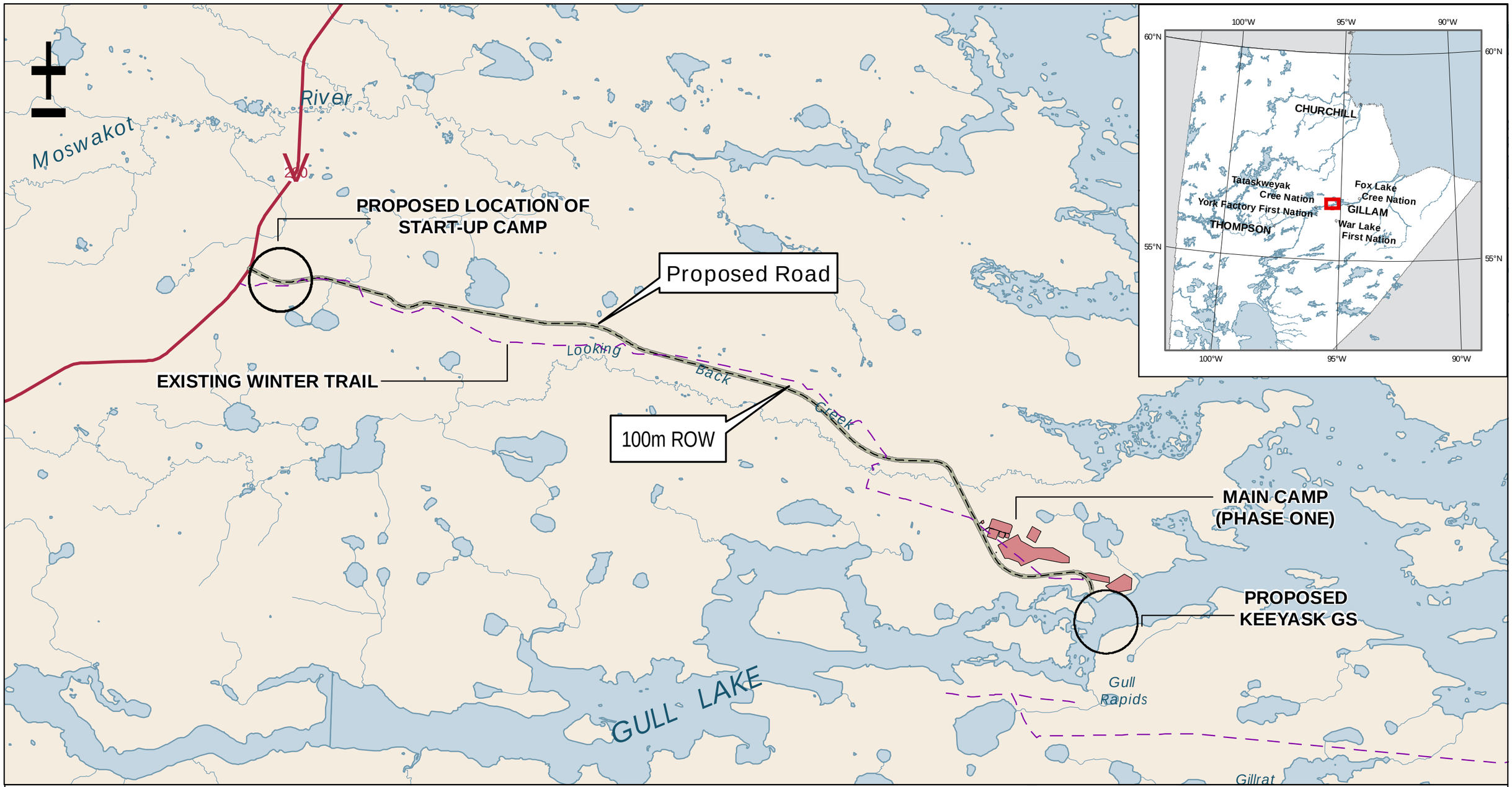
Potential environmental effects (adverse and beneficial) of the proposed Project were identified and assessed, and mitigation to avoid or minimize adverse effects was proposed using available scientific studies, professional judgement, expert and local knowledge, stakeholder consultation and First

Nation input. Both direct and indirect environmental effects of the proposed Project were considered. Follow-up requirements were identified where appropriate and residual environmental effects were evaluated using predetermined factors and criteria. Further information on the assessment approach including an explanation of the factors and criteria used to evaluate the residual environmental effects are provided in Section 5.1.



Project Area Location in Manitoba

Figure 1.1-1



KEEYASK

Scale

0 1.25 2.5 5 km

0 1.25 2.5 5 mi

Projection: UTM NAD83, Zone 15N
Data Source: Manitoba Hydro and Government of Canada
Created By: TetrES Consultants INC.
Date Created: July 24, 2009

LEGEND

Main Camp (Phase One)

100m ROW

Winter Trail

Keeyask Infrastructure Project Site

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\KIP_Project_Site_150709.mxd - 7/24/2009 @ 11:51:52 AM

Figure 1.3-1

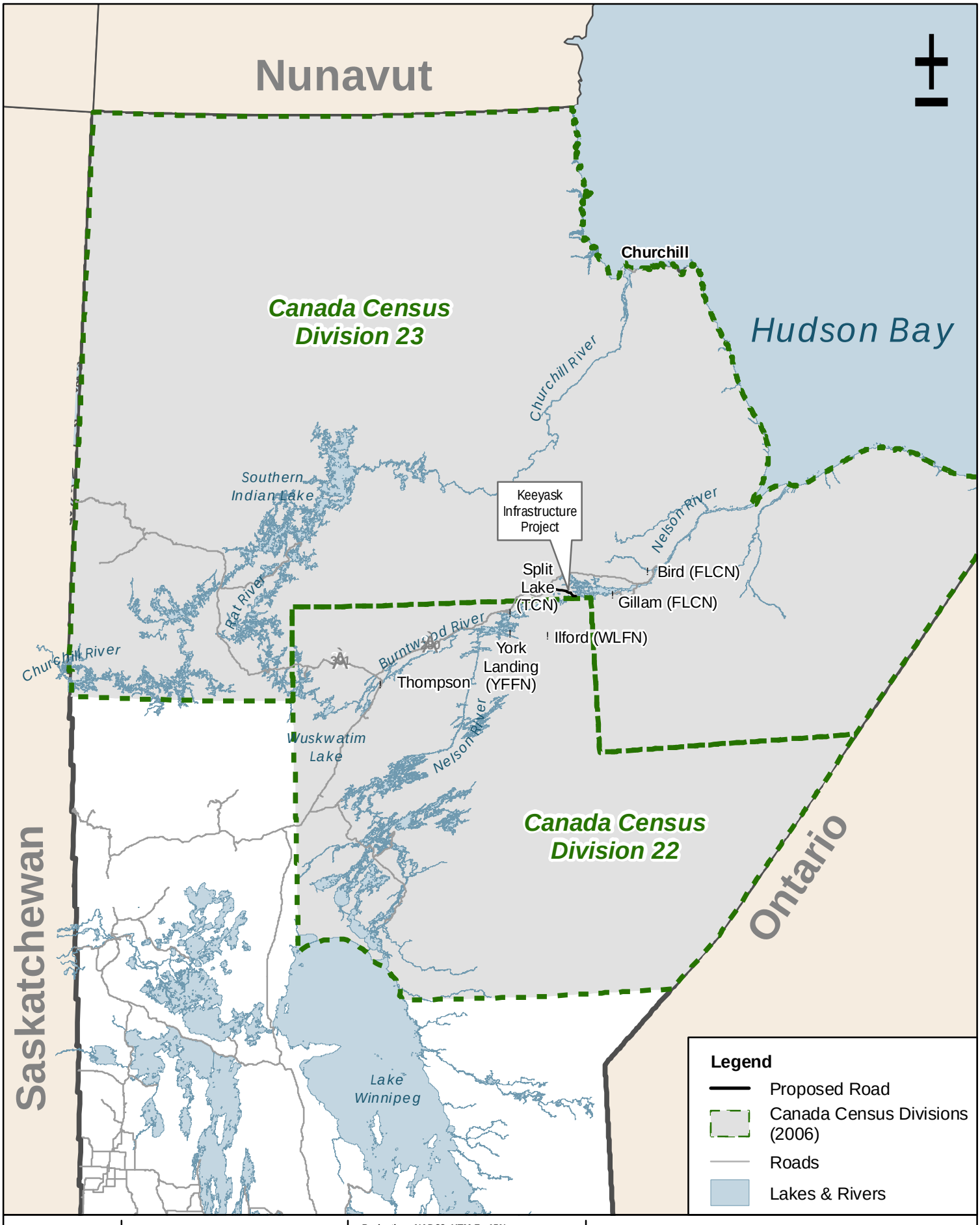
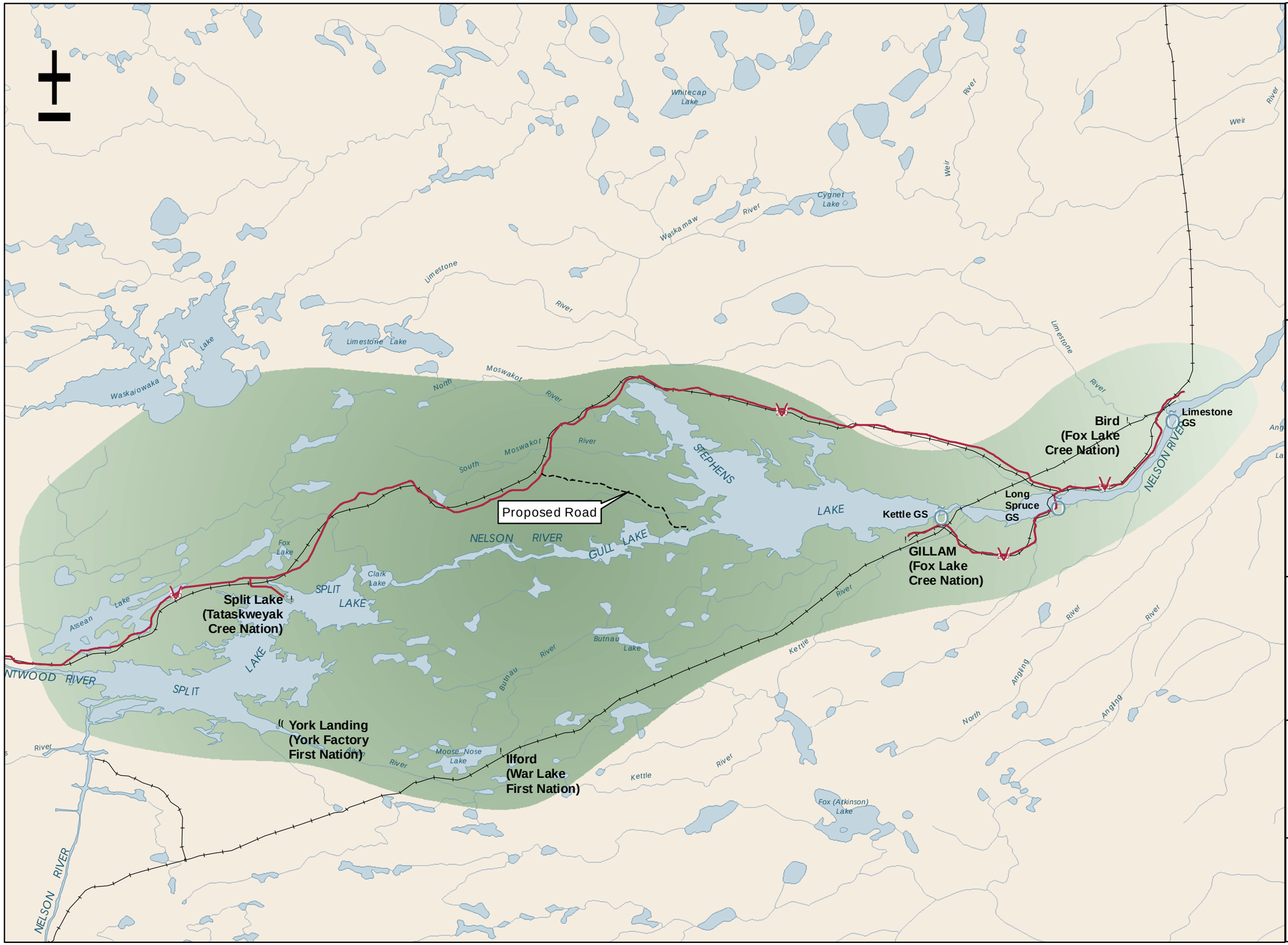

Nunavut
Churchill
Canada Census Division 23
Hudson Bay
Churchill River
Southern Indian Lake
Keeyask Infrastructure Project
Nelson River
Split Lake (TCN)
Bird (FLCN)
Gillam (FLCN)
Rat River
Churchill River
Burntwood River
Ilford (WLFN)
York Landing (YFFN)
Thompson
Wuskwatim Lake
Nelson River
Canada Census Division 22
Saskatchewan
Ontario
Lake Winnipeg
Legend
Proposed Road
Canada Census Divisions (2006)
Roads
Lakes & Rivers
KEEYASK
0 25 50 100 km
0 20 40 80 mi
Projection: NAD83, UTM Zn 15N
Data Source: Province of Manitoba, Government of Canada, Manitoba Hydro
Created by: TetrES Consultants Inc.
Date Created: July 23, 2009
Northern Manitoba Study Area
G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\SE_Northern_MB_220709.mxd

Figure 1.4-1



Legend

Generalized Boundary of KCN Community Study Area

Õ Existing Generating Stations

Transportation

Roads

Rail Line

Projection: NAD 83, UTM Zn15N
Data Source: Government of Canada, Manitoba Hydro, TetrES Consultants Inc.
Created By: TetrES Consultants Inc.
Date: July 24, 2009

0 5 10 20 km
0 5 10 20 mi

KCN Community Study Area

KEEYASK

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\SE_KCN_StudyArea_220709.mxd - 7/24/2009 @ 11:56:32 AM

Figure 1.4-2

2.0 PROJECT DESCRIPTION

2.1 OVERVIEW

The proposed Keeyask Infrastructure Project (the Project) consists of construction and operation of a start-up camp capable of accommodating approximately 125 people with an engineered wastewater treatment plant, construction of a 25-km two-lane, all-weather gravel road and construction of a 500-person main camp (phase one) on the north side of Gull Rapids in northern Manitoba (Figure 2.1-1). The area to be developed currently consists entirely of Provincial Crown Lands, which would be purchased and converted to private ownership. With the exception of the start-up camp, the proposed Project does not include the operation of the infrastructure and only limited maintenance activities will be required. There may be occasions where access to the facilities will be required on a limited basis for engineering and environmental studies. The temporary start-up camp will be decommissioned at the end of the Project and the buildings will be removed.

The three main components of the Project are the start-up camp, the road, and the main camp (phase one). Each Project component consists of a number of sub-components, including facilities, supporting services, construction activities and workforce requirements.

The start-up camp will accommodate approximately 125 construction workers and staff. The camp will be equipped with the following facilities and utilities:

- Fire truck and storage facility;
- First-aid vehicle;
- Potable water supply;
- Wastewater treatment;
- Solid-waste collection and haulage;
- Power supply;
- Pre-engineered buildings;
- Trailers;
- Fuelling facilities and equipment;
- Communication system;
- Accommodations and offices; and
- Kitchen and dining hall.

The two-lane gravel road will be designed and built to provincial road (PR) standards starting at Kilometre 174 on PR 280, approximately 185 km east-northeast from Thompson, extending approximately 25 km east from PR 280 to the north shore of Gull Rapids. The proposed road will include the following facilities and utilities:

- A security gatehouse equipped with space for vehicle turnaround;
- A by-pass on PR 280 at the intersection of the proposed road;
- A 12-m communication tower;

- Approximately 25 km of two-lane gravel road;
- A clear-span bridge crossing at Looking Back Creek;
- Temporary 10-person camp at Looking Back Creek for bridge construction;
- A culvert crossing at an unnamed tributary;
- Approximately 12 through-grade culverts for overland drainage;
- Snowmobile crossings at selected, established snowmobile trails;
- Road signage;
- Borrow areas; and
- Portable diesel generator set (2 MW).

The main camp (phase one) will be equipped with the following facilities and services:

- Potable water supply;
- Wastewater treatment;
- Power supply;
- Pad for a future power transformer station;
- Helicopter pad;
- Accommodations for up to 500 people;
- Kitchen facilities;
- Dining hall;
- Offices;
- Borrow areas;
- Contractor work areas;
- Manitoba Hydro work area;
- Recreational facility; and
- Fire and first-aid vehicle garage structures.

Table 2.1-1 summarizes the various activities associated with the Project components.

Table 2.1-1: Project Components and Related Activities

Project Component	Project Activities
1. Start-up Camp	• Clearing and grubbing
	• Preparing (establish drainage)
	• Controlling erosion and sediment
	• Constructing pads (excavation, backfilling, grading)
	• Gravelling pads
	• Installing trailers (accommodations, office, kitchen, dining facilities)
	• Installing utilities and services (potable water, wastewater treatment, power supply)
	• Operating potable water supply
	• Operating wastewater treatment

Table 2.1-1: Project Components and Related Activities	
Project Component	**Project Activities**
	• Operating power supply: 2-MW diesel set
	• Decommissioning
2. Road	• Clearing and grubbing
	• Controlling erosion and sediment
	• Constructing security gatehouse and communication tower
	• Establishing drainage and start embankments
	• Continuing embankment construction
	• Gravelling for roadbed surface
	• Trimming slopes
	• Constructing clear-span crossing at Looking Back Creek
	• Constructing culvert crossing at an unnamed tributary
	• Installing through-grade culverts for local overland drainage
	• Cleaning up of construction waste
	• Managing access (security, signage, etc.)
3. Main Camp (phase one)	• Clearing and grubbing for camp (250 ha) and three main work areas
	• Controlling erosion and sediment
	• Constructing pads (excavation, backfilling, grading)
	• Gravelling
	• Installing pre-engineered bunkhouses, kitchen/dining facilities and trailers (recreation facility, fire, first aid, vehicle garage)
	• Trenching for utilidors (with potential for controlled blasting)
	• Installing utilities and services, including service to water wells and installing package wastewater treatment plant

2.2 PROJECT COMPONENTS

2.2.1 Start-up Camp

A temporary start-up camp will be established to support construction of the proposed road and the main camp (phase one). The start-up camp will be sized to accommodate approximately 125 workers and will be located in approximately 400 m from PR 280 at its junction with the road (Figure 2.1-1) The camp will consist of facilities and utilities as described below and will require construction materials to be hauled in or extracted from local borrow areas.

2.2.1.1 Facilities

The start-up camp will require specific services to support the construction and management workforce. Accommodations for approximately 125 workers will be provided by self-contained trailers brought to the site. Trailers will also be used to house the kitchen services, dining hall and site offices. Pre-engineered buildings will be used to store equipment and some construction materials. A fuelling facility consisting of a small tank farm containing fuels for construction power,

vehicles and equipment, and propane for cooking and heating will be established. Tankage will consist of approximately three 25,000 L tanks for diesel, one 10,000 L for gasoline, and one 85,000 L tank for propane. Petroleum products will be transported and stored in accordance with *The Dangerous Goods Handling and Transportation Act* (Manitoba).

2.2.1.2 Utilities

Camp utilities will include a potable water supply, wastewater disposal, solid waste disposal, communications and power supply. Utility corridors (**utilidors**) will carry utility lines such as electricity, sewer, water and communications.

Potable Water

The camp's domestic-use water demand is expected to be approximately 43,000 L per day at full capacity. Two wells (Figure 2.2-1) will be established near the start-up camp for potable water. One well will serve as the camp's primary supply. The other well will serve as a backup water source to ensure adequate potable water supply to the camp in the event of a malfunction.

Wastewater Disposal

Options are being examined for the management of wastewater (combined grey water and sanitary waste) at the camp (Appendix A1). The preferred option is to collect the wastewater in a holding tank and discharge it to a septic field. The field will be located near the camp and will be partially within the right-of-way of the access road, as shown in Appendix A1. The design of the preferred system is based on criteria outlined in Manitoba Regulation 83/203 (Onsite Wastewater Management Systems), as described in Appendix A-1. Septage solids from the holding tank will be removed and hauled to an approved treatment facility. In the event that *in-situ* soils testing (currently underway) do not support the use of a septic field, one of two alternative methods will be used: i) a mechanical wastewater treatment plant discharging to an absorption field, or ii) a wastewater holding tank with haulage to the wastewater treatment facility at Gillam.

Solid Waste Disposal

Solid wastes (camp garbage) will be taken to a collection site (secured from wildlife) on-site and will be hauled to an approved disposal facility.

Communications and Power Supply

Communications infrastructure for data, video and voice services will be established at the start-up camp. It will consist of a 12-m wooden pole equipped with a communications dish. The dish-antenna will be tied into Manitoba Hydro's existing microwave system.

With the exception of propane, which will be used for kitchen and heating needs, diesel generators will provide all power for the start-up camp. A 2-MW generator set will be installed at the start-up camp to provide backup in the power supply.

2.2.1.3 Material Sources

The materials required for constructing the road and the other infrastructure will include impervious fill, granular fill/crushed rock, rock fill, riprap and concrete aggregates. Materials for the start-up camp will come from borrow sites within the 100-m road ROW and may be supplemented from established sources known as the G-1 and G-5 deposits (Figure 2.1-1).

2.2.2 Road and Stream Crossing

The proposed Project includes construction of a two-lane all-weather gravel road starting at Kilometre 174 on PR 280, approximately 185 km east-northeast from Thompson, and extending approximately 25 km east to the north shore of Gull Rapids. The proposed road required the establishment of design criteria, including appropriate cross-sections. The road will also involve construction of a clear span bridge across Looking Back Creek, establishment of associated facilities and use of borrow materials.

2.2.2.1 Design Criteria

Road

A fully-developed by-pass intersection will be designed and built at the intersection of PR 280 and the proposed road to provide safety to local road users. The design of the intersection will exceed the Manitoba Infrastructure and Transportation intersection treatments as required by their warrant process.

A 100-m ROW will be established for the proposed road and the centreline of the road will vary within the ROW (Figure 2.1-1). This alignment allows for borrow material to be obtained from deposits identified within the ROW as well as from sites G-1 and G-5.

The gravel roadway will be designed and constructed to maintain existing drainage patterns. The road will conform to current Manitoba Infrastructure and Transportation Geometric Design Criteria for Secondary Arterial Roadways (Manitoba Transportation and Government Services 1998) (Table 2.2-1).

Table 2.2-1: Current Manitoba Infrastructure and Transportation Geometric Design Criteria for Secondary Arterial Roadways

Criteria Description	Secondary Arterial
Number of lanes	Two lanes
Design speed	100 km/h
Gradient (maximum percent)	6%
Minimum stopping sight distance	200 m
Minimum passing sight distance	680 m
Minimum vertical curve	Sag = 50, Crest = 70
Minimum curvature (radius)	440 m
Lane width	3.7 and 5.7 m

Table 2.2-1: Current Manitoba Infrastructure and Transportation Geometric Design Criteria for Secondary Arterial Roadways	
Criteria Description	**Secondary Arterial**
Shoulder width	1.0 m gravel
Shoulder edge treatment	0.25 m
Right-of-way width	100 m

There will be two typical cross-sections used in the construction of the proposed road (Figure 2.3-1):

1. Typical Cross Section 1 will extend from km zero (0) at the junction of PR 280 to approximately Kilometre 18 and will consist of a 9.5-m-wide finished road top; and
2. Typical Cross-Section 2 will extend from Kilometre 18 to 24.5 and will consist of a 13.5-m-wide finished road top.

Stream Crossings

A hydraulic analysis was conducted for the two crossing locations on the proposed road to determine water regime conditions at each of the crossing locations. The design parameters for the hydraulic sizing of the crossings were determined by:

- Collecting spot readings of water surface levels and stream discharge;
- Measuring the channel characteristics and computing channel slope and bed roughness;
- Defining a relationship between stream stage and discharge for each crossing;
- Estimating design velocity and water surface elevations at the crossing locations;
- Computing an appropriate design discharge for hydraulic sizing of the crossings;
- Assessing additional design considerations for ice effects, particularly the Looking Back Creek crossing (see Section 3.2.3.1 for ice details); and
- Assessing fish habitat conditions (see Section 3.3.1).

2.2.2.2 Road Facilities

Additional road facilities will include a security gatehouse, communication tower, clear-span bridge and signage.

Security Gatehouse

The security gatehouse will be constructed at the junction of PR 280 and the proposed road. The gatehouse will be staffed by a security contractor on a full-time basis. It will be equipped with a turnaround apron for larger vehicles to exit back on to PR 280 if declined entry at the gatehouse. A 12-m communications tower will be installed adjacent to the gatehouse. Snowmobile crossings will be developed at intersections of the proposed road and established snowmobile trails to facilitate the safe crossing by local resource users. Road signage will be erected as appropriate along the road.

Bridge Crossing

A clear-span bridge crossing will be built across Looking Back Creek with all structures built entirely above the ordinary high water mark (Figure 2.3-2). The bridge structure will be designed and constructed in accordance with the Operational Statement for Clear Span Bridges (version 3.0) (Fisheries and Oceans Canada 2007a), the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Fisheries and Oceans Canada and Manitoba Natural Resources 1996), and Manitoba Infrastructure and Transportation's Standard Construction Specifications (Manitoba Infrastructure and Transportation 2008). Roadway ditches will be graded away from the bridge structure to an outfall with erosion protection.

Culvert Crossings

A culvert crossing will be established on a small unnamed intermittent tributary to the South Moswakot River (Figure 2.3-3). The culvert crossing will be designed in accordance with the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Fisheries and Oceans Canada and Manitoba Natural Resources 1996). Approximately 12 other culvert crossings will be required for localized overland drainage. All culverts will be constructed using a through-grade design with sizing to follow Manitoba Infrastructure and Transportation standards (MIT 2008). The return period of peak flow for these culverts will be 3% and the minimum culvert size will be 750 mm in diameter. Inlet and outlet protection will be designed for the through-grade culvert to minimize potential erosion (Figure 2.3-3).

2.2.2.3 Material Sources

The materials required for constructing the road will include impervious fill, granular fill/crushed rock, rock fill, riprap and concrete aggregates. Materials for the roadway will be taken from borrow sites within the 100-m ROW with supplements from sources known as the G-1, located approximately two-thirds of the way down the road, and G-5 deposits (Figure 2.1-1). Short-term temporary access trails may be required into the deposits.

2.2.3 Main Camp (Phase One)

The 500-person main camp (phase one) will be constructed in a 129 ha area located north of the Gull Rapids on the Nelson River (Figure 2.1-1). Pre-engineered bunkhouses for workforce accommodations, a recreation hall, bays for fire and first-aid vehicles, and kitchen and dining facilities will be erected on the cleared area. In addition to accommodation facilities, there will also be work areas, offices and a helicopter pad.

2.2.3.1 Facilities

The main camp (phase one) will consist of prefabricated trailers, pre-engineered buildings and possible stick frame buildings. All camp accommodations will be in prefabricated trailers. Pre-engineered buildings will be used for ambulance/fire emergency vehicle bays. The contractor may erect additional temporary structures in the contractor work area.

The camp will include two contractor work areas, identified as Areas A and C, and a work area for Manitoba Hydro (Figure 2.1-1). The work areas will consist of granular pads for staging areas. Offices for Manitoba Hydro and contractor staff will be established using prefabricated trailers. A helicopter pad will be constructed near the main camp (phase one).

A fuel tank farm for storage of propane and diesel will be constructed at the camp site. Propane will be used for kitchen services and heating while diesel will be used for construction equipment and vehicles.

2.2.3.2 Utilities

Main camp (phase one) utilities will include a potable water supply, wastewater disposal, solid waste disposal, and power supply (2-MW diesel generator set). Utility services provided at the main camp will include a combination of shallow and deep buried utility corridors and utilidors for electricity, sewer and water.

Potable Water

Wells for potable water will be established at the main camp (phase one). A network of four observation wells and one production well has been established at locations illustrated in Figure 2.2-1. Using 48 hour pumping test results, the well yield was calculated at 1,350 L/min per m down (350 USgpm/min) in a 200 mm diameter pumping well. Based on the available drawdown of 12.3 m from the static water table to the top of the well screen the yield could possibly range as high as 11,400 L/min (3000 USgpm).

Waste Treatment

A package mechanical plant will be installed at the main camp (phase one) to collect and treat wastewater. The outfall pipe will not be constructed since the plant will not be operated as part of the Project. Solid wastes associated with construction of the main camp will be hauled to an approved facility or burned under permit.

Power Supply

Two diesel generator sets rated at 2 MW will be installed to provide power for the main camp. A pad will be constructed for future installation of a construction power transformer station.

2.2.3.3 Material Sources

Like the road, the materials required for constructing the main camp (phase one) infrastructure will include impervious fill, granular fill/crushed rock, rock fill, riprap and concrete aggregates. Materials for the camp will come from borrow sources within the 100-m road ROW (primarily from the area known as G-1) and may be supplemented from established sources known as the G-5 deposit source near the intersection of PR 280 and the proposed road.

2.3 CONSTRUCTION ACTIVITIES

Construction activities are described for the start-up camp, road and stream crossings, and main camp (phase one). The construction schedule is also presented.

2.3.1 Start-up Camp

Construction activities for establishing the start-up camp will include the following:

- Clearing and grubbing;
- Preparing site (establish drainage);
- Applying erosion and sediment control measures;
- Constructing pad (excavation, backfilling, grading);
- Gravelling;
- Installing trailers;
- Trenching for utilidors;
- Installing utilities and services; and
- Decommissioning.

It is proposed to commence construction of the start-up camp in early November 2009 and to develop the camp facilities during the spring of 2010. During the clearing and grubbing activity workers will be accommodated in a self-contained camp or will commute to and from Split Lake (Figure 1.1-1).

Site preparation will involve clearing and grubbing. Clearing involves removal of brush through mechanical clearing, except near streams where manual clearing is preferred. Mechanical clearing will typically include equipment such as scrapers, bulldozers, motor graders and front-end loaders. Grubbing is the removal of the roots of vegetation and is only undertaken where necessary in accordance with the Preliminary Construction Environmental Protection Plan (EnvPP). Cleared matter will be burned or mulched. Mulch material will be collected and used for camp walkways and for erosion and sedimentation control.

After completion of clearing and grubbing, topographic surveys will establish appropriate drainage elevations, which will be followed by excavating, backfilling and grading. Equipment will typically include scrapers, bulldozers, backhoe excavators, motor graders and front-end loaders. Construction will then begin on granular pads for facilities in the camp. Sub-base and traffic gravel will be applied next. Erosion and sedimentation-control measures and drainage culverts will be installed. Trailers will then be installed at the start-up camp site. Utility hook-ups will be established using shallow and deep bury utilidors, including a fire-protection system consisting of fire hydrants and extensions. Installation of parking barriers and parking lot electrification will also occur.

After completion of the infrastructure, the start-up camp will be decommissioned. The process will include removal of the temporary trailers and utilidors and a cleanup of the site. Once decommissioning is complete, the site will be redeveloped into a storage yard for the road.

2.3.2 Road

Road construction activities will include the following:

- Clearing and grubbing;
- Applying erosion and sediment control measures;
- Constructing security gatehouse and communications tower;
- Establishing drainage and start embankments;
- Continuing embankment construction;
- Gravelling for roadbed surface;
- Trimming slopes;
- Constructing clear-span crossing at Looking Back Creek;
- Installing culvert crossing at the unnamed tributary;
- Installing culverts for local drainage; and
- Cleaning up.

It is proposed to commence construction of the road in early November 2009 and to complete roadwork by October 2011.

Clearing and grubbing will involve removal of brush through mechanical clearing, except near streams, where manual clearing will occur. Equipment will typically include scrapers, bulldozers, backhoe excavators, motor graders and front-end loaders. Grubbing will remove the roots of vegetation and will only be undertaken as necessary. Topographic surveys will be conducted on the cleared and grubbed route for design purposes. Cleared matter will be burned or mulched, with mulch material retained for walkways, and erosion and sedimentation control. The area to be cleared for the road will be confined to the 100-m ROW, with 50 m reserved for the roadbed. A buffer of approximately 25 m will remain on each side of the road, with vegetation left *in situ*. Some areas will undergo mulch application as appropriate. Mulch will provide an organic layer for reseeding and will also offer some erosion control.

Construction of a security gatehouse and erecting a 12 m communications tower will begin the road construction process in the summer of 2010 and will serve to manage access to the road construction site. The gatehouse will be equipped with a granular turnaround apron for vehicles that are not cleared to enter the construction area.

Following establishment of the centreline, a preliminary roadway grade line will be designed based on the surveyed profile (Figure 2.3-1). The limits of the ROW clearing will be flagged by measuring from the established centreline. Clearing width will be determined by the material requirements for the new grade construction. In accordance with Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Fisheries and Oceans Canada and Manitoba Natural Resources 1996), clearing will be restricted to hand methods adjacent to watercourses, around sensitive areas and in terrain too rugged to permit the use of mechanical clearing. Vegetation buffers near watercourses will be observed according to established guidelines.

Establishing drainage and starting embankment construction will immediately follow clearing and grubbing. During this phase, ditches will be excavated, road drainage will be established and fill will be placed based on the roadway's preliminary elevation first grades. The construction process will proceed with embankment construction, where crews will continue to build the road embankments based on cut and fill requirements for the second and third grades.

Upon completion of the road embankments, gravel will be applied to finish the road-top surface. Slopes will then be trimmed and cleaned as a finishing step for the constructed road cross-section along the length of the road. Lastly, cleanup of construction debris and material along the ROW will be completed in preparation for future use of the road.

2.3.2.1 Stream Crossings

Looking Back Creek

A clear-span bridge crossing will be constructed at Looking Back Creek. The general arrangement for the stream crossing is shown in Figure 2.3-2. Construction of the crossing will require heavy equipment such as excavators, a truck-mounted drilling rig equipped with solid-stem auger and air hammer, pile driver, front-end loader and scraper. Construction is planned to start in November 2009 and be completed in April 2010.

To allow a quick start of construction, a temporary, self-contained 10-person camp may be established at the crossing site by the contractor. The camp will consist of trailer-based accommodations for sleeping quarters, kitchen power and waste-handling facilities. The trailers will be equipped with holding tanks for water, wastewater and sanitary wastes. All wastes will be collected and hauled to an approved facility.

Construction of the clear-span crossing will involve installation of steel **HP piles** driven to the point at which they can no longer be pushed deeper into the ground (refusal). A minimum amount of excavation will be conducted for the integral abutments and all excavations will be shored. Sheet pile cofferdams may be required for the abutment excavations. Forming will take place once the excavation is complete. Reinforcing steel will be installed and then concrete will be poured. Girders will be installed once abutment concrete is in place. The superstructure will consist of pre-cast, pre-stressed concrete box girders shipped to the site. The box girders will be launched over the abutments using a launching truss in combination with two small cranes, with one parked at each side of the creek. Alternatively, girders may be erected using one large crane which would install the girders from the west abutment. The final construction steps will include installation of concrete barriers, high-performance concrete overlay, approach slabs at each end of the bridge, and approved guardrails at each end of the bridge.

Reinforcing steel, stone, sand, cement and other construction materials will be stored in temporary stockpiles at the site. Construction of the crossing is planned for the winter season to avoid in-stream disturbance and minimize runoff and potential erosion. In addition, a number of temporary and permanent erosion control and sedimentation control measures will be implemented. Best management practices for temporary erosion and sedimentation control will involve the following:

- Winter construction;
- Minimal disturbance of existing vegetation cover;
- Measures to prevent soils or construction materials from entering creek; and
- Silt fencing upslope of the creek bank.

In addition, a number of permanent management practices will be applied, including the following:

- Riprap blankets adjacent to and extending from abutments, but above the ordinary high water mark;
- Riprap ditch liner on creek slopes;
- Rock ditch checks incorporated into the ditch liners; and
- Revegetation of disturbed areas.

Unnamed Tributary

Construction techniques for the crossing of the unnamed tributary will be similar to those required for the establishment of through-grade culverts in low-lying areas to deal with local drainage. The main difference will be additional measures, if required, to manage erosion and sediments, although all will be planned appropriately during times of low surface runoff.

The construction timeline for each culvert site is estimated at 2 to 3 days. Construction equipment and materials will be mobilized at the culvert location. If necessary, the crossing site will be de-watered prior to the start of construction by temporarily routing the flow of water around the culvert location. A trench for the culvert will then be excavated and the foundation for the culvert will be prepared by placing and compacting the bedding material along the full length of the culvert. A 750 mm diameter corrugated metal culvert will be laid on the foundation. Fill material will be placed in uniform layers adjacent to and over the culvert and compacted after each lift. Once in place, geotextile fabric and stone riprap for erosion control will be placed at the culvert inlet and outlet. Construction equipment and materials will then be demobilized and temporary water detour, if needed, will be restored. The construction timeline for each culvert is estimated to be from 2 to 3 days which will be planned to be carried out during times of low surface runoff.

2.3.3 Main Camp (Phase One) Construction

Main camp (phase one) construction activities will include the following:

- Clearing and grubbing for camp (250 ha) and three main work areas;
- Applying erosion and sediment control measures;
- Constructing pad (excavation, backfilling, grading);
- Gravelling;
- Installing pre-engineered bunkhouses, kitchen/dining facilities and trailers;
- Installing utilities and services, including service to water wells and installing package wastewater treatment plant; and
- Trenching for utilidors (potential for controlled blasting).

It is proposed to complete construction of the main camp (phase one) facilities by May 2012. Construction equipment will typically consist of scrapers, bulldozers, backhoe excavators, motor graders, front-end loaders and material-haulage trucks. Construction will begin with mobilization of equipment, followed by clearing and grubbing for identified work areas A, B, C and required yards, parking lots and sport fields (Figure 2.1-1). Once clearing is complete, excavation backfill and grading will be conducted to establish drainage and start granular pad construction. Sub-base and traffic gravel will then be applied and buildings for accommodations, facilities and utilities will be installed. Utilities will then be established, including wastewater lines, sewer lines, drying beds, potable water lines and fire hydrants/extensions via utilidors. Amenities such as parking barriers, boat ramps, parking lot electrical services and security fencing for the camp will be installed.

2.3.4 Construction Schedule

The construction schedule is dependent upon the timing of regulatory approvals, but it is anticipated that the main Project components would be constructed according to the schedule in Table 2.3-1.

Table 2.3-1: Project Construction Schedule

Timeframe	Construction Activities
Nov 2009 - Mar 2010	• Clearing and grubbing contract
Nov 2009 - Apr 2010	• Clear-span bridge at Looking Back Creek
Feb 2010 – Oct 2011	• Road construction
May 2010 – July 2010	• Start-up camp
Oct 2010 – May 2012	• Main camp (phase one)

2.4 OPERATION AND MAINTENANCE

The majority of activities associated with the proposed Project relate to construction. The only operational activities are associated with the use of the start-up camp while construction of the Project is underway. Once construction is complete, the start up camp will be decommissioned and only minor maintenance of the road and camp will be required. There may be occasions when the facilities may be used on a limited basis to access the area for engineering and environmental studies.

2.4.1 Start-up Camp Operation

Approximately 125 workers will be living in the start-up camp during construction of the road and associated infrastructure. In addition to sleeping and eating (using propane for cooking and heating), operational activities will include the storage of equipment and some materials, fuelling vehicles and equipment, and using the tank farm. Diesel generator sets will provide power for the start-up camp. Activities will also include use of the one well for water supply with domestic-use water demand expected to be approximately 43,000 L per day at peak camp occupancy. The current preferred option to manage wastewater at the start-up camp is to collect the wastewater in a holding tank and discharge it to a septic field. Septage from the holding tank will be removed and hauled out to an approved facility (Appendix A1). Solid wastes will be taken to a collection site (secured from wildlife) on-site and will be hauled to an approved facility.

2.4.2 Access Management

A Preliminary Access Management Plan has been developed to minimize site access and to accommodate local resource users (Appendix E). Access to the road construction area will be managed by a security contractor. The entrance to the road construction area will be gated and it will not be open to the public. The security gate will be staffed by a security services contractor on a full-time basis. Construction contractors, their employees, authorized subcontractors and authorized resource users will be required to follow pre-defined identification and access procedures to gain access to the road for the duration of the Project.

2.4.3 Camp Maintenance

Camp maintenance activities will include heating of facilities, winterizing as required and ongoing security at each camp area.

2.4.4 Vegetation Management

Vegetation management will be undertaken by the contractors using mechanical means as the preferred method of vegetation control. Temporarily cleared areas will be graded and stockpiled organic material will be spread to control erosion, encourage regrowth of native vegetation and reduce the risk of invasive plant species.

All cleared areas such as ditches that require revegetation will be seeded with a grass mixture only containing native and/or non-invasive introduced grasses (i.e., it will not contain sweet clover or other herbs). The restored areas will be monitored to evaluate revegetation efforts and to determine if additional actions are required.

2.4.5 Stream Crossing Protection

Stream crossing protection is described in the EnvPP and will include several safeguards to minimize effects on stream flow and water quality. Aggregate material will not be removed from any stream or waterway. Flow from ditches will be directed into either vegetated buffer areas or dissipated, but never directly into a stream. All maintenance vehicle traffic and associated machinery will only cross waterways at constructed road crossings.

2.5 CONTRACTS AND WORKFORCE REQUIREMENTS

The Project will provide an estimated 184 person-years of employment over a proposed 2.75 year period between the last quarter of 2009 through the second quarter of 2012. The work will be carried out through 11 separate work packages undertaken by construction and construction support contractors. Manitoba Hydro will also have staff onsite. As proposed in the Joint Keeyask Development Agreement (JKDA) and the tentative Keeyask Infrastructure Agreement, the first ten of the work packages will be undertaken as direct negotiated contracts DNCs by businesses and

joint ventures that are at least 50% owned by one or more of the Keeyask Cree Nations. The DNCs consist of the following packages:

- Catering (FLCN and YFFN);
- Camp Maintenance and Operations Services (CNP);
- Security Services (FLCN and YFFN);
- Employee Retention Support Services (FLCN and YFFN);
- First Aid Services (CNP);
- Start-Up Camp Site Development and Installation (CNP);
- Main Camp Site Development (CNP);
- Main Camp Sewer and Water Services (CNP);
- North Access Road Construction (CNP); and
- Clearing and Grubbing (CNP).

The contract for construction of the clear-span bridge at Looking Back Creek will be competitively bid, while the remaining work will consist of Manitoba Hydro's site staff to oversee the Project.

Figure 2.5-1 presents estimated peak Project workforce requirements for the proposed Project by quarter and by occupational category. A more detailed breakdown by occupation is contained in Appendix A2. These estimates could change when the construction work is implemented, depending on how the contractors choose to perform their work. Figure 2.5-1 and Appendix A2 illustrate the following:

- The highest level of employment occurs in the third quarter of 2011 when the number of job opportunities reaches 126. In the period of high employment between the third quarter of 2010 and the first quarter of 2012, peak quarterly employment ranges from 80 to 126 jobs;
- Total employment opportunities will increase until the fourth quarter of 2010, and then remain at high levels for the next five quarters until the first quarter of 2012, followed by a decline in the second quarter of 2012; and
- A sizable portion of the workforce requirements occurs in trades that are available among KCN members, namely the following:
    - Construction support occupations, such as catering and janitorial, security, first aid and employee retention support;
    - Non-designated trades occupations, such as construction labourer, heavy equipment operator and teamster; and
    - Some designated trades occupations such as carpenter, electrician and plumber.

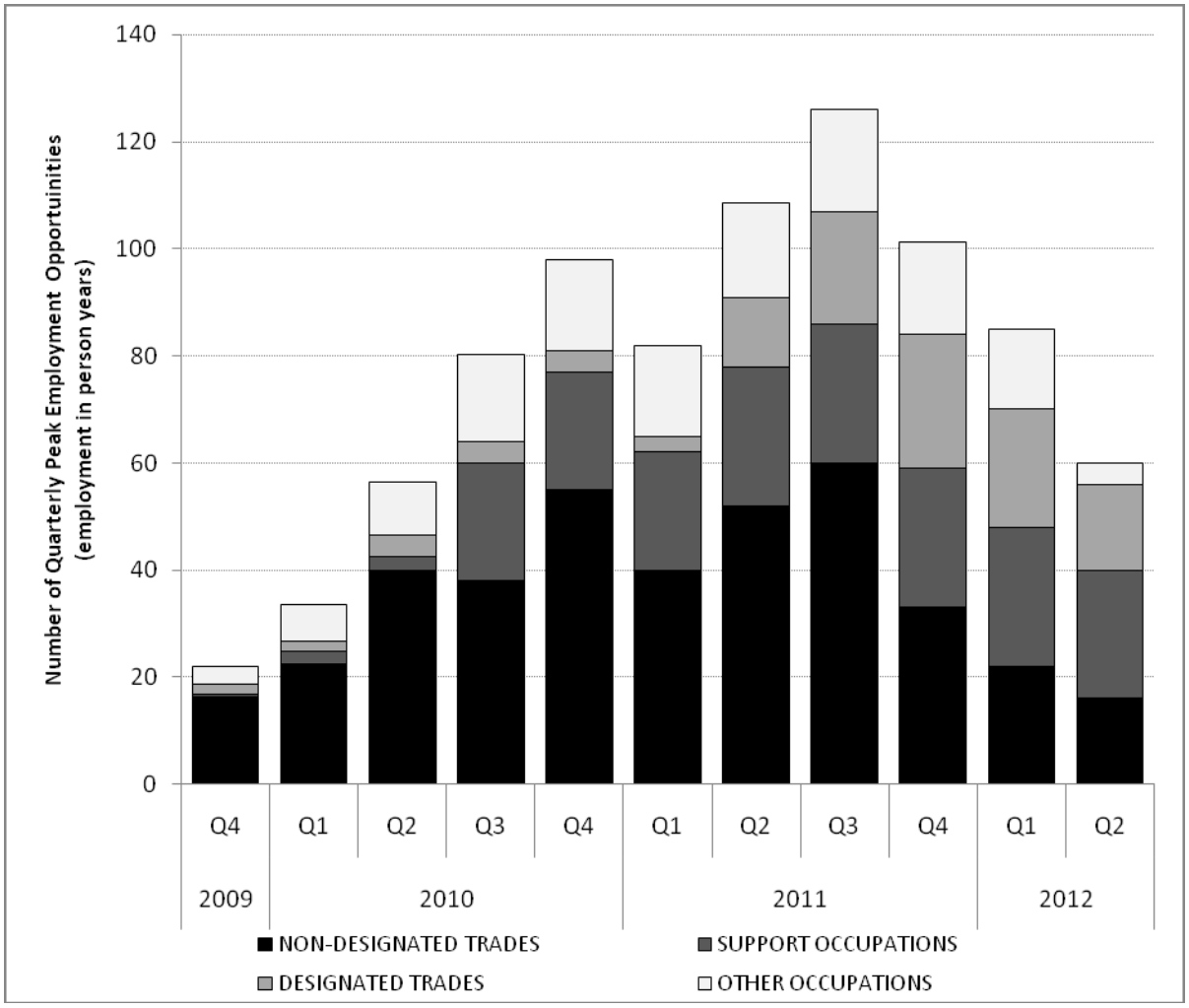


Figure 2.5-1: Estimated Peak Quarterly Workforce Requirements by Occupational Categories for the Project

Non-designated trades, construction support and identified designated trades positions dominate the workforce required for the construction period of Q4 2009 to Q2 2011. In the remaining construction period of Q3 2011 to Q2 2012, more than two-thirds of the workforce requirements are in these trades.[1]

[1] The designated trade positions have apprenticeship programs typically requiring four years of technical training and work experience leading to a journeyperson certification. Based on the current Burntwood/Nelson River Agreement (BNA), it is anticipated that apprentices will account for at least 20% of the Project's designated trades positions. The construction support, and non-designated trades positions have trainee positions but do not have apprenticeships, and most of these positions require less than three years of related work experience, with about 45% requiring one year or less of related work experience or training. The BNA provision would also allow for entry level workers to account for at least 20% of these positions[0].

2.6 RECLAMATION

Disturbed areas requiring reclamation will include borrow areas, quarry sites, work areas, temporary haul roads, settling ponds and spoil deposition sites will be disturbed during construction activities. Reclamation measures based on best management practices, guidelines and regulations, and KCN principles (Appendix C) will be used to stabilize soils and prevent erosion. The Preliminary EnvPP provides a description of the standard methods for disturbed site reclamation. Specific plans will be developed for reclamation activities that are outside of the ROW or camp footprint areas. Reclamation will commence upon completion of the Project construction.

2.7 DECOMMISSIONING

In the event that the Keeyask GS project does not proceed in the future, the proposed infrastructure would not be required and would be decommissioned. It is intended that decommissioning would return the environment to the pre-construction conditions to the extent reasonable and practicable. Decommissioning activities would include removal of the roadbed, clear-span bridge, culvert crossing and through-grade drains, and camp buildings and utilities. The roadbed and camp site would be regraded and revegetated. A decommissioning plan would be prepared and submitted to the appropriate regulatory authorities for approval prior to implementation. Public notification of decommissioning and associated activities would also take place.

PROPOSED LOCATION OF START-UP CAMP

Unnamed Tributary Stream Crossing

Proposed Road

G-5

EXISTING WINTER TRAIL

100m ROW

G-1

Looking Back Creek Stream Crossing

MAIN CAMP (PHASE ONE)

PROPOSED KEEYASK GS

INSET MAIN CAMP (PHASE I)

Helicopter Pad

Main Camp Facilities

Package WW Treatment Plant

Work Area A

Work Area B

Work Area C

100 metre Right-of-Way (ROW)

Construction Power Substation

Gull Rapids

William Smith Island

Moswakot River

STEPHENS LAKE

GULL LAKE

Looking Back Creek

Gull Rapids

Gillrat Lake

KEEYASK

Scale

0 1.25 2.5 5 km

0 1.25 2.5 5 mi

Projection: UTM NAD83, Zone 15N
Data Source: Manitoba Hydro and Government of Canada
Created By: TetrES Consultants INC.
Date Created: July 24, 2009

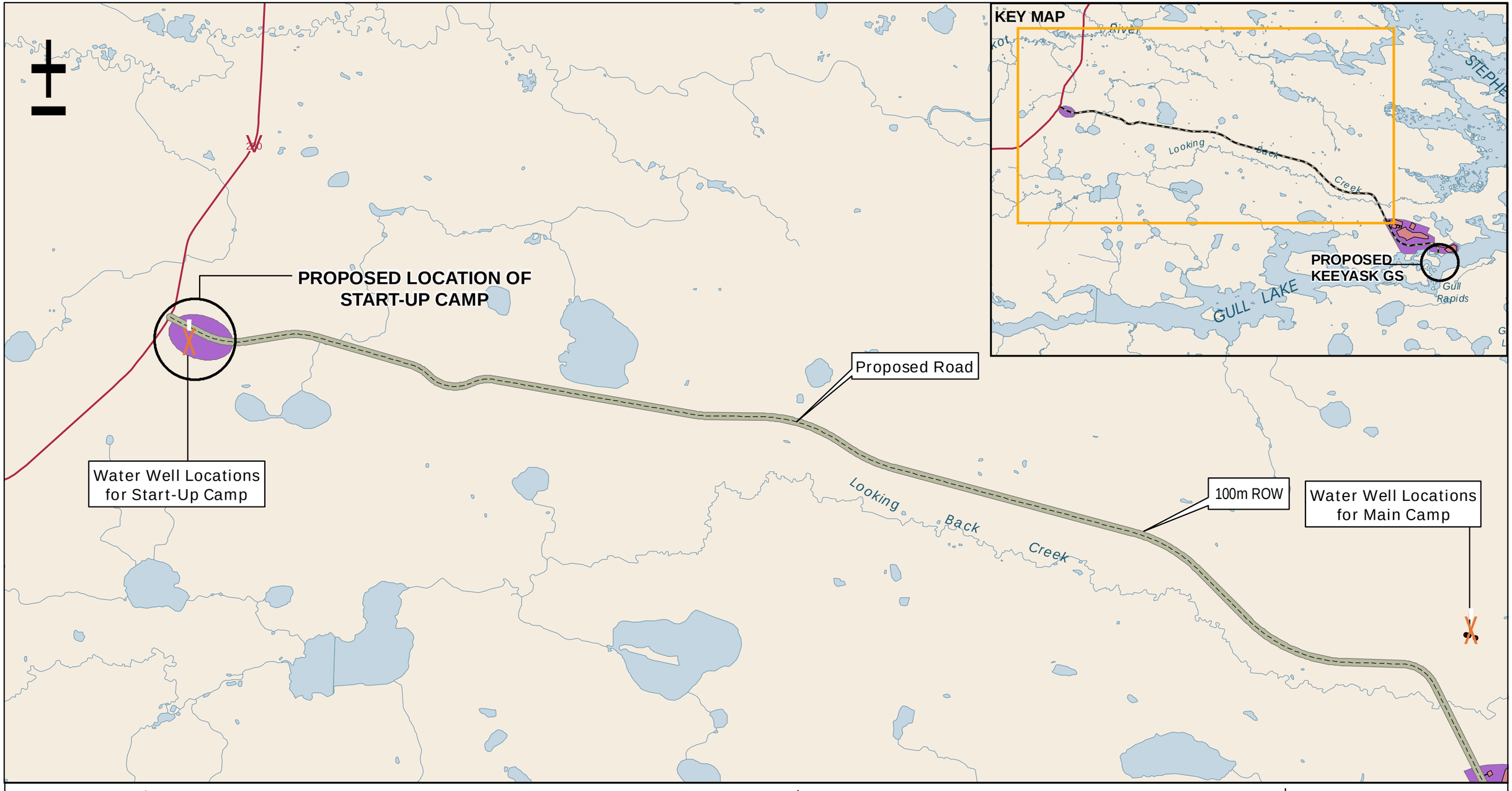
LEGEND

- Borrow Areas
- Start-Up Camp
- Main Camp (Phase One)
- 100m ROW
- Winter Trail

Location of Borrow Sources and Infrastructure

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\KIP_Borrow_Sources_220709.mxd - 7/24/2009 @ 12:18:00 PM

Figure 2.1-1



KEEYASK

Scale

0 1 2 4 km

0 0.5 1 2 mi

Projection: UTM NAD83 Zone15N
Data Source: Manitoba Hydro and Government of Canada
Created By: TetrES Consultants INC.
Date Created: July 23, 2009

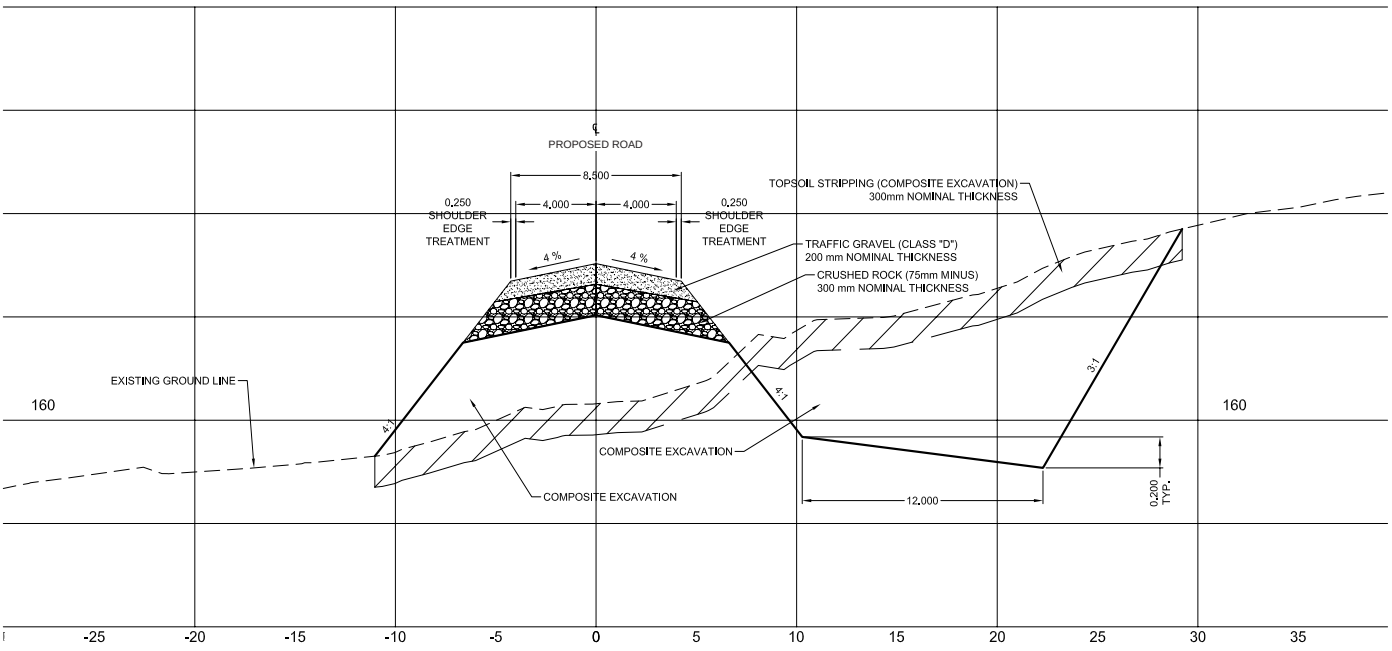
LEGEND

- Infrastructure (Footprint)
- Water Well
- 100m ROW

Water Well Locations in the Study Area

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\KIP_CampWells_150709.mxd - 7/15/2009 @ 3:43:24 PM

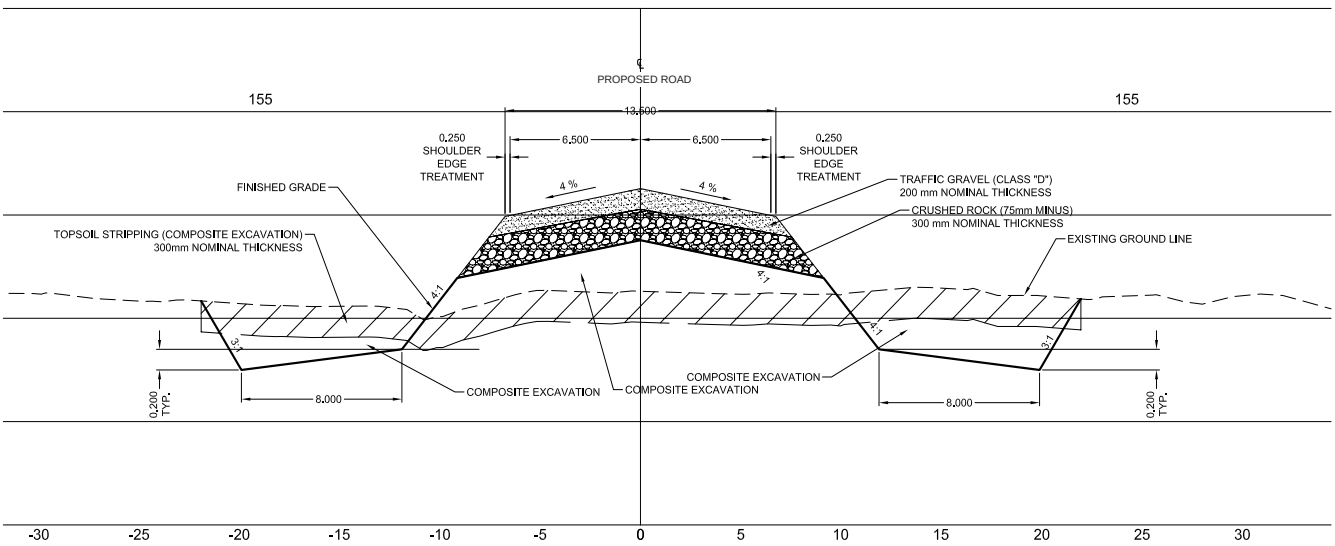
Figure 2.2-1



SECTION AT STA. 6+700

GRADE CONSTRUCTION

V=1:30
H=1:150

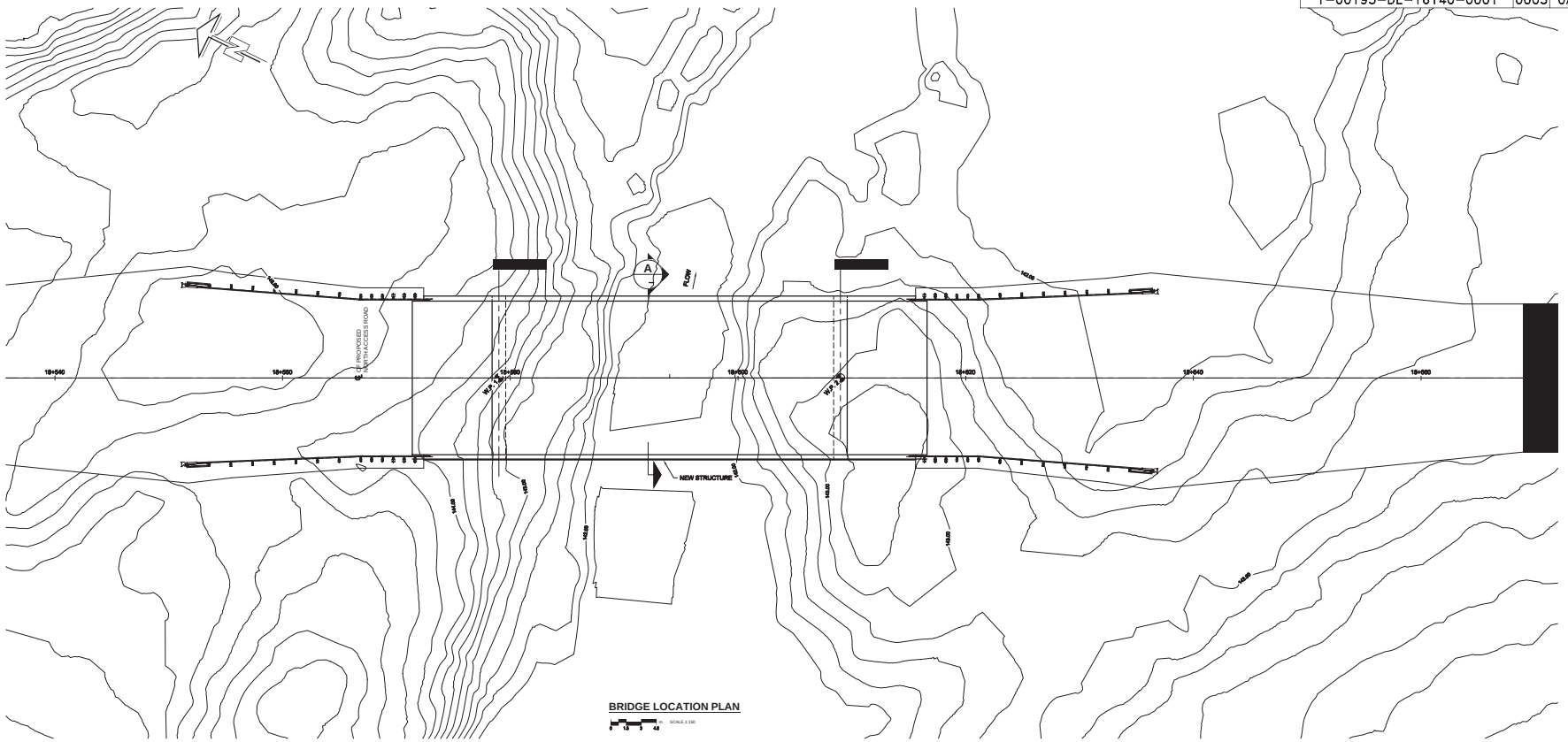


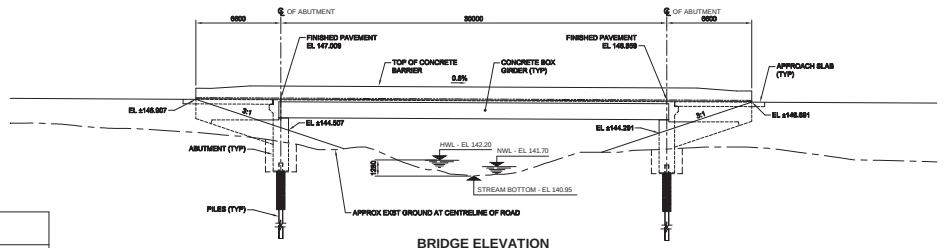
SECTION AT STA. 15+000

GRADE CONSTRUCTION

V=1:50
H=1:250

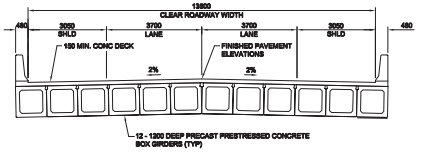
Road Cross Sections
Figure 2.3-1





BRIDGE ELEVATION

SCALE 1:150



SECTION A–A

SCALE 1:75

LOOKING BACK CREEK
WATER LEVELS AND DISCHARGES 2007-2008

DATE (Y.M.D)	TIME (CST)	WATER SURFACE ELEVATION (m)	DISCHARGE (CMS)	HIGH WATER MARK
2007 06 23	11:55	141.73	2.82	
2007 06 28	9:44	141.67	N/A	
2007 06 10	12:24	141.49	0.82	
2007 07 09	16:15	141.66	1.44	
2007 07 30	13:47	141.58	0.22	
2007 09 03	13:55	142.06	3.69	
2007 10 09	14:15	141.90	N/A	
2008 06 25	14:24	142.13	N/A	
2008 06 08	10:40	141.49	1.84	142.30
2008 07 07	18:28	141.51	1.17	
2008 08 10	19:26	141.53	0.13	

WORKING POINT COORDINATES

	LOCAL COORDINATE SYSTEM (GROUND DISTANCES)		C.S.R.S. (NAD 83) U.T.M. GRID	
WORKING POINTS	NORTHING	EASTING	NORTHING	EASTING
WP 1			6280070.086	360691.795
WP 2			6280043.279	360815.305

CONSULTANT PROJECT NUMBER: 0217-200-06

AECOM

DELCAN CORPORATION

SNC-LAVALIN

NO.	DATE	REVISIONS	BY	CKD.	APP.
A	–	–	–	–	–

NOTED

MANITOBA HYDRO

Keeyask Infrastructure Project

LOOKING BACK CREEK BRIDGE

GENERAL ARRANGEMENT

DRAWN

CHECK

SCALE AS NOTED

DATE

1-00195-DE-16140-0001 | SHT. 0003 | REV. 0A

AUTOCAD ORIGINAL

FOR WORKPLAN USE ONLY

Plot Time 6/24/2009 8:59 AM

Drawing File: 0217-200-06_01-S-0103_RX.DWG

Figure 2.3-2

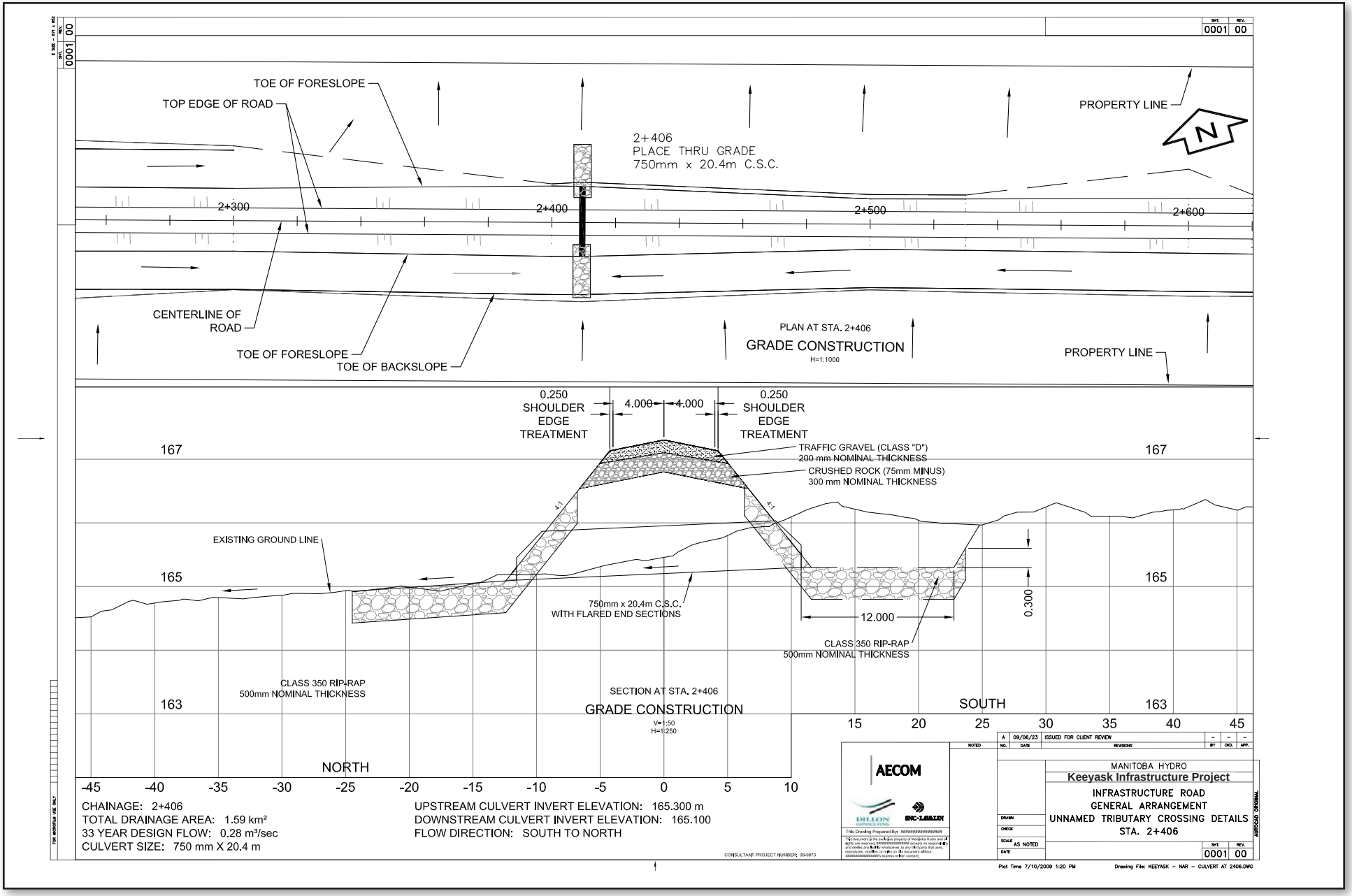

TOE OF FORESLOPE
TOP EDGE OF ROAD
PROPERTY LINE
2+406
PLACE THRU GRADE
750mm x 20.4m C.S.C.
2+300
2+400
2+500
2+600
CENTERLINE OF ROAD
TOE OF FORESLOPE
TOE OF BACKSLOPE
PLAN AT STA. 2+406
GRADE CONSTRUCTION
H=1:1000
PROPERTY LINE
0.250 SHOULDER EDGE TREATMENT
4.000
4.000
0.250 SHOULDER EDGE TREATMENT
TRAFFIC GRAVEL (CLASS "D")
200 mm NOMINAL THICKNESS
CRUSHED ROCK (75mm MINUS)
300 mm NOMINAL THICKNESS
4:1
4:1
EXISTING GROUND LINE
167
165
163
750mm x 20.4m C.S.C.
WITH FLARED END SECTIONS
12.000
0.300
CLASS 350 RIP-RAP
500mm NOMINAL THICKNESS
CLASS 350 RIP-RAP
500mm NOMINAL THICKNESS
SECTION AT STA. 2+406
GRADE CONSTRUCTION
V=1:50
H=1:250
NORTH
SOUTH
-45 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10
15 20 25 30 35 40 45
CHAINAGE: 2+406
TOTAL DRAINAGE AREA: 1.59 km²
33 YEAR DESIGN FLOW: 0.28 m³/sec
CULVERT SIZE: 750 mm X 20.4 m
UPSTREAM CULVERT INVERT ELEVATION: 165.300 m
DOWNSTREAM CULVERT INVERT ELEVATION: 165.100
FLOW DIRECTION: SOUTH TO NORTH
A 09/06/23 ISSUED FOR CLIENT REVIEW
NOTED NO. DATE REVISIONS BY CKD. APP.
AECOM
DILLON CONSULTING
SNC-LAVALIN
MANITOBA HYDRO
Keeyask Infrastructure Project
INFRASTRUCTURE ROAD
GENERAL ARRANGEMENT
UNNAMED TRIBUTARY CROSSING DETAILS
STA. 2+406
DRAWN
CHECK
SCALE AS NOTED
DATE
SHT. 0001 REV. 00
CONSULTANT PROJECT NUMBER: 08-9673
Plot Time 7/10/2009 1:20 PM
Drawing File: KEEYASK – NAR – CULVERT AT 2406.DWG
AUTOCAD ORIGINAL
FOR MANITOBA USE ONLY

Figure 2.3-3

3.0 ENVIRONMENTAL SETTING

3.1 OVERVIEW

The proposed Project is located to the north and east of Lake Winnipeg (Figure 1.1-1) in the Knee Lake **Ecodistrict**, the Boreal Shield **Ecozone**, and the Hayes River Upland **Ecoregion** in northern Manitoba (Figure 3.1-1). Since the Project is located in the northern part of the Knee Lake Ecodistrict, characteristics of the study region are likely to be intermediate between the Knee Lake values and those listed for the Embleton Lake Ecodistrict located just north of the Project location. Where available, information for sites closer to the Project (e.g., climate information reported for Gillam) is used as being representative of that area.

The following sections provide information on the main components of the environmental setting:

- Physical environment:
  - Climate (temperature, precipitation, wind);
  - Physiography (topography, geology, soils, permafrost);
  - Surface water (hydrology, quality);
  - Groundwater (hydrogeology, quality).
- Aquatic habitat and biota.
- Terrestrial environment:
  - Vegetation (terrestrial ecosystems and habitat, plants);
  - Wildlife (invertebrates, amphibians, reptiles, birds, mammals).
- Socioeconomic environment:
  - Population and demographics;
  - Land and resource use;
  - Infrastructure and services;
  - Labour Force and Employment; and
  - Community and family life.
- Heritage resources.

3.2 PHYSICAL ENVIRONMENT

Physical environment includes climate, noise, air quality, physiography (topography, geology, soils and permafrost), surface water (hydrology, surface water quality) and groundwater (hydrogeology, groundwater quality).

3.2.1 Climate, Noise and Air Quality

The proposed Project is located within the sub-Arctic climate zone that is characterized by long, usually very cold winters, and short, cool to mild summers. Based on measurements at Gillam Airport, the mean annual temperature is -4.2°C, with a range of monthly average temperatures from -25.8°C in January to +15.3°C in July (Environment Canada 2009).

The mean annual precipitation is 499.4 mm, of which approximately 63% is rain, with the highest values occurring in July (81.8 mm) and August (77.2 mm). October through April tend to receive the most amount of precipitation in the form of snow, typically in the range of 23.4 to 43.9 cm per month. September and May can be considered transitional months, when both rainfall and snowfall can occur.

The predominant wind direction is northeast from March to July, northwest from August to November, and westerly from December to February. Monthly normal wind speeds range from 14.0 km/h in February, March and December to 17.8 km/h in October. A maximum gust speed of 107 km/h was recorded in July of 1991.

No data is available for ambient noise levels and no data was obtained for air quality; however, existing noise and air quality levels are expected to be low and typical of relatively undisturbed areas.

3.2.2 Physiography

3.2.2.1 Topography

The topography of the Knee Lake **Ecodistrict** is generally flat with undulating loamy moraines that erode into drumlin crests and ridges. Elevations range from 150 to 213 m above sea level (masl) in the lowlands near Stephens Lake. Eskers provide local relief to heights of 20 to 30 m (Smith *et al.* 1998).

The proposed road ROW is located along and adjacent to an **esker** (Gull Esker), which extends southeast from PR 280 to Stephens Lake, just north of Gull Rapids (Figure 3.2-1). Studies undertaken in support of this EA report indicate that the **topography** adjacent to the proposed road includes gently-sloping terrain, with peat of varying thickness overlying fine-grained glaciolacustrine clay and silt. Steeper slopes are found on the flanks of elongated **drumlins** that formed in an approximate east-west direction resulting from glaciers.

3.2.2.2 Geology

The region lies within the **Canadian Shield** near the boundary between the Churchill and Superior provinces in which its **geological overburden** thickness is estimated to be up to 30 m over the **Precambrian bedrock** (Betcher *et al.* 1995). This bedrock generally consists of **greywacke gneisses**, **granite gneisses** and **granites**. The overburden **stratigraphy** is a reflection of the last glacier retreat eastward and the resulting inundation of much of Manitoba by glacial Lake Agassiz. Some preglacial and silty sands are found immediately above the **bedrock** formation, but generally the overburden consists of a thick layer of deposited glacial material (**till**) overlain by postglacial deposits in the form of **alluvium** (cobbles and boulders overlying sands and gravels) and Lake Agassiz silts and clays. Studies undertaken as part of this EA report indicate that the latter are commonly **varved** and relatively thin in nature (except in topographic lows) or absent (e.g., on nearby ridges and knolls).

Within the Gull Rapids area, the bedrock basement is generally **metamorphic** and **cataclastic** in texture. Further downstream, **metasedimentary** rocks and **igneous intrusive** rocks are also found (Manitoba Hydro 1993a, 1993b). Studies undertaken in support of this EA report indicate that along the Stephens Lake shore zone, a **boulder lag** is present in places between the bedrock and the overlying glacial drift and some or all of the overburden units are reported to be locally absent.

3.2.2.3 Soils and Permafrost

Soils from the **Brunisolic**, **Cryosolic**, **Gleysolic**, **Luvisolic**, **Organic** and **Regosolic** soil orders were represented in field studies undertaken in support of this EA report for the Regional Study Area. Organic soils were the most common, followed by Cryosols (Appendix B2, Table B2-2-1). **Fibrisols** and **Mesisols** are the dominant Organic soil; Organic Cryosols are the dominant Cryosol. ineral soils, which cover approximately 10% of Regional Study Area, are concentrated on elevated areas which primarily occur along the Nelson River and the upper portions of the eskers and moraines. Mineral soils tend to be well-drained due to their locations.

As described in Section 3.2.2.1, the proposed road ROW extends along and adjacent to the Gull Esker in the vicinity of Gull Lake (Figure 1.3-1). Post-glacial peat and clay in this area has an average thickness ranging between 0.6 and 1.3 m (Manitoba Hydro 1993a, 1993b). Studies undertaken in support of this EA report indicate that median peatland depths in the region (i.e., combined thickness of peat, water and ice core) range from 0.5 to 3.2 m depending on peatland type. Three separate till-**intertill horizons**, which range in thickness between 2 and 10 m (Manitoba Hydro 1993a, 1993b), comprise the underlying deposited glacial material.

Peatlands are the dominant wetland type in the region (Appendix B2, Table B2.2-2). Measured peat thicknesses range from 20 cm to over 5 m. **Veneer bog**s and blanket peatlands are the most common peatland types, covering approximately 65% of the region. Veneer bogs primarily occur on upper and mid-slope positions. Blanket peatlands primarily occur on lower slopes, valleys and level areas. Blanket peatlands are thicker than veneer bogs and often contain scattered patches of ground ice. Peat plateau bogs and their transitional stages cover approximately 16% of regional land area. The remaining peatland types are **horizontal peatland**s, **aquatic peatland**s, thin wet peat and deep wet peat. These peatlands, which are generally found in depressional locations, cover approximately 9% of Regional Study Area.

Soil type and permafrost activity throughout soil horizons contributes to surface topography (Smith *et al.* 1998). Uneven soil horizon development in sediments with high clay content is evidence of permafrost effects on deeper soil layers. Permafrost activity is illustrated in surface layers by the presence of low earth hummocks (Smith *et al.* 1998). Mineral and organic soils present at regional and local scales frequently include bodies of **permafrost**. The permafrost table and bottom depths vary, depending on the depths of organic and mineral layers. While permafrost is widely distributed throughout the region, studies undertaken in support of this EA report indicate that the sandy, gravely soils of the esker have been found to be generally free of permafrost and that permafrost is expected to be absent in ridges composed of granular soils.

Surface permafrost is widespread in the area and generally occurs in all peatland types except for horizontal and aquatic peatlands. The types of permafrost range from cold soil temperatures only to

ice crystals, ice lenses and ground ice. Ground ice in peat plateau bogs can be several metres thick. Although permafrost may exist in the esker soils, it is unlikely that these frozen sandy/gravely soils will include large masses of frozen water (ice).

3.2.3 Surface Water

3.2.3.1 Hydrology

Overview

The Project is contained within the Nelson River Drainage Basin (Figure 3.2-2). The southern terminus of the proposed road is near Gull Rapids on the Nelson River (Figure 1.3-1). Lakes of various sizes are densely scattered across the landscape. Many of the lakes have shorelines composed of **unconsolidated** materials and often lie between drumlin ridges. The majority of the area is drained by Looking Back Creek westward into Stephens Lake. Drainage in the immediate area of the proposed road flows off the north side of the esker to the northeast and off the south side of the esker to the southeast.

The proposed road crosses Looking Back Creek and an unnamed tributary (Figure 2.1-1). Since no flow records have been previously collected on these streams a regional hydrology study was conducted for these local tributaries in support of this EA Report (Section 2.2.2.1). The study was necessary to determine the hydrological parameters for the analysis of the two crossings. It included using updated hydrometric information representing the region.

The hydrologic analysis involved using the regional flood analysis for estimating average flood peaks based on eleven hydrometric gauges of similar basins in the region. A relationship was determined between the average flood data and the corresponding drainage area. Design inflow hydrographs were computed using this information for the two stream crossings.

The proposed road will also require approximately 12 additional through-grade drains to allow passage of local overland runoff. These culverts do not constitute stream crossings and no hydrology studies were conducted for these locations.

Looking Back Creek

The proposed road crosses Looking Back Creek approximately 4 km upstream from the Nelson River. Approximately 95% of the 126- km^2 drainage area is upstream of the crossing site (Appendix B1-2). Looking Back Creek is a classified as a **third-order stream** at the crossing location.

Looking Back Creek is a medium-sized seasonal to perennial stream with a well-defined meandering channel lying within a narrow well-drained floodplain. The hydrologic assessment of Looking Back Creek undertaken in support of this EA report indicates that on average this creek will maintain low flows through the winter, with occasional (approximately 30% of the time) backwater flooding resulting from ice damming on the Nelson River. The mean monthly hydrograph indicates that flows rise quickly during the spring freshet, reach a peak of approximately 3.0 m^3/s in May, and then

decrease and stabilize at about 1.5 m^3/s throughout summer. Flows during the fall gradually decrease, reaching about 1.2 m^3/s by October. Flows continue dropping throughout the winter months, reaching the lowest flow values of approximately 0.15 m^3/s by the end of March. During fall 2004, channel width and maximum depth at the crossing were 7.4 and 0.8 m, respectively. During spring 2005, mean water velocity and discharge were 0.32 m/s and 2.37 m^3/s, respectively.

Unnamed Tributary

Although the unnamed tributary is a small **second-order stream**, the road crossing is in the headwaters, where the tributary is a **first-order stream**. Approximately 4-km^2 (11%) of the 36-km^2 watershed is upstream of the crossing location. The crossing site is approximately 1 km downstream of a small headwater pond, 11 km upstream of its confluence with the South Moswakot River and 30 km upstream of the North Arm of Stephens Lake (Appendix B1).

The tributary is a small intermittent stream with morphology and habitat ranging from boreal wetland with a braided channel and beaver dams to a well-defined narrow channel in upland forest. Studies undertaken in support of this EA report included an estimate of flow patterns for the unnamed tributary creek. The mean monthly hydrograph indicates that flows rise quickly during the spring freshet, reaching a peak of about 0.09 m^3/s in May, then decreasing and stabilizing at about 0.04 m^3/s throughout summer. Flows during the fall gradually decrease, reaching about 0.01 m^3/s by October. Flows continue dropping throughout the winter months and by March the flow is essentially zero at which time the creek is frozen to the bottom. This is the typical winter process, since this crossing location is well above ice staging effects on the Nelson River.

During a March 2005 field visit, the tributary was not accessible at the crossing location, but sampling was conducted approximately 1 km further upstream at the outlet of a small pond. Anoxic conditions were measured in the only site that water was found at that location. In February 2009, the crossing location was accessed and the tributary was found to be frozen to the bottom. During the fall of 2004, channel width and maximum depth of the main channel at the crossing location were 2.5 and 0.6 m, respectively. Discharge was 0.02 and 0.07 m^3/s during the fall 2004 and spring 2005 surveys, respectively.

3.2.3.2 Surface Water Quality

Surface water quality was examined at or near the proposed stream crossings four times in the open-water seasons of 2003 and 2004, once in the spring of 2005 and once in the winter of 2005 (Appendix B1). Sampling in 2003 and 2004 was conducted near but not at the crossing location of the unnamed tributary. Due to the relative proximity of the sampling site, conditions are considered to be adequate to characterize this stream-crossing location.

In situ conditions measured during the open-water season at the two stream crossings indicate a wide fluctuation in dissolved oxygen (DO) conditions. At both sites, DO ranged from 3.6 mg/L, which is below the instantaneous minimum for the protection of early life stages of cool-water species (5.0 mg/L), to near saturation. The pH remained near neutral to slightly alkaline at all times and was consistently within the water-quality guideline range for the protection of aquatic life (CCME 1999; updated to 2009). Water-quality data from the stream-crossing sites are presented in Appendix B1.

Turbidity and total suspended solids (TSS) varied across sampling times and were generally higher in Looking Back Creek than in the unnamed tributary. Total phosphorus (TP) also ranged relatively widely across sampling periods at both crossings and was consistently higher at the Looking Back Creek crossing than the unnamed tributary site, possibly reflecting the higher TSS at this site. With one exception (sample collected at Looking Back Creek in July 2004) all concentrations of TP were below the Manitoba narrative guideline for streams (0.050 mg/L; Williamson 2002). Ammonia and nitrate concentrations were generally quite low and were within the Manitoba water-quality objectives (Williamson 2002) and the CCME (1999; updated to 2009) guidelines for the protection of aquatic life, respectively.

Stream primary productivity, as estimated from chlorophyll *a* concentrations, varied notably between years at both crossing locations but peaked at both sites in August 2003. Chlorophyll *a* was consistently detected in the open-water season of 2003 but remaining generally low in 2004.

Looking Back Creek was frozen to the bottom at the crossing location when visited in March 2005. In February 2009, the Creek channel was approximately 6.5 m wide at the crossing location, with an average of 0.9 m of water under an ice cover of about 1.1 m. A DO reading could not be obtained but no stagnant odour was apparent. In March 2005, the tributary was sampled approximately 1 km upstream of the crossing location at the outlet of a small headwater pond due to poor access at the crossing location. Several holes were drilled at the outlet of the pond and all but one contained a mixture of mud and stagnant water. One location yielded approximately 0.2 m of water with a low DO concentration (1.72 mg/L and stagnant odour). The results suggest that DO conditions are not suitable to support aquatic life in winter. The tributary was investigated in February 2009 and was found to be frozen to the bottom at the crossing location.

3.2.4 Groundwater

Results from recent studies carried out on the **aquifers** in the region in support of this EA report indicated that groundwater levels generally drain towards Looking Back Creek and then to Stephens Lake. Groundwater levels have been noted to change in response to fluctuations in surface-water levels as a shared response to precipitation events.

3.2.4.1 Hydrogeology

The existing groundwater regime consists of unconfined surficial and semi-confined overburden aquifers (Betcher *et al.* 1995). The groundwater table below the esker is generally from 5 to more than 7.5 m below grade. The connection between the aquifers is not entirely understood but is expected to be present based on the local stratigraphy (specifically the lack of a continuous confining layer). Groundwater elevations and flow appear to correspond directly with surface topography. More specifically, groundwater elevations are highest in the highland areas and groundwater flows from topographic highs to topographic lows. Overall, groundwater is shallow (0 to 1.5 m below the ground surface). However, there are scattered locations on topographic highs where the depth-to-groundwater is more than 7.5 m.

Precambrian igneous and metamorphic rocks form the bedrock basement of the region (Section 3.2.2.2). This basal **hydrostratigraphic** unit is generally **impermeable** to groundwater

except where the bedrock has been fractured by **tectonic** movement (Betcher *et al.* 1995). The **permeability** of the bedrock units within the region is reported to be varied, based on the location of local bedrock positions.

3.2.4.2 Groundwater Quality

Carbonate-rich glacial till and bedrock units contribute to groundwater quality in the northern reaches of the Nelson River **watershed**. Betcher *et al.* (1995) describes groundwater in the area as "slightly alkaline," typified by calcium, magnesium and bicarbonate components, with total dissolved solid concentrations from 400 to 450 mg/L. According to Betcher *et al.* (1995), in some locations, groundwater samples show high levels (1,300 mg/L) of sodium and chloride, which is thought to represent residues of marine waters from the Tyrell Sea, which formed approximately 8,000 years ago and extended an estimated 250 km inland from the present day shore of the Hudson Bay.

In the study area, recent (2008) groundwater analyses and monitoring-well water sampling undertaken in support of this EA report confirm the previous findings of Betcher *et al.* (1995). Two water types can be distinguished based on general groundwater chemistry as follows:

- Calcium-magnesium-bicarbonate waters with pH between 6.5 and 7.5, and TDS concentrations between 470 and 550 mg/L. This type of water was collected on the north side of the Nelson River at four locations and three locations on the south side; and
- Residual marine-water pockets of sodium-chloride composition with a pH of 6.5, and TDS concentrations around 11,700 mg/L. This type of water was collected on the south side of the Nelson River at one location.

A separate camp well investigation has confirmed the potability of the groundwater to be used for the start up camp and main camp. Figure 2.2-1 shows the well locations.

3.3 AQUATIC HABITAT AND BIOTA

Aquatic habitat and biota consist of the aquatic, semi-aquatic and riparian environments in which aquatic plants and animals interact. Habitat requirements particular to a species can change at each stage of its life-cycle. For example, the habitat requirements for fish spawning will often be substantially different than those required for feeding. A species of fish may require a wide variety of habitats to successfully complete its life-cycle.

3.3.1 Aquatic Habitat

Aquatic habitat was assessed at the two crossing locations during the fall of 2004. A replicate of some of the physical measurements was obtained in spring of 2005. Winter conditions were assessed at or near both sites in March 2005 and February 2009. Detailed aquatic habitat assessments are provided in Appendix B1.

3.3.1.1 Looking Back Creek

Fish habitat at the Looking Back Creek crossing site consisted entirely of run/glide habitat (flat, laminar flow) with a small amount but high diversity of cover, including over-stream vegetation, woody debris, cut bank, in-stream vegetation, and boulder. In-stream vegetation accounted for approximately 40% of the cover within the reach. Emergent vegetation (e.g., sedges) and rooted aquatic macrophytes occurred in approximately equal abundance along the shorelines (Appendix B1). Stream substrate was moderately compacted fine sediments with sporadically occurring boulders.

3.3.1.2 Unnamed Tributary

The tributary at the proposed crossing site lies within a saturated floodplain with dense willow growth. Immediately upstream of the crossing site, the tributary channel is braided with numerous side channels and off-current pool areas. In contrast, downstream the channel is well-defined within a well-drained forested area. The crossing site consisted entirely of pool habitat with a moderate level of cover composed primarily of over stream vegetation and woody debris. In-stream vegetation (including rooted aquatic macrophytes) accounted for approximately 10% of the cover. Stream substrate was poorly compacted fine silts and organic matter.

3.3.2 Aquatic Biota

Aquatic invertebrate diversity was assessed in the streams potentially crossed by the proposed road during the fall of 2004 using D-ring kick netting. The scientific and common names for species identified are listed in Appendix B1. Fish use was assessed during the fall of 2004 and again in the spring of 2005 using a variety of equipment including electro-fishing, gill netting, seine, hoop netting and D-ring kick netting.

3.3.2.1 Invertebrates

During fall 2004, aquatic invertebrate sampling was conducted at Looking Back Creek and at the unnamed tributary. Aquatic invertebrates from 33 taxa were identified in kick net samples from Looking Back Creek, which supported a considerably more diverse aquatic invertebrate community than the 17 taxa identified from the unnamed tributary (Appendix B1).

3.3.2.2 Fish

Looking Back Creek

No fish were captured in Looking Back Creek during the fall 2004 study. The spring 2005 catch was limited to walleye and northern pike. A total of seven walleye and 54 northern pike were captured in a hoop net set at the crossing site, oriented to capture fish moving upstream in May 2005. The majority of northern pike females were ready to spawn and none were in post-spawning condition. In contrast, both ready-to-spawn and post-spawn northern pike males were captured. All of the walleye males were ready to spawn, as was the one female walleye for which maturity could be

determined. The capture of northern pike and walleye in pre-spawn condition suggests that these fish were moving to spawning habitat further upstream in Looking Back Creek, while the presence of some northern pike in post-spawn condition suggests that spawning may also take place further downstream.

The crossing location is in close proximity to Stephens Lake, with no barriers to fish passage downstream. At the time of the survey, the nearest upstream barrier to fish passage was a beaver dam located approximately 2 km upstream, from which point beaver dams were present into the headwaters of the creek. The diversity of habitat and size of the stream likely means that it provides spawning, foraging and rearing habitat for a number of both small- and large-bodied spring and summer spawning species. However, this Creek maintains little to no flow in the winter and therefore is not suitable for fall spawning species such as lake whitefish. It would appear that the crossing location may provide overwintering habitat for small- and large-bodied fish species in some years but not in others.

While the only species captured at this site were northern pike and walleye, it is expected that cyprinids and suckers may also use this site. These species would be considered as moderately resilient to change and perturbation. It is expected that the habitat at this site would be used for feeding and rearing. The site is not expected to supporting spawning habitat for walleye or suckers, although northern pike may spawn along the margins of the channel. The habitat and species present at this site is classified as prevalent because nothing about the habitat at the site appears rare. Looking Back Creek would be classified as a cool-water stream having moderate resiliency. Based on the Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff Version 1 (Fisheries and Oceans Canada 2007a), the site would be ranked as moderate sensitivity. This ranking is due to the presence of species such as northern pike and walleye that are moderately resilient to perturbation, use of habitat to fulfill a variety of life history functions (but no critical habitat), prevalence of habitat and species found within the stream, and flow for much of the year.

Unnamed Tributary

No fish were captured in the tributary either during the fall 2004 or spring 2005 sampling periods. The presence of numerous beaver dams along the tributary likely inhibits fish passage to the road location from the pond upstream of the crossing and from areas downstream. At the proposed road location, the tributary may provide some habitat for small-bodied species such as brook stickleback and fathead minnow during the open-water season, although access to the site likely is difficult. The pond located approximately 1 km upstream of the road location was found to contain some water with little oxygen. The dissolved oxygen concentration of 1.7 mg/L was well below Manitoba's Water Quality Standards, Objectives and Guidelines instantaneous minimum objective of 3 mg/L for the protection of mature life stages of cool-water aquatic life in winter (Williamson 2002). When the crossing site was accessed in February 2009, the unnamed tributary was frozen to the bottom. Large-bodied species such as northern pike are not expected to make use of the unnamed tributary at the road due to numerous beaver dams impeding passage and the distance from potential overwintering sites. If small-bodied fish are present in the area (e.g., brook stickleback and fathead minnow), it is likely that the habitat at the site could be used only for feeding and rearing, with deeper pools outside of the ROW being used as overwintering habitat.

The tributary at the stream crossing does not appear to support any potential spawning or overwintering fish habitat. It is classified as a cool-water stream with moderate resiliency. Based on the Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff, Version 1 (Fisheries and Oceans Canada 2007a) the site would be ranked as low sensitivity, given the potential presence of only resilient species (e.g., brook stickleback, fathead minnow), limited habitat use, prevalence of habitats and species found within the stream, and little or no flow for much of the year**.**

3.3.2.3 Aquatic Species at Risk

No aquatic species considered at risk by Manitoba's *The Endangered Species Act* (MESA) (2007), the *Species at Risk Act* (SARA) (Schedule 1) (2008) or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2007) are known, or expected, to make use of the two streams crossed by the proposed road.

3.4 TERRESTRIAL ENVIRONMENT

The terrestrial environment includes terrestrial plants, animals and other terrestrial organisms and the habitats on which they rely. Terrestrial habitat includes uplands and wetlands. Some terrestrial animal species also use aquatic habitat.

3.4.1 Terrestrial Ecosystems and Habitat

3.4.1.1 General

Key topic areas for the description of terrestrial ecosystems and habitats are **ecosystem diversity, priority habitat types, plant species, wetland** function and **fragmentation**. These topic areas provide information on ecosystem health. The methods used to describe terrestrial ecosystems, and the key topic areas are described in Appendix B2-1.

3.4.1.2 Regional Overview

Numerous lakes and waterways are scattered throughout the Regional Study Area, accounting for approximately 28% of its area. Human features, not including cut lines, account for less than 1% of the current land area (Figure 3.4-1). Most of the region is covered by a mixture of forest, woodland, sparsely treed and low vegetation types. Tall shrub vegetation covers less than 2% of the land area. About two-thirds of the forest is concentrated along the Nelson River and the elevated portions of the esker and moraines. The remaining forest is scattered throughout the region. Woodlands occur as large patches throughout the region except in the large recent burns. Sparsely treed vegetation and mixtures of sparsely treed and woodland vegetation are throughout the region.

Needle leaf tree communities on peatlands cover two-thirds of regional land area. Most of the remaining area is covered by needle leaf tree communities on mineral soils and young regenerating burns on peatlands.

Black spruce[2] is the most widespread and abundant overstorey tree species. Jack pine is generally found on coarser textured or other very well-drained mineral soils where it can be the dominant species. Tamarack tends to occur on peatlands, occasionally as the dominant species or occasionally in pure stands. White spruce was found along the Nelson River and a few other locations but nowhere with enough canopy cover to appear in the habitat mapping.

Broadleaf tree communities account for less than 1% of land area and occur almost exclusively on mineral soils. Trembling aspen is the most common broadleaf tree species and primarily occurs in mixed woods with needle leaf species (black spruce and/or jack pine), or as mixtures with white birch and/or balsam poplar. Balsam poplar and white birch stands are uncommon. Balsam poplar is more frequent on wetter soils. White birch is most abundant on mineral soils but is also scattered on veneer and peat plateau bogs.

In combination, tall shrub and low vegetation on peatlands account for the second highest percentage of land cover (approximately 16%). Most tall shrub vegetation occurs along streams, rivers, lakes, or small channels on slopes or in other wet areas. Willow is the most common tall shrub species. Swamp birch and speckled alder also occur on the wetter peatlands. Green alder is common on uplands. Low vegetation consists of various mixtures of low shrubs, herbs, sedges, grasses, mosses and lichens, with sedges and/or Sphagnum mosses the most abundant species. Low vegetation is generally found where the water table is close to the surface. The main exception is the few large 19 or 24 year old burns in the north and southwest portions of the mapping area (Figure 3.4-2) where the vegetation is regenerating slowly. The low vegetation in these burns consists primarily of low shrubs with scattered tall shrubs and short black spruce.

More than 20% of the in the region land area burned at least once between 1976 and 2003. Fires in 1999 and 2001 burned half of the Local Study Area (Figure 3.4-2). The average age of the vegetation mosaic is relatively young due to the prevalence of disturbance by large fires. Plant communities in young regenerating burns, which primarily occur on peatland ecosites, cover approximately 8% of Regional Study Area (Appendix B2).

3.4.1.3 Ecosystem Diversity

Habitat composition is illustrated in Figure 3.4-3. In this report, ecosystem diversity refers to the number of habitat types and distribution of area amongst them. The region includes 55 terrestrial habitat types, not including the marsh and shallow water wetland types, and permanent human features. The distribution of area between these habitat types is highly uneven. Pure black spruce on peatlands covers approximately 64% of the regional land area while the 50 least abundant habitat types only cover approximately 7% of the Regional Study Area (Appendix B2).

The Local Study Area and Project Footprint contain 32 and 28 of the habitat types, respectively. The distribution of area among the habitat types is considerably more even in the Local Study Area than in the surrounding region. Pure black spruce on peatland only covers 33 and 25% of the Local Study Area and Project Footprint, respectively. The eastern half of the Local Study Area has much lower

[2] See Appendix B2-4 for full scientific names and Manitoba Conservation Data Centre conservation concern rankings.

ecosystem diversity than the western half because it is within the 1999 and 2001 burns. This will gradually change as these areas regenerate.

Two factors contribute to some substantial differences in Local Study Area and Regional Study Area habitat composition. First, the Project Footprint and Local Study Area have a higher percentage of mineral soils and shallow organic soils because they occur along an esker. Second, fires in 1999 and 2001 burned much of the eastern half of the Local Study Area (Figure 3.4-3). Consequently, compared with the surrounding region, the Local Study Area has:

- Substantially lower percentages of surface soil permafrost, needle leaf treed peatland and pure black spruce on peatland;
- Substantially higher percentages of young regenerating habitat types; and
- Somewhat higher percentages of jack pine mixture, trembling aspen mixtures and trembling aspen mixedwood communities on mineral soils.

Since the Project Footprint is smaller and more confined to the esker area than the Local Study Area, it has lower percentages of blanket peatland and horizontal terrain and a higher percentage of ridge terrain.

3.4.1.4 Habitat Types

The most common habitat types in the Regional Study Area are pure black spruce communities on peatlands, pure black spruce communities on mineral soils, pure jack pine communities on mineral soils, trembling aspen with scattered spruce communities on mineral soils, and tall shrub communities growing on peatlands.

Pure black spruce communities on peatlands are characterized by a black spruce overstorey, a low shrub understorey of common Labrador tea, bog cranberry, small bog cranberry and a herb layer composed mainly of cloudberry. Northern bog laurel and northern bog bilberry are often found in the understorey. The ground is covered by feathermosses, Sphagnum mosses, other mosses, reindeer lichens and club lichens.

Pure black spruce communities on mineral soils are characterized by a black spruce overstorey, a green alder tall shrub layer and a low shrub layer of common Labrador tea, bog cranberry and prickly rose. Feathermosses and other mosses excluding Sphagnum mosses, reindeer lichens and club lichens cover the ground.

Pure jack pine communities on mineral soils generally have green alder in the tall shrub layer, prickly rose and bog cranberry in the low shrub layer and common Labrador tea, bunchberry and twinflower in the herb layer. Feathermosses and mosses other than Sphagnum dominate ground cover and reindeer lichens are frequent.

Trembling aspen communities on mineral soils generally have black spruce in the understorey, green alder in the tall shrub layer and a low shrub layer with common Labrador tea, prickly rose and bog cranberry. The herb layer generally contains bunchberry, twinflower and fireweed; one-sided

wintergreen is also frequent. Ground cover is dominated by feathermosses and mosses other than Sphagnum.

Tall shrub communities growing on peatlands have a tall shrub canopy that generally contains various mixtures of speckled alder, swamp birch and flat-leaved willow. There is generally a low shrub layer with leatherleaf and a sparse herb layer. Sphagnum mosses and other mosses dominate ground cover. The composition of low vegetation communities varies considerably depending on the associated ecosite and topographic types.

A key topic for this assessment is priority habitat types. Thirty habitat types are very uncommon (i.e., cover 1% or less of the land area) and 5 types are uncommon (i.e., cover between 1.1%.1 and 10% of land area; Appendix B2). All of the uncommon types, as well as 21 of the very uncommon types occur in the Local Study Area. The very uncommon habitat types occur less frequently in the eastern half of the Local Study Area due to the large recent burn in this area. Figure 3.4-4 shows the distribution of priority habitat types in the Local Study Area and surrounding area.

Some habitats are not common because they are associated with site conditions that are uncommon. This is generally the case for the mineral soil habitat types. It is especially true for jack pine on mineral soils which primarily occurs on the well-drained mineral soils found on the esker. This esker is one of the few that are found in the region.

Uncommon peatland habitat types are typically associated with specific topographic and hydrological conditions. Most of the uncommon and very uncommon peatland habitats in the Local Study Area are found along streams, creeks and lakes. Fens in depressions with flowing water are more likely to support a higher number of plant species.

Diverse habitat types in the region are, in descending order of species richness, trembling aspen mixture tree communities on mineral soil, black spruce pure tree communities on mineral soil, jack pine pure tree communities on mineral soil, black spruce pure tree communities on peatland and trembling aspen pure tree communities on mineral soil.

3.4.1.5 Wetland Function

Relative to many other habitat types, wetlands make disproportionately high contributions to ecosystem functions such as cleaning water, storing water and storing carbon. The importance of wetlands is recognized by federal policy and guidance for the maintenance of wetland function (Government of Canada 1991; Milko 1998). **High quality wetlands** refer to wetlands that usually have high primary productivity, high species richness, are critical habitat for rare species, and/or are high quality habitat for mammals or birds.

Approximately 5,000 ha of high quality wetlands occur in the Habitat Mapping Area (Appendix B2). High-quality wetlands cover approximately 85 ha of the Project Footprint with the majority of this area in borrow area zone G-1 (Figure 3.4-4 and Figure 3.4-5). Low vegetation on peatlands accounts for nearly three-quarters of this area followed by tall shrub peatlands. Most high-quality wetlands are concentrated along waterways and lakes.

3.4.1.6 Plants

Ninety plant species were found within the Local Study Area during field studies (Appendix B2 for the species list and scientific names). Black spruce, common Labrador tea, bog cranberry, club lichens, green reindeer lichen, stair-step moss, Sphagnum mosses and red-stemmed feathermoss were found in at least 50% of sample locations in the region. Of these species, stair-step moss is much more common on mineral soils while Sphagnum mosses are largely confined to peatlands. The remaining species are frequent on all soil types.

Invasive and/or non-native plants are of concern since they can crowd out other plant species and, in extreme cases, change vegetation composition. Invasive and/or non-native plant species encountered during field studies include ox-eye daisy, narrow-leaved hawks-beard, wild barley, reed canary grass, common plantain and common dandelion. All six species were found in cleared areas near Gull Rapids. Reed canary grass was the only invasive species found in the Local Study Area. Some additional invasive and non-native plants may be present but undetected within the Local Study Area. White sweet clover was found in ditches and borrow pits along PR 280 (Figure 3.4-6).

Plant Species at Risk

None of the plant species found in the Local Study Area are listed as being at risk by MESA, SARA (Schedule 1) or COSEWIC (Appendix B2). As well, none are provincially very rare to uncommon based on Manitoba Conservation Data Centre (CDC) (2007) rankings[3].

Some species of conservation concern may be present but undetected in the Local Study Area. Plant species found elsewhere in the region during field studies included oblong-leaved sundew, shrubby willow and rock willow (Appendix B2). Oblong-leaved sundew was restricted to three patterned fens. Shrubby willow was found at 12 locations, primarily on veneer bog in pure black spruce forest and woodlands. Rock willow was found at four locations on rocky substrate. Data collected for other studies suggests that rock willow is more common in this region than indicated by its CDC ranking.

Species found in the Local Study Area that may be near a range limit include twining honeysuckle, ground-pine, hairy goldenrod and tufted bulrush. Twining honeysuckle and ground pine were each found at one location on mineral soils in a jack pine mixture community and a white birch mixedwood community, respectively. Hairy goldenrod was found at several locations in aspen or jack pine mixtures and mixedwoods, primarily on deep mineral soil, but also on a thin mineral and outcrop site. Tufted bulrush was found in low vegetation on a transitional peat plateau bog.

3.4.1.7 Fragmentation

Fragmentation essentially refers to the extent to which an area is broken up into smaller areas by human features and how easy is it for animals, plant propagules and other ecological flows such as

[3] The Manitoba Conservation Data Centre (CDC) assigns conservation status ranks to species as an indication of their rarity and degree of provincial conservation concern. Of these plant species, the ones of highest concern are those that are listed by MESA, SARA (Schedule 1) or COSEWIC.

surface water to move from one area to another area. Road density (length of roads in the region expressed as km/km^2) can be a good synthetic indicator of the extent of fragmentation effects on plant and animal populations (Forman 1995). There are 29.3 km, or 0.03 km/km^2, of all weather roads in the Habitat Mapping Area (Figure 3.4-7).

3.4.2 Wildlife

3.4.2.1 Invertebrates

Overview

Arthropoda is the largest phylum in the animal kingdom, comprising 84% of the known species of animals. The most commonly recognized members of this group include spiders, centipedes, millipedes, isopods (pill bugs) and insects (Table B3-1 in Appendix B3).

The diversity of plant communities present in Manitoba's Boreal Forest (Section 3.4.1) gives rise to equally diverse terrestrial invertebrate communities. Such invertebrate communities include species living in the soil (e.g., nematodes, earthworms), on the ground (e.g., beetles, spiders), in the air (e.g., butterflies, moths, flies) and within the vegetation canopy (e.g., spiders, aphids, beetles).

Invertebrate Species at Risk

None of the invertebrate species listed under MESA, SARA (Schedule 1) or COSEWIC are recognized as having the potential to occur in northern Manitoba.

3.4.2.2 Amphibians

Overview of Amphibian Community

Most amphibian species in Manitoba are generally restricted to more southerly regions of the province. The ranges of three species of amphibians extend into the Regional Study Area include the boreal chorus frog, wood frog and northern leopard frog (Preston 1982). These three species are the most abundant and widespread of the 15 amphibian species known to be native to Manitoba (Koonz 1992). While boreal chorus frogs and wood frogs were found to be common in the region during field studies, they are present in low densities compared to those in southern Manitoba (Cash *pers. comm.* 2006). Frog observations during the course of field studies undertaken in support of this EA report tended to consist of small groups of several frogs. Northern leopard frogs were not encountered during field investigations in the region.

Field studies undertaken in support of this EA report have indicated that the mating periods for boreal chorus frogs and wood frogs overlap during May and June and that they use similar types of breeding ponds during the spring. Frog species disperse into terrestrial habitats after the breeding season, overwinter in leaf litter and return to waterbodies that do not contain fish populations to breed the following spring.

The proposed road is primarily routed along the lower slopes of an esker. There are occasional low-lying wet areas along the slopes of the esker where willow and alder grow in standing water. While these densely vegetated wet areas support populations of boreal chorus frogs and wood frogs, frogs are less common in the boggy lowlands at the base of the esker. Some high-quality wetlands near the proposed route (Section 3.4.1.5; Figure 3.4-4) may support higher amphibian populations.

Amphibian Species at Risk

The only amphibian species at risk that may occur within the Regional Study Area is the northern leopard frog, a species of **special concern** by COSEWIC and SARA (Schedule 1). The northern leopard frog's northern range limit in Manitoba falls within the Regional Study Area (Preston 1982), however large population declines for this species during the mid-1970s occurred throughout Manitoba and other parts of Canada, causing this species to disappear from parts of its historical range (Seburn and Seburn 1998). Due to the lack of population monitoring following this decline, the recovery of this species is not well known (Seburn and Seburn 1998). It is therefore uncertain whether or not the northern leopard frog has recolonized its former range within the Regional Study Area. Studies in support of this EA Report did not reveal the presence of any breeding populations of northern leopard frog within the Regional Study Area. Anecdotal evidence has however, placed northern leopard frogs near Limestone Generating Station in 2004. If in fact the northern leopard frog has recolonized parts of its northern historical range, including the Regional Study Area, populations would be small and isolated (Seburn and Seburn 1998). Although this species has re-populated southern parts of its range, leopard frog populations are still considered low compared to pre-1970 populations (Preston 1982; Seburn and Seburn 1998).

The northern leopard frog typically breeds between April and early June in small, warm and shallow (less than 2 m deep) breeding ponds (Preston 1982). It forages in grassy meadows, often spending time in damp patches of soil. In forest habitat they are inconspicuous, hiding in dark crevices found along the forest floor. In August, adults return to lakes, deep ponds, rivers and creeks to over-winter in submerged sediments (Preston 1982; BC Government 2002).

3.4.2.3 Reptiles

The known range of reptile species in Manitoba is well south of the proposed Project location. Common garter snakes, snapping turtles, and western painted turtles all have the potential to occur in low numbers in the Regional Study Area (CARCNET 2009). There is an anecdotal record of one sighting of a snapping turtle along the Nelson River near Gillam (Preston 1982). None of the species with any potential to occur in the Regional Study Area are listed by the MESA, SARA (Schedule 1) or COSEWIC as being of conservation concern.

3.4.2.4 Birds

Overview of Bird Community

The terrestrial and aquatic environments in the Regional Study Area provide breeding, staging (during migration), foraging and over-wintering habitat for a potential total of 177 species of birds (Appendix B3, Table B3-1). Of these species, 27 are considered resident birds that may breed and

over-winter in the Local Study Area (Figure 3.4-1). No nationally, regionally or locally important migratory bird habitat occurs within the Regional Study Area as indicated by the Canadian Wildlife Service (Poston *et al.* 1990).

Bird studies conducted in 2004 and 2005 as part of this EA report (see Appendix B3) identified 113 different species of bird using the Regional Study Area. These species include forest-dwelling birds (e.g., songbirds, woodpeckers, upland game birds, raptors and nighthawks), waterbirds (e.g., ducks, geese, cranes, herons, rails, gulls and terns), shorebirds (e.g., sandpipers, yellowlegs), raptors (owls, hawks and eagles) and other birds (e.g., woodpeckers and kingfishers). The most common birds observed within the various plant communities surveyed in the Local Study Area were songbird species such as ruby-crowned kinglet, yellow-rumped warbler and northern waterthrush.

Waterbirds

There are a number of small inland lakes, creeks and wetlands in the vicinity of the proposed Project that are utilized by waterbirds (e.g., ducks and loons) and shorebirds (e.g., snipes, yellowlegs and sandpipers). They provide breeding and staging habitat for migrant ducks (e.g., ring-necked ducks, scaup and common goldeneye) and other waterbirds (e.g., common loon).

Bog and fen wetland habitat located within the region support sandhill crane and Wilson's snipe. These areas also have the potential to support small breeding populations of rails, bitterns and herons.

Gull Rapids, located at the south end of the proposed road, is an area of fast flowing, turbulent water that supports a number of vegetated islands and rocky reefs. During the breeding season, reefs located near the south shore of the Nelson River (at Gull Rapids) support breeding colonies of ring-billed and herring gulls (up to 2,000 gulls), as well as common terns (up to 200 terns).

Shorebirds

Wetland habitat located within the Region Study Area supports Wilson's snipe. Creeks (such as Looking Back Creek) and the inland lakes may support small, localized populations of shorebirds (e.g., spotted sandpiper, solitary sandpiper and yellowlegs).

Raptors

A total of 13 raptor species have been identified in the Regional Study Area, with a further five species expected to breed within or migrate through the area. Most raptors observed in the region were bald eagles, although red-tailed hawks and northern harriers were also common. Most of the bald eagle sightings were along the Nelson River, which is considered a regionally important area for breeding and migrating eagles due to its ample breeding and forage opportunities (Koonz 1988).

Five owl species have been observed in the Regional Study Area: long-eared owl, short-eared owl, great horned owl, northern hawk owl and great grey owl. Owls that were observed nesting and roosting in the Local Study Area were observed in upland forested transects both along and adjacent to the proposed road.

Upland Game Birds

Forests, open fens and willow-covered cut lines within and adjacent to the Regional Study Area provide ideal habitat for a variety of upland game bird species (e.g., grouse and ptarmigan). Ruffed grouse are common in the alder-dominated understory of jack pine and mixed-wood forests located along the road route. Spruce grouse are common along the black spruce-dominated forest and sparsely treed wetland areas (lower-lying areas). Sharp-tailed grouse are also a year-round resident in the Regional Study Area, but are less common. Willow ptarmigan occur only as a winter resident, utilizing areas that support willows (e.g., in and along forest openings, edges of wetlands, riparian areas and cut lines; Storch 2000).

Songbirds (Passerines)

Studies undertaken in support of this EA report indicate that overall bird densities along the road route ranged from 3.3 to 5.3 birds/ha, with the five most common species being ruby-crowned kinglet, yellow-rumped warbler, hermit thrush, blue-headed vireo and white-throated sparrow. With the exception of the white-throated sparrow, which is a short-distance migrant and blue-headed vireo, all abovementioned species are **neotropical migrant** songbirds. The most common passerine species recorded in forest communities within the Local Study Area are also very common throughout boreal forest habitat of Manitoba (Erskine 1977, Bezener and DeSmet 2000).

Other types of bird groups observed in the Local Study Area included woodpeckers, kingfishers and nighthawks. Four of the six possible woodpecker species were observed in the Local Study Area (hairy woodpecker, three-toed woodpecker, black and northern flicker). Common nighthawks were also observed using open areas found within the region.

Species at Risk

Several bird species that utilize the Regional Study Area are currently experiencing population declines in all or parts of their range and are considered to be species at risk (COSEWIC 2008, CWS 2005, Manitoba Conservation 2008). Six bird species potentially occurring within the area have been listed as species at risk by MESA, SARA (Schedule 1) or COSEWIC: olive-sided flycatcher (**threatened**, COSEWIC), common nighthawk (threatened), short-eared owl (special concern, COSEWIC), rusty blackbird (special concern, SARA Schedule 1), peregrine falcon (threatened, MESA and Schedule 1 of SARA) and yellow rail (special concern, SARA Schedule 1).

Yellow rails breed in sedge or grass-dominated fen habitat containing shallow water (0-20 cm) or damp ground (Goldade *et al.* 2002). This species is not expected to breed within the Local Study Area as fen habitat is uncommon (Figure 3.4-3; Bookhout 2009).

The peregrine falcon may occur as a transient migrant within the Regional Study Area, but not as a breeder, as optimal nesting habitat for this species does not occur in the area. Peregrine falcons nest in the Arctic, on steep cliffs located where seabirds are abundant (Manitoba Naturalists Society 2003).

The common nighthawk is listed as threatened and is known to occur, and likely nests, in the Local Study Area, based on studies undertaken in support of this EA report. This species nests on bare rock or gravel, and forages along rock outcroppings, recent burns and other forest clearings (Poulin *et al.* 2009). Recently burned habitat is common throughout the eastern portion of the Local Study Area (Figure 3.4-3).

The short-eared owl has been observed using riparian areas, including creeks, marshes and fens throughout the Regional Study Area. This species prefers to hunt and nest in open fen habitats that are uncommon within the Local Study Area (Figures 3.4-3 and 3.4-5).

The olive-sided flycatcher is considered to be an uncommon breeder in the boreal forest (Manitoba Naturalists Society 2003). This species uses recent burns, clearings and forest edges and nests in conifers (Manitoba Naturalists Society 2003). Olive-sided flycatchers likely nest within the Local Study Area and throughout the Regional, as their preferred habitat (recent burns and edge habitat) is common in the eastern half of the Local Study Area (Figure 3.4-3).

The Rusty blackbird was not observed within the Local Study Area during environmental studies. This species has, however, been observed using creeks and lakes within the Regional Study Area. The rusty blackbird nests near water, in low willows or conifers, along edge habitat and along dense coniferous forests (Manitoba Naturalists Society 2003).

3.4.2.5 Mammals

Overview of Mammal Community

Scientific studies in the Regional Study Area undertaken in support of this EA report identified 32 mammal species. While data were collected on all mammal species, studies focused on priority mammals such as caribou, moose and beaver. This is because these species are an important resource to the local communities and/or have sport, commercial or scientific value. Detailed approach, methods, tables and figures from the field studies are reported in (Appendix B4).

The majority of mammal species found in the Local Study Area and surrounding Regional Study Area are common to Manitoba's boreal forest. Regionally common mammal species may include moose, black bear, red fox, snowshoe hare, red squirrel and Gapper's red-backed vole. Uncommon mammals may include caribou, wolverine, raccoon and porcupine.

Common habitats types for mammals in the Local Study Area include pure black spruce on peatland, low vegetation on peatland, young regeneration on recent burn and pure black spruce on mineral soil. These habitats cover approximately 93% of the land area (Section 3.4.1.2.1; Appendix B2). Most other broad habitats are uncommon. Based on habitat composition (Figure 3.4-3), terrestrial mammals that prefer coniferous dominated habitats are likely more numerous in the Local Study Area compared to mammals that inhabit broadleaf or broadleaf-dominated mixedwoods. Aquatic mammals are more likely to be widely distributed and common in the surrounding Regional Study Area compared to the Local Study Area, which has limited riparian habitat.

The balance of this section discusses ungulates (caribou and moose), furbearers (aquatic mammals, carnivores, etc.) and potential species at risk.

Ungulates

The key ungulate species considered in this assessment are caribou (coastal, barren-ground and summer resident caribou) and moose.

Caribou

Caribou ecotypes present in the Regional Study Area include barren-ground caribou (Qamanirjuaq), two subpopulations of coastal caribou (Pen Islands and Cape Churchill), and a group of forest-dwelling summer resident caribou.

Historically, Qamanirjuaq barren-ground caribou that originated from Nunavut used to migrate as far south as Split Lake or further and as far east as the Hudson Bay. Local resource users reported steadily decreasing numbers of barren-ground caribou around the 1950s. Based on studies undertaken in support of this EA report it appears that barren ground caribou only recently returned to the study region in the winter of 2004-05.

Currently, the majority of caribou observed in the region resemble a woodland caribou type in that they are darker in colour and appear to be larger in size than barren-ground caribou. Studies done in support of this EA report indicate that these animals are most likely coastal (Pen Islands) caribou. Larger numbers of Pen Islands caribou are found here in winter as compared to summer. Winter movements of Pen Islands animals were first reported in the 1990s near the study areas (Thompson and Abraham 1994, Abraham and Thompson 1998). Although there are indications that some Pen Islands caribou may spend the summer period in the study area and that these animals may account for some or all of the summer-residents, the majority of these animals characteristically move back towards the Hudson Bay coast during this period.

There is a group of caribou that appear to reside in the region for the summer period and do not move back towards the coast with the other Pen Islands caribou. These animals have been observed to calve in isolation or make use of island habitat, as is characteristic of boreal woodland caribou (Rettie and Messier 2000). While coastal and boreal woodland caribou are indistinguishable in appearance, and at this time, may be genetically indistinguishable (based on studies done in support of the EA report), coastal caribou can be differentiated by their calving behaviour. They reported to calve en-mass in more open areas, as is characteristic of barren-ground caribou (Kelsall 1968), and form nursery groups. This en-mass calving behaviour has not been demonstrated by the summer resident caribou present in the region during the summer and fall months.

Other caribou types that may periodically occur in the surrounding region include coastal caribou such as Cape Churchill animals, which originate from the Wapusk National Park and Cape Churchill Wildlife Management Area. Although there is some level of uncertainty, few of these caribou range into the Local Study Area and surrounding region during winter. The majority of these animals are expected to stop their southward migration by an area north and east of the Limestone Lakes.

Studies undertaken in the Regional Study Area in support of this EA report indicate that abundances of caribou can range from uncommon to very abundant, depending on year and location. During the summer months, caribou are uncommon in the Regional Study Area and densities are low. With the possible exception of a few Pen Islands animals, most of these caribou are forest-dwelling summer residents. It is highly unlikely for Qamanirjuaq and Cape Churchill animals to be present in the Regional Study Area in summer or fall. During winter, caribou tend to be more common in the region in early and mid-winter, becoming less common during late winter. The large majority of these animals are Pen Islands caribou. Occasionally, Qamanirjuaq caribou may comprise the majority of animals in the region.

Studies undertaken in support of this EA report indicate that a total of 541 caribou were observed in the Regional Study Area during winter aerial surveys. Tracks, beds and craters were also recorded. The caribou density averaged 0.23 caribou/km^2 (min=0, max=2.24). Although high variations were apparent among habitats, seasons and years surveyed, most caribou were generally observed south and east of Ilford. Density variations were expected seasonally, as several caribou populations migrate through the region. The timing of movements and the habitats used may be different among caribou types[4] from year to year. Variations in caribou densities are explained further by habitat quality, habitat availability, and the spatial distribution of habitats in the study areas (Thompson and Abraham 1994, Abraham and Thompson 1998). Caribou density estimates are not available from provincial records for comparison.

Studies undertaken in support of this EA report indicate that the regional subpopulation of summer resident caribou is estimated conservatively to number from 20 to 50 individuals. The total is based on the approximate use of islands for calving in the area, as well as signs identified during the summer surveys. The summer resident caribou are uncommon within the Local Study Area, as caribou numbers appear to be low to moderate in summer. Summer resident caribou do not appear to use the Local Study Area in winter when caribou numbers vary from very low to none. There is uncertainty as to how far and where these caribou migrate. After the Pen Islands caribou migrated from the Regional Study Area in April 2009, potential late winter range was identified for approximately 12 caribou. This range was located from 30 to 60 km south of the Nelson River in the Regional Study Area

Particularly important habitat for the summer resident caribou includes calving and rearing habitats. These animals calve in isolation or make use of island habitat, as is characteristic of woodland caribou in Manitoba and elsewhere (Shoesmith and Storey 1977, Hirai 1998, Rettie and Messier 2000). Potential calving habitat identified (Figure 3.4-7) includes islands in lakes and habitat complexes (i.e., raised conifer-dominated treed islands surrounded by peat bog or fen habitat). One unverified moderate quality calving habitat complex and four unverified low quality calving habitat complexes are present in the Local Study Area. Potential calving habitat is relatively abundant for the summer resident caribou. The **Habitat Mapping Area** contains at least 69 potential calving complexes and at least 33 additional verified calving islands in lakes with a minimum of 400 calving islands. Many more caribou calving complexes and islands in lakes extend outside the area displayed in (Figure 3.4-7) into the Regional Study Area.

[4] Potentially including summer resident, Pen Islands, Cape Churchill and Qamanirjuaq caribou.

Studies undertaken in support of this EA report indicate that winter and summer food, cover and migration habitats are common and extensive in the Local Study Area and in the surrounding region. These habitats are not mapped for this assessment because these habitats are not uncommon and are unlikely to limit this population.

The coastal and barren-ground caribou that are found in **Game Hunting Area** (**GHA**) 1, 2, and 3 (Appendix B4) are legally hunted by resident hunters. All other caribou in Manitoba are known as boreal woodland caribou. Boreal woodland caribou are listed as Threatened by MESA and cannot be legally harvested (Hedman, *pers. comm.* 2008). The majority of the study region is located in GHA 9, which is outside the licensed caribou hunting area.

The Pen Islands caribou herd tends to migrate into the Bird and Gillam areas in early to mid-November. Presently, there are 75 licenses in GHA 3 that are sold to hunt this herd; almost all of the licenses are sold to residents of Gillam. The Cape Churchill herd is located to the north of Bird. An average of 20 resident licenses are sold for this area. The combined resident harvest of the two herds has historically been an average of 40 caribou for the Pen Islands herd and 5 to 10 animals for the Cape Churchill herd (Hedman, *pers. comm.* 2008). Although it is unclear as to how many animals are harvested annually by local First Nations, caribou from these herds are harvested most often in winter. Pen Islands caribou are highly likely the type of animal to be harvested most frequently. Although Qamanirjuaq caribou are harvested much less frequently, this population appears to sustain a high level of harvest should they be present in the Regional Study Area. The harvest of Cape Churchill caribou is currently unknown, although it is unlikely that many of these animals are harvested in the Local Study Area given their expected distribution.

Moose

Aerial surveys for moose (and caribou) were conducted during winter on nine occasions between 2002-03 and 2006-07 in support of this EA report. A total of 212 moose were observed in a 2,338-km^2 regional survey area during the survey periods. Tracks and beds were also recorded. The moose density averaged 0.09 moose/km^2 (min=0; max=0.77) over the study periods. Moderate to high variations in moose density were apparent among habitats, seasons and years surveyed.

Moose densities in the Regional Study Area are similar to previous Provincial aerial surveys (1999-2000). In GHA 3[5], densities ranged from 0 moose per km^2 in low strata[6] to 0.317 moose per km^2 in super high strata. In medium strata, moose densities are 0.165 moose per km^2 (Manitoba Conservation, unpubl. data). On average, 2002-2007 moose densities in the Regional Study Area were low to medium compared to the full range of moose strata in GHA 3. A few local areas in the region may support higher moose densities than are found in super high moose strata in GHA 3. In the Split Lake RMA, the moose population was estimated at 1,639 animals. In a much larger survey area (GHA 9[7]), the 2001-02 provincial estimate of this population was 6,822 moose (95% Confidence Interval = 3,406 to 10,238).

[5] I.e., a region that overlaps with a portion of the Keeyask Study Areas.
[6] Low strata are considered as sample unit areas with low quality habitat for moose. Strata sampled may range from extra low to super high.
[7] GHA 9 extends from about Keeyask to the Manitoba-Saskatchewan border.

Moose generally show a preference for lowland and upland mature tree stands, shrubs, riparian and wetland areas. Burns provide important habitat (Split Lake Cree and Manitoba Conservation 1994); however, deciduous burns are preferred over coniferous burns. Edge habitats that may be composed of coniferous tree stands with adjacent shrub habitat are often preferred by moose in winter. Field study results indicated that as new growth becomes available during the summer, moose ranges tend to increase in response to premium growth (Franzmann and Schwartz 2007). Studies undertaken in support of this EA report indicate that at the local level, moose track densities averaged 0.13 signs/100 m^2 in the Local Study Area during the winter while summer track densities averaged 1.71 signs/100 m^2. At the regional level, moose track densities averaged 0.33 and 0.07 signs/100 m^2 in the summer and winter, respectively.

Approximately 750 moose (range: 661 to 812) are harvested per year by licensed hunters in GHA 9 and/or in parts of GHAs 1, 2, 3, and 3A (Manitoba Conservation 1993-2007; unpubl. data). This harvest level is less than the proportional harvest of most other southern GHAs in Manitoba (Rebizant, *pers comm.* 2008). Although it is unclear as to how many moose are harvested annually by First Nations in the Regional Study Area, moose are a preferred source of **country food** (Section 3.5.3-1).

Furbearers

A total of 18 furbearing species were identified from all of the surveys conducted in the region. These include aquatic furbearers (beaver, muskrat, etc.), terrestrial furbearers (red fox, red squirrel, ermine, and racoon) and small mammals (voles, shrews, etc.).

Muskrat and beaver are common semi-aquatic furbearers and aerial surveys for aquatic mammals were conducted as part of this EA report indicate that in the spring and fall of 2001 and 2003 using low-altitude helicopter flights to cover about 6,100 km of riparian habitat in the surrounding region. Marsh, shallow water and high quality wetlands are uncommon in the Local Study Area, but tend to be more common in the surrounding region (Section 3.4.1.2 and Section 3.4.1.5). The average density of beaver sign was 0.10 beaver lodges/km of water. Ponds, creeks and streams generally supported the highest densities of beaver, while rivers and large lakes supported the lowest densities of beaver lodges in the region. Density variations were observed between habitats, seasons and by year surveyed, and were attributed to habitat availability and quality (Novak *et al* 1999).

Studies undertaken in support of this EA report indicate that the most common terrestrial furbearers include red fox, red squirrel and ermine. Red squirrel was the most abundant species (0.79 sign/100 m^2), while lynx, muskrat, raccoon and weasel were least abundant in common habitat types. Uncommon habitat types had more mammal sign than the common habitat types. Nine species were identified in **uncommon** habitat transects, with red squirrel being the most abundant furbearer (0.33 sign/100 m^2). Gray wolf and red fox were the least abundant. Overall frequency of mammal sign in uncommon habitat transects was 1.24 sign/100 m^2, compared to 0.15 sign/100 m^2 for common habitats.

A total of 14 species were detected from tracking studies in the Local Study Area that contains the proposed road. Red squirrel and snowshoe hare were the most abundant species (0.92 and 0.78

sign/100 m^2, respectively), while coyote, fisher, mink and wolverine were least abundant with only one sign being recorded for each.

Raccoons are uncommon in the Local Study Area and surrounding region. This species is considered uncommon because the proposed Project is at the northern fringe of its range. Studies undertaken in support of this EA report found only a single raccoon sign on a habitat-based transect near water in four years of mammal studies. Only three raccoons were trapped in the Split Lake RMA between 1961 and 1984 (Manitoba Conservation trapping records). Manitoba Conservation reports that the range for racoons is extending beyond The Pas toward Thompson and this species is considered common throughout the southern half of Manitoba. Racoons are not listed by MESA or SARA (Schedule 1).

Although porcupine range is widespread in Manitoba (Chapman and Feldhamer 1982), this species is very uncommon in the Regional Study Area. Porcupines were not found in the Local Study Area, and only one porcupine has been reported east of Gillam near the community of Bird. It is unclear why porcupines are uncommon in the Local Study Area and surrounding region. Porcupine densities are often lower in areas where fishers are present, but relatively little is known about the existence of porcupine in the boreal forest (Chapman and Feldhamer 1982). Porcupines are not listed by SARA (Schedule 1).

Studies undertaken in support of this EA report resulted in a total of 12 small mammal species being captured in the Local Study Area at a mean frequency from all species of 1.43 individuals/100 Trap Night. The average capture frequency for small mammals was greater in riparian habitats compared to terrestrial habitats. Red-backed vole was the most abundant and wide-spread species. Water shrew was the least abundant species, with only one animal trapped. Large variations of small mammals were observed between habitats, seasons and by year surveyed. These variations were likely due to natural population cycles of small mammals, habitat availability and habitat quality (Chapman and Feldhamer 1982).

Species at Risk

Mammal species considered in this assessment include species that are listed by MESA or SARA (Schedule 1), species that are rare, dependent on uncommon or rare habitats near a range limit or those which are highly sensitive to disturbance, and/or may be considered invasive. Protected and mammal species in the Local Study Area and surrounding region include potential woodland caribou and wolverine.

In Manitoba, there are an estimated 1,800 to 3,150 boreal woodland caribou, which are listed as threatened under SARA (Schedule 1) (Thomas and Gray 2002). The Manitoba woodland caribou population is also listed as threatened in the MESA as of June 2006 (MESA 2007). Historically, woodland caribou range was mapped near Keeyask in the Nelson-Hayes area. Currently, Manitoba Conservation and Environment Canada do not consider Schedule 1-listed woodland caribou range to occur in the Regional Study Area (MESA 2007, Environment Canada 2008a).

Although there is some uncertainty as to whether or not the MESA or SARA-listed boreal woodland caribou ecotype is present in the Regional Study Area, calving behaviour[8], general morphology and possibly genetic evidence suggests that the small subgroup of summer resident caribou found in the Local Study Area and surrounding region are more similar to woodland caribou than to any other ecotype found in the region. For the purposes of this environmental assessment, the seasonal occurrences of this subgroup of animals and their respective habitats were treated as a boreal woodland caribou ecotype.

Wolverines are rare in the Local Study Area and surrounding region. Studies undertaken in support of this EA report resulted in only 20 wolverine sign being found in the Regional Study Area from 2001 to 2004. Important wolverine habitats such as den sites have not been identified in the Local Study Area or surrounding region. The western population of wolverine is not listed under SARA (Schedule 1); however, COSEWIC designated this species as special concern, the status of which was last revised in 2003 (COSEWIC 2003, Environment Canada 2008b). Manitoba animals are still being harvested for fur. About two wolverines are trapped annually in the Split Lake RMA (Manitoba Conservation trapping records 1961-1984). The Manitoba wolverine population has been estimated to be between 1,200 and 1,600 animals (COSEWIC 2003).

3.5 SOCIO-ECONOMIC ENVIRONMENT

3.5.1 Overview

The socio-economic environment for the environmental assessment of the proposed Project includes the following:

- Population and demographics;
- Land and resource use;
- Infrastructure and services;
- Labour force and employment; and
- Community and family life.

3.5.2 Population and Demographics

According to Statistics Canada, the population of Thompson was 13,256 people in 2001 (Statistics Canada 2002), and increased to 13,446 people in 2006 (Statistics Canada 2007) (Appendix B5. In 2006, 4,910 people in Thompson reported Aboriginal identity (37% of the total population), including 1,505 Métis.

According to Statistics Canada, the population of Gillam was 1,178 people in 2001 (2001 Census of Canada), and increased to 1,209 people in 2006 (Statistics Canada 2007) (Appendix B5). In 2006, 580 people in Gillam reported Aboriginal identity (48% of total population), including 125 Métis.

[8] As found in the Keeyask area, solitary calving behaviour is an important part of the definition of woodland caribou

It is noted that Statistics Canada uses its own series of definitions to name places or communities, especially for First Nation communities. Thus, Statistics Canada refers to the Indian Reserves of Tataskweyak, York Factory, War Lake, and Fox Lake First Nations respectively as Split Lake, York Landing, Ilford, and Fox Lake 2 (Bird) (Appendix B5). Census of Canada information provided in this EA report describes conditions within the geographical boundary of each community specified. These First Nations have off-reserve members who reside outside of the KCN Community Study Area, including many in Thompson, Gillam and beyond.

According to the 2006 Census of Canada, the combined on reserve population of the four communities included in the KCN Community Study Area was 2,455 people, predominantly Aboriginal (Appendix B5). These data indicate that, consistent with northern Manitoba in general, these four communities had relatively young populations. On average, almost one-third (32%) of the population was below the age of 15, and less than 6% of the population was over the age of 60. By comparison, approximately 20% of the total population of Manitoba was below 15 years of age and almost 19% was over the age of 60 (Statistics Canada 2007). Individual community population is described below:

- Of the four communities noted, Split Lake's on reserve population makes up the majority of the population of the KCN communities. In 2006, the total population of Split Lake was 1,819, consisting mainly of Aboriginal people. Approximately 37% of the population (684 people) are under the age of 15 and less than 6% (105 people) are over 60 years of age (Appendix B5).
- York Landing's on reserve total population in 2006 was 416 (Appendix B5). In 2006, approximately 36% of this community's population was under the age of 15 and approximately 2% are over 60 years of age.
- The on reserve population of Ilford in 2006 was 116 (Appendix B5). In 2006, the population under the age of 15 was approximately 30% of the total, and 4% were over the age of 60 years.
- Fox Lake's on reserve population, at Bird, was 105 (Appendix B5). In 2006, approximately 25 % of Bird's population was under the age of 15 and 10% over the age of 60 years. The Fox Lake population in Gillam has not been included as FLCN members comprise part of the Statistics Canada population for Gillam.

The above Statistics Canada population data should also be considered within the context of overall First Nation total population. Table 3.5-1 below provides the June 2009 Registered On and Off Reserve Population as available on the Indian and Northern Affairs website: http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/SearchFN.aspx?lang=eng.

Table 3.5-1: Registered On and Off Reserve Population as of June 2006.				
Residency	**Tataskweyak Cree Nation**	**War Lake First Nation**	**York Factory First Nation**	**Fox Lake Cree Nation**
Registered Males On Own Reserve	1,065	37	208	64
Registered Females On Own Reserve	1,057	31	184	69
Registered Males Off Reserve	505	67	320	362*
Registered Females Off Reserve	534	79	354	462*
Total Registered Population	3,240	256	1,110	1,066

Source: Indian and Northern Affairs Canada Website 2009

Notes:

- Population counts only include registered Indians under the Indian Act of Canada. Therefore, they contain no information on any Non-Registered individuals who may be living on reserve or Crown lands, and similarly, they contain no information on any members registered to other bands who may be living on reserve or Crown lands.
- An individual's information on INAC's Indian Registry System is usually updated on the reporting of a life event to the First Nation's Indian Registry Administrator (IRA), although some bands may update the system more frequently. Thus, a significant limitation on Indian Register data involves the late reporting of these life events.

*It should be noted that FLCN members comprise part of the Statistics Canada population for Gillam, therefore the above table does not accurately represent the total population of FLCN.

There are no known existing or permanent residences in the Project Footprint. However, there are traditional-use areas, such as campsites, which are used by people living in the surrounding communities.

3.5.3 Land and Resource Use

3.5.3.1 Community and Domestic Resource Use

Moose, caribou, and other **country foods** (e.g., fish, ducks, geese, grouse, rabbit, beaver and muskrat) constitute a large part of the diet for many people in northern Manitoba. Traditional gathering and harvesting activities constitute important additions to earned income and help to offset the high cost of living. Furthermore, these resources have cultural and spiritual importance including their contribution to maintaining Aboriginal Traditional Knowledge (ATK). Typically, seasonal harvesting activities include moose hunting in the fall, spring and fall harvesting of waterfowl, berry and plant gathering from the spring through to fall, and trapping during the winter.

Tataskweyak Cree Nation and War Lake First Nation carry out extensive land and resource use activities throughout the Split Lake Resource Management Area (RMA), a part of which is in the

KCN Community Study Area. Tataskweyak Cree Nation and War Lake First Nation consider land and resource use as being at the core of their cultural identity.

Fox Lake Cree Nation and York Factory First Nation both have resource management areas within the Northern Manitoba Study Area. Fox Lake Cree Nation members hunt for moose and caribou in the areas around Stephens Lake. Fox Lake Cree Nation has also identified the South Moswakot River as an important area for fishing and hunting near the Project Footprint. York Factory First Nation has noted that the Project Footprint is not a main resource use area for their community. However, the Project Footprint is near York Factory First Nation's traditional territory and members do travel through the area and may harvest resources from time to time.

The Registered Trapline System is a provincial commercial furbearer harvest management system whereby a person is granted the exclusive opportunity to commercially harvest furbearing animals in a particular area. One trapline (Trapline 15) exists within the Project Footprint. Although there is currently no registered holder, it is understood that Trapline 15 is currently used by a number of families who are members of Tataskweyak Cree Nation. Typically, about a dozen furbearer species have been trapped in this trapline area. Beaver and muskrat comprise the main species that have been trapped in the past, and pine marten has become a more frequent species for trapping in recent times. A trapline (Trapline 9) currently registered to a Fox Lake Cree Nation member, is also located just outside the Project Footprint on the south side of Stephens Lake within the KCN Community Study Area.

Domestic fishing in local tributaries may occur within the Project Footprint; however, the Project site has not been identified as having major fishing activity.

3.5.3.2 Other Resource Use Activities

Northern Manitoba, including the KCN Community Study Area and the Project Footprint is located within the Manitoba Conservation, Forestry Branch designated "Non-commercial Forest Zone" due to its limited timber production potential (due to climatic conditions), distance to mills and markets, and lack of infrastructure (i.e., roads and railroads).

At present, there is no commercial scale demand and therefore no commercial harvest of timber within, or in close proximity to, the KCN Community Study Area (Holmes *pers. comm.* 2008). In part, this condition is created by a supply of wood fibre that exceeds the demand in closer proximity to mills and markets. Small-scale timber harvest for personal use, primarily firewood, does exist within the Study Area, most notably in the vicinity of the Tataskweyak Cree Nation community on the north shore of Split Lake.

A review of Manitoba Science, Technology, Energy and Mines (MSTEM) Geographic Information System maps (2009) indicates no active mineral dispositions within the Project Footprint (i.e., no mining claims, mineral leases, mineral exploration licenses, exploration projects, or operating mines). There are currently three mineral exploration licenses within the KCN Community Study Area that are located in the northeast section of Stephens Lake and in areas east of Gillam and west of Split Lake.

According to MSTEM (2009), the above information has been compiled solely from sources in the public domain, such as company news releases, mineral tenure information and geological base-maps. Only projects that are "active" (i.e., currently being worked) are included.

Four outfitting companies have been identified that operate in the Split Lake RMA. Dunlops Lodge is at the mouth of the Little Churchill River on Lake Waskaiowaka, approximately 50 km northwest of the proposed Project location. Recluse Lake Lodge and Outfitters operates at Recluse Lake which is about 70 km north of the Project location on the Little Churchill River. Spence's Outfitting Service operates out of Split Lake, and Fox River Outfitters, located in Gillam, makes use of the area around Stephens Lake.

3.5.4 Infrastructure and Services

3.5.4.1 Roads and Trails

PR 280 is a gravel public highway that runs from the intersection with PR 391 immediately north of Thompson to Gillam, a distance of approximately 290 km (Figure 1.4-1). The distance from the PR 391 intersection to the proposed road is approximately 174 km. The current role and function of PR 391 and PR 280 are to serve commercial goods movement and passenger mobility between the communities along its route. PR 280 is a provincial road classified by Manitoba Infrastructure and Transportation as an A1 Highway[9]. It is the main road directly connecting the communities of Gillam and Bird, and indirectly Split Lake and York Landing (via ferry in summer or winter road in winter). It is therefore important to KCN community members. In 2007, the average annual daily traffic (**AADT**) on PR 280 was between 60 and 310 vehicles (MIT 2007). Residents in the area have noted concerns with respect to the poor condition of PR 280 in many sections including damage to vehicles as a result of the poor road conditions.

In 2002, the Government of Manitoba allocated funding for improvements to PR 280, including gravel stabilization on 261 km of PR 280 from PR 391 to Gillam under the Community Main Access Gravel Road Stabilization Program, additional gravel on various locations of PR 280 between PR 391 and PR 290 (the road north from Gillam to Bird); and road improvements on PR 280 at Troy Lake, 52 km north of PR 391 (Government of Manitoba 2002). Planning is under way to undertake further site grade improvements including curve shaving and road widening in 2011.

There are a few trails that cross the Project Footprint that are used for snowmobile access and resource harvesting activities.

3.5.4.2 Public Services

As the main service centre in northern Manitoba, Thompson (in the Northern Manitoba Study Area) offers many services such as restaurants, shopping, the regional airport, entertainment, health and social services, post secondary education services and recreation facilities. The Hudson Bay Railway, owned by OmniTrax, provides supplies by rail from The Pas to Thompson and Gillam up to three times a week. Thompson's health and social services includes the Thompson General

[9] As defined in the Vehicle Weights and Dimensions on Classes of Highways Regulation under the *Highway Traffic Act*.

Hospital, which currently operates 30 in-patient beds for general medicine, surgery and paediatrics, 16 for obstetrics, 10 for psychiatry and three for the special care unit. The hospital is rated for 74 beds and provides both primary and secondary inpatient care. The Thompson General Hospital is within 200 km of the proposed Project site.

Thompson supports several local firms capable of providing goods and services related to construction activities of the proposed Project. These include sale and repair of heavy equipment, hydraulic repair, sale of large tires and retreads, safety and industrial outfitting and fabrication.

The Town of Gillam (in the Northern Manitoba Study Area) has become Manitoba Hydro's key operations and service centre in northern Manitoba. Services and facilities include the Gillam School (K-12), a recreation centre (including skating and curling rinks, gymnasium and library), an aquatic centre, a child-care centre, a hotel, Co-op store and True Value store, the Gillam Hospital, RCMP station and several other businesses. Nearby at Stephens Lake, there is a marina for boating and a campground to park a camper with sites that have picnic tables and fire pits. The Gillam Hospital is a 10-bed facility, with three beds allocated to long-term care, five for medical and surgical patients, and the remaining two for paediatric care. A constant challenge for the Gillam and Thompson hospitals is maintaining consistent staffing levels of professional caregivers. Child and family services for northern Aboriginal people are available through the Awasis Agency of Northern Manitoba.

The four KCN communities face challenging living conditions. Cost of living in the communities is high due to long travel distances to Winnipeg, where most of their goods and supplies originate, and to Thompson, the closest regional centre. Retail, commercial and health services are limited in each community. Housing shortages, crowding and a lower standard of living are common.

The community of Split Lake (in the KCN Community Study Area) is located approximately 6 km from PR 280 on the shores of Split Lake. A range of facilities and services are available in Split Lake including a nursing station (under the First Nations and Inuit Health Branch, Health Canada), an office of the Awasis Agency, fire department and police station, water treatment facility (upgraded service in 2002), landfill, telephone, electricity, a radio station, the elderly persons home and the TMC Arena. The community also houses the Tataskweyak band office, the Chief Sam Cooke Mahmuwee Education Centre (K-12 school), the Tataskweyak/University College of the North Regional Centre and the St. John the Baptist Anglican Church. Businesses include Jo-anne's Convenience Store, the Northern Store, Morris Chicken, a gas bar, the 14-unit Kistepinanik Hotel and the Tataskweyak Construction LP. Scheduled bus service is also available.

A range of services and facilities are located in Bird (Fox Lake Cree Nation's reserve community in the KCN Community Study Area, Figure 1.4-2) which is accessible by road approximately 55 km northeast of Gillam. The Band administrative offices include a nursing station, housing services, public works services and educational services (including those related to adult education). The community also has a K-8 school, public works garage and facilities, and a recreation centre. The community has a convenience store located in the recreation centre. These programs and services can be accessed by Fox Lake Cree Nation members living in Gillam. A scheduled transportation service is available Monday to Saturday between Bird and Gillam. Fox Lake Cree Nation members also live, work and depend on programs and services provided in the Town of Gillam.

The community of Ilford (in the KCN Community Study Area, Figure 1.4-2) is located on the rail line approximately 65 km south of Gillam and is the home of War Lake First Nation. Services in Ilford include a new health centre (opened in November 2007), airport and rail, a K-8 school, a daycare centre, post office, sewage treatment plant and landfill, and an adult training facility. Hudson Bay Railway train service provides supplies from The Pas up to three times a week and there is winter road access to York Landing. Fire fighting capability is based on a well-equipped pumper truck from the community fire hall. RCMP response is from the Gillam detachment. The community's lack of year-round road access results in isolation that poses barriers for effective and affordable access to opportunities and services such as higher education, job sites, health and social services, as well as adding to the cost of living.

The community of York Landing (in the KCN Community Study Area, Figure 1.4-2) is located at the mouth of the Aiken River and Split Lake. York Landing is accessible by air, daily summer ferry operations on Split Lake and winter road access in the winter. Community services include a modern school for Kindergarten to Grade 9, an indoor hockey rink, a learning institute, a child-care centre, a nursing station, a motel/bunkhouse, a water treatment facility and piped domestic water supply, sewage lagoon and collection system, and a sanitary landfill. There is also a fuelling station, the Ripple River Store and an Anglican Church. The community's lack of year-round road access results in isolation that poses barriers for effective and affordable access to opportunities and services such as higher education, job sites, health and social services, as well as adding to the cost of living.

3.5.5 Labour Force and Employment

This section provides an overview of the economies for the four KCN communities. The discussion relies, in part, on Statistics Canada Census of Canada information. Caution should be used when interpreting these data as the communities are small and the data are subject to random rounding procedures to preserve confidentiality. It should also be noted that data for some communities were suppressed for the 2006 Census of Canada due to concerns about data quality and low response rates. As a result, this section relies primarily on 2001 Census of Canada data. Finally, it should be noted that quantitative statistical information does not adequately describe the economies in the KCN communities. The section below on barriers to employment provides some additional perspectives on employment.

3.5.5.1 Labour Force

The labour force is defined as the number of people in the potential labour force (i.e., persons 15 years and older excluding institutional residents) who were either employed, or unemployed and looking for work, in the week prior to the Census day (Statistics Canada 2001). Typically, individuals not considered to be part of the active labour force include full-time students, homemakers, retired workers, seasonal workers in an "off-season" who are not looking for work and individuals with disabilities or illnesses that preclude them from being able to work.

Statistics Canada provides labour force characteristics for the four in-vicinity communities and the Northern Manitoba Study Area (Census divisions 22 and 23, Figure 1.4-1). Census data for Split Lake from 2001 reported the largest potential and active labour force, followed by York Landing,

War Lake and Fox Lake. In 2001, the participation rate[10] for the KCN communities ranged between 50.0% and 73.7%. A weighted KCN average for the four communities was 58.8 %. By contrast, the weighted average participation rate reported for the Northern Manitoba Study Area was 60% in 2001.

3.5.5.2 Employment Levels

Statistics Canada defines employment rate as the number of persons employed in the week prior to Census Day, expressed as a percentage of the total population 15 years of age and over (Statistics Canada 2001). Information from Statistics Canada Census 2001 indicates the employment rates for the KCN communities ranged between 29.3% and 63.2% with a weighted average employment rate of 35.6%. By comparison, the total employment rate for northern Manitoba in 2001 was 48.4%. The total employment rate during this period for the province and Canada was 63.3 and 61.5%, respectively.

Employment rates calculated by Statistics Canada Census 2001 demonstrate that, on a weighted average basis, employment rates for the KCN communities are below the provincial and national averages. Lower employment in these communities, as with many other northern Manitoba communities, is in part due to the lack of opportunities available. Consistently, among the top three types of employment available for all of these communities are: occupations in social science, education, government service and religion; trades, transport and equipment operators; and sales and service. The range of employment rates between the KCN communities suggests that this variable may be influenced by the size of the population relative to the amount of jobs available in these types of employment (i.e., there are more jobs available per capita in band administration or government services for a smaller community).

3.5.5.3 Unemployment Levels

Unemployment rate refers to the unemployed expressed as a percentage of the labour force in the week prior to Census Day (Statistics Canada 2001). Information from Statistics Canada (2002) indicates unemployment rates for the KCN communities ranged between 14.3% to 50.4%. A weighted average unemployment rate for the KCN communities was 40.0%. The total unemployment rate for northern Manitoba in 2001 was 18.3%. The total unemployment rate during this period for Manitoba and Canada was 6.1 and 7.4% respectively, which is considerably lower than that for all four communities and the average for northern Manitoba.

3.5.5.4 Barriers to Employment

The Northern Economic Development Commission Benchmark Report (1992) noted that, in addition to a lack of employment opportunities, Northern Manitoba First Nations and Northern Affairs communities face certain barriers to labour force participation. Such barriers can include lack of opportunities, lack of training and work experience, perceptions and attitudes of potential employers, language barriers, and cultural differences. In addition, many employment and education

[10] Participation rate is defined by Statistics Canada as the labour force in the week prior to Census Day, expressed as a percentage of the population 15 years of age and over.

opportunities require individuals or family members to leave home communities. This can lead to stress and anxiety for those who leave and can diminish social networks and resources for families and the home community. As a result, the existence of training and job opportunities alone does not necessarily ensure uptake of those opportunities.

Members of the KCN communities have indicated that many of these same conditions exist and are relevant today. In addition, York Factory and War Lake members face logistical challenges in traveling to employment opportunities outside their community as neither community has year round access.

3.5.5.5 Skills Available in the Communities

The Hydro Northern Training and Employment Initiative (HNTEI) has been providing pre-project training and employment support to prepare northern Aboriginal residents for skilled labour positions since 2001. A focus has been employment opportunities generated by construction of the Wuskwatim project and the Keeyask project. This $60.3 million initiative is funded by Manitoba Hydro, the Province of Manitoba, Human Resources and Skills Development Canada, Indian and Northern Affairs Canada and Western Economic Diversification, and extends until March 31, 2010. Partners and key participants in the Initiative are the four Cree Nations located in the vicinity of the Keeyask Infrastructure Project, namely, Tataskweyak Cree Nation, War Lake First Nation, Fox Lake Cree Nation and York Factory First Nation, along with Nisichawayasihk Cree Nation, Manitoba Keewatinook Ininew Okimowin, the Manitoba Métis Federation, Manitoba Hydro, the Province of Manitoba, and Human Resources and Skills Development Canada (HRSDC). Each of the seven Aboriginal partners plans, manages and delivers its own training programs using a five-phased approach consisting of the following:

- Assessment;
- Academic preparation;
- Academic and technical instruction;
- On-the-job training; and
- Employment.

The group develops multi-year and annual training plans to deal with all aspects of career planning, training and support for individuals. The partners have implemented a wide variety of training using this community-based training and employment approach. The Wuskwatim and Keeyask Training Consortium (WKTC) (2008) is a non-profit corporation with legal responsibility for the governance and administration of the Initiative.

According to the Hydro Northern Training and Employment Initiative 2008-09 3rd Quarter Statistical Analysis Report as of December, 31 2008 a total of 2,086 individuals had participated in training activities over the previous four years, as follows:

- 375 trainees had completed training in non-designated trades such as labourers, heavy equipment operators, and truck drivers;

- 43 trainees had completed training in business and management for management of labour force programming at the community level, and management and accounting in existing businesses as well as potential new entrepreneurial Aboriginal ventures in response to new economic activity generated by hydroelectric construction activity;
- 64 trainees had completed training in technical/professional areas including surveyors, civil engineering technologists, environmental monitors, and health/safety and emergency response personnel;
- 66 trainees had completed training in construction project supports such as catering staff, administrative and clerical workers, and security personnel; and
- 414 individuals had completed training in designated trades areas such as plumbing or carpentry, with 20 trainees becoming certified journeypersons.

3.5.5.6 Education Levels

In 2001, 59% of the population over the age of 25 in the KCN Community Study Area did not have a high school graduation certificate (compared to 23% provincially and 29% for the Northern Manitoba Study Area for the same time period) (Statistics Canada 2002). On average 23% of the four communities over the age of 25 had a trades, college, or university certificate or diploma (below a bachelor's degree). Less than 1% had a university degree. The factors affecting participation in post-secondary education such as background characteristics (age, gender, place of residence, Aboriginal status) and intervening factors (academic performance, work/employment, family responsibility, personal barriers) have been extensively researched by government agencies, education authorities, funding agencies, and academics across Canada and worldwide. The links among better education, better jobs, and better income are well documented and there is "ample evidence that education attainment leads to greater opportunities in the areas of employment and income" (Hull 2005).

Manitoba Hydro recognizes that northern Aboriginal communities often face barriers in attaining the necessary education and training to access the employment opportunities it provides in northern Manitoba. As such, in addition to participating in the Hydro Northern Training and Employment Initiative, Manitoba Hydro offers a variety of programs to northern Manitobans and First Nation peoples including bursaries, scholarships, internships, pre-placement programs, career development programs, and trades training programs.

3.5.6 Community and Family Life

First Nation communities are often structured around social networks, kinship relationships and functional roles within a community. These roles and relationships are not limited to families and child rearing but are community wide and intertwined into all aspects of daily life, including sharing of resources and providing services. The Royal Commission Report on Aboriginal Peoples (INAC 1996-Volume 3, Chapter 2, Section 1.2) describes these diverse and interconnected relationships as follows:

> *"As is the case in contemporary society in Canada, among Aboriginal peoples traditionally it has been the responsibility of the family to nurture children and introduce them to their*

responsibilities as members of society. However, the extended family continued to play a significant role throughout the lives of its members. When a young man went out on the hill to seek a vision of who he was to be and what gifts were uniquely his, it was not because he was preparing to go out into the world and seek his fortune. Rather, he would come back to the camp or the village to obtain advice from his uncles or his grandfather on the meaning of his experience, and his 'medicine', or personal power, was to be exercised in the service of family and community.

To Aboriginal people, family signifies the biological unit of parents and children living together in a household. But it also has a much broader meaning. Family also encompasses an extended network of grandparents, aunts, uncles and cousins. In many First Nations communities, members of the same clan are considered family, linked through kinship ties that may not be clearly traceable, but stretch back to a common ancestor in mythical time.

The effect of these diverse, overlapping bonds was to create a dense network of relationships within which sharing and obligations of mutual aid ensured that an effective safety net was in place."

These networks are fundamental to life in the KCN communities. They help to increase social-capital, personal and community well being and resilience.

3.5.6.1 Workplace Public Health and Safety

Workplace safety and health for Manitoba Hydro and contractors is a top priority at all times during a project. Hazards in the workplace are caused by the use of materials, tools, machinery and chemicals, and can be exacerbated by literacy or language barriers (Workers Compensation Board of Manitoba 2008). Manitoba Hydro's safety systems and services provide prevention through minimizing risks to people, property, and the environment. The policies and programs in place to support employee safety and health include the following:

- Safety, Health, and Workplace Policies and Programs;
- Technical expertise and assistance to support employee activities in safety and health;
- Discrimination and Harassment Free Workplace Policies;
- Health Education Programs;
- Personal and Confidential Health Counselling;
- Employee Assistance Program; and
- Construction camp policies and rules.

All Manitoba Hydro employees and contractors are required to follow *The Workplace Safety and Health Act* and associated regulations dealing with the health and safety of workers, protection of the public from unsafe mechanical and electrical equipment and fuel-burning appliances in buildings, and the licensing of tradespersons in the province. The Manitoba Workplace Health and Safety Division emphasizes a preventive focus to eliminate workplace and public hazards through education, training, working with employers and employees, and inspections and incident assessments.

3.6 HERITAGE RESOURCES

3.6.1 Overview

Heritage resources are defined in *The Manitoba Heritage Resources Act* to include: "a heritage site; a heritage object, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, cultural, natural, scientific or aesthetic features, and may be in the form of sites or objects or a combination thereof". 'Heritage sites' refers to designated sites that are considered to be of Provincial significance. Heritage resource sites refer to all sites, both undesignated and designated. Heritage objects include archaeological (product of human endeavour), palaeontological (fossilized animal remains), natural heritage (geological features that may or may not contain floral or faunal evidence), and human remains that are discovered outside a recognized cemetery. Found human remains during fieldwork or Project activities are subject to *The Manitoba Heritage Resources Act* (1986) and Manitoba's *Policy Respecting the Reporting, Exhumation and Reburial of Found Human Remains* (1987).

3.6.2 Regional Context

The tangible cultural heritage (artifacts) of northern Manitoba coincides with post-glacial conditions that paved the way for successive migrations of wildlife (plants and animals) into previously inaccessible lands.

Evidence of human occupation indicates that as recent as 6,500 years ago the Nelson River system, as a well-established travel route, supported small bands of seasonally subsistent people. The skeletal remains of a variety of wildlife show that early human populations relied on a range of large and small mammals, birds and fish for their nutritive requirements. As well, the size and shape of the tool assemblage indicates specialized tools for different uses and occasions.

New ideas and technologies quickly spread through the network of intricate waterways where they were modified and improved upon according to need. For example, the ceramic tradition considered to have been introduced into the area approximately 2,000 years ago, quickly spread throughout the boreal forest from the southeast. Attribute analysis and C14 dating illustrate the changing ceramic technology in both form and function. The same applies to the vast range of tools and weapons that are recovered from archaeological sites. From the producers of changing traditions emerged the predecessors of today's Cree Nation inhabitants. Appendix B6 (Table B6-2) provides a brief overview of the cultural chronology related to technological advancement.

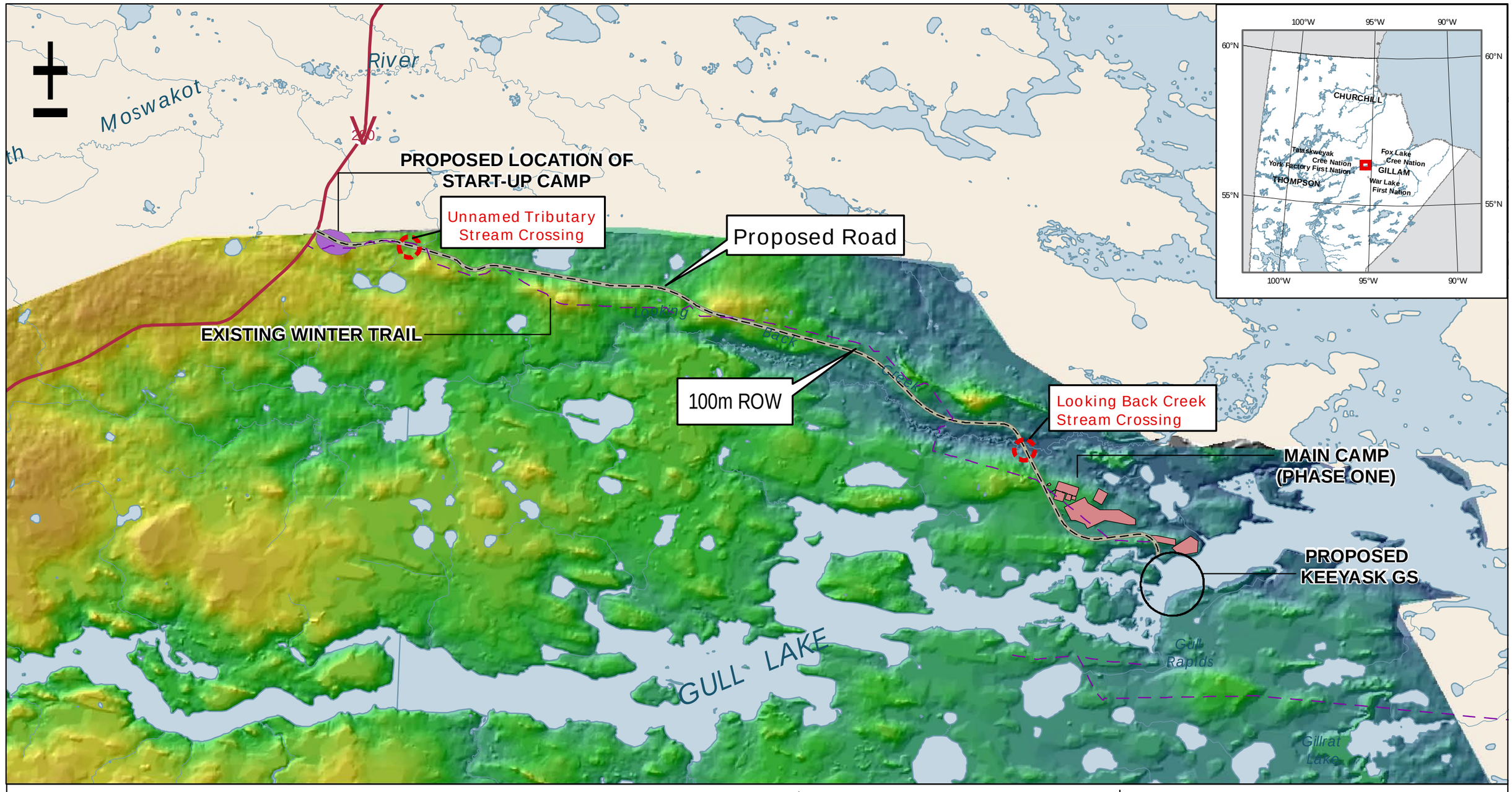
In addition to the Pre-European contact component, there are historical Cree and European fur trade sites along with more recent resource use sites found in the vicinity of the proposed road. These sites illustrate a longstanding use of the surrounding area. Experience in other areas of the province demonstrates that eskers and beach ridge formations in particular have been used as travel routes for humans as well as animals.

3.6.3 Project Area

The investigation of the proposed road, adjacent borrows locations and portions of the Project Footprint consisted of aerial and pedestrian surveys conducted between 2002 and 2005. A total of 66 shovel tests were carried out (Appendix B6, Table B6-2); of these 5 were positive for artifacts. These positive tests were located on the north bank of the Nelson River at Keeyask Rapids.

Aerial and pedestrian surveys will be conducted in late July 2009 for the start-up and main camp (phase one) areas. This component was not included in the original field surveys as the exact locations of the start-up and main camps were not known at that time. The specific locations for both the start-up and the main camp have now been established. The archaeological field investigations will include aerial (helicopter) and pedestrian survey with shovel testing along random transect routes within the coordinates for both the start-up and main camps. The results and analysis of the investigation will be submitted as a supplementary filing on completion of the assessment.

While no heritage resources sites have been found along the esker ridge or proposed road and borrow areas, eskers are known to have been used extensively as travel routes for humans as well as animals. Therefore, there is potential for pre- and post-European contact sites (including camp and kill sites) and burials to be present beneath the overburden.



KEEYASK

Scale

0 1.25 2.5 5 km

0 1.25 2.5 5 mi

Projection: UTM NAD83, Zone 15N
Data Source: Manitoba Hydro and Government of Canada
Created By: TetrES Consultants INC.
Date Created: July 24, 2009

LEGEND

Elevation (meters)
High : 202
Low : 117

- Main Camp (Phase One)
- Start-Up Camp
- 100m ROW
- Winter Trail

Keeyask Infrastructure Project
Digital Elevation Model

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\KIP_DEM_230709.mxd - 7/24/2009 @ 11:51:18 AM

Figure 3.2-1

Nunavut

THLEWIAZA RIVER BASIN

SEAL RIVER BASIN

Churchill

Hudson Bay

Churchill River

HUDSON BAY BASIN

Southern Indian Lake

Keeyask Infrastructure Project

Nelson River

HUDSON BAY BASIN

CHURCHILL RIVER BASIN

Rat River

Fox Lake

Split Lake

Bird

Gillam

Ilford

York Landing

Shamattawa

Churchill River

Burntwood River

Thompson

Wuskwatim Lake

Nelson River

NELSON RIVER BASIN

HAYES RIVER BASIN

Saskatchewan River

SASKATCHEWAN RIVER BASIN

SEVERN RIVER

Lake Winnipeg

LAKE WINNIPEG BASIN

Saskatchewan

Ontario

ASSINIBOINE RIVER BASIN

Winnipeg

WPG. RIVER BASIN

RED RIVER BASIN

North Dakota

Minnesota

LEGEND

- Nelson River Drainage Basin
- Other Drainage Basins
- Keeyask Proposed GS
- Community

KEEYASK

0 50 100 200 km
0 30 60 120 mi

Projection: NAD83, UTM Zn 15N
Data Source: Province of Manitoba, Government of Canada, Manitoba Hydro
Created by: TetrES Consultants Inc.
Date Created: July 22, 2009

Nelson River Drainage Basin

G:_GIS_Project_Folder\0221-Hydro\63_Keeyask_Road\ArcMaps\MB_Key_Map_AccRd_Watersheds_220709.mxd - 7/23/2009 @ 9:08:59 AM

Figure 3.2-2

Legend

Study Areas

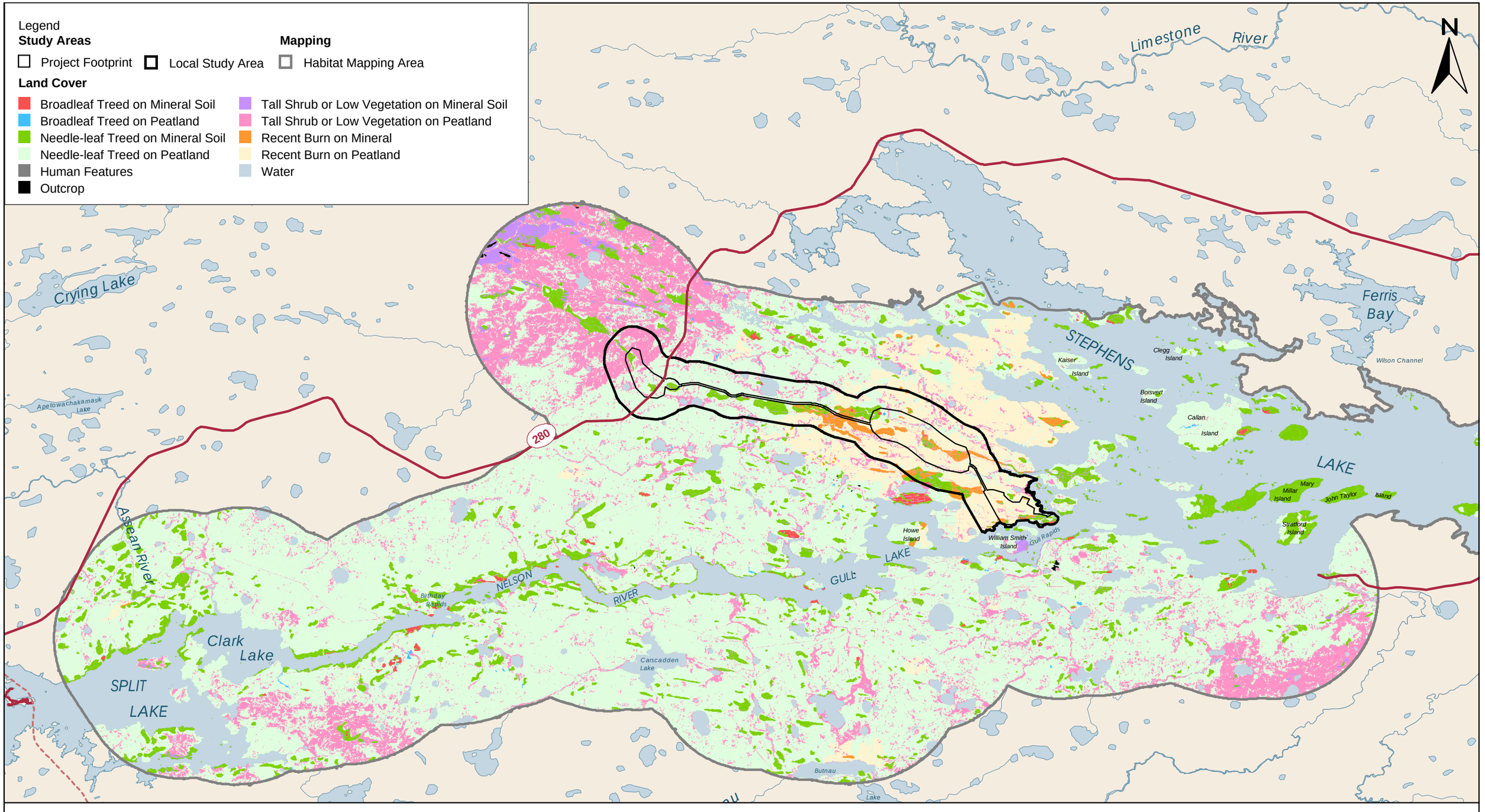
- Project Footprint
- Local Study Area

Mapping

- Habitat Mapping Area

Land Cover

- Broadleaf Treed on Mineral Soil
- Broadleaf Treed on Peatland
- Needle-leaf Treed on Mineral Soil
- Needle-leaf Treed on Peatland
- Human Features
- Outcrop
- Tall Shrub or Low Vegetation on Mineral Soil
- Tall Shrub or Low Vegetation on Peatland
- Recent Burn on Mineral
- Recent Burn on Peatland
- Water



KEEYASK

0 2.5 5 10 Kilometres

0 1.5 3 6 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Study Areas, Land Cover, Nelson River and Highway 280 - ECOSTEM Ltd.; Impact areas- MB Hydro.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

Land Cover Composition

Figure 3.4-1

Legend

Study Areas

- Project Footprint
- Local Study Area

Mapping

- Habitat Mapping Area

Year of Fire

- 2003 to 2004
- 1996 to 2002
- 1986 to 1995
- 1976 to 1985

N

LIMESTONE LAKE
North Ministik Lake
Asitayatik Lake
Crying Lake
Apetowachakamasik Lake
280
Assean River
Limestone River
STEPHENS LAKE
Kaiser Island
Clegg Island
Boisvert Island
Callan Island
Ferris Bay
Wilson Channel
Mary Millar Island
John Taylor Island
Stratford Island
Howe Island
William Smith Island
Gull Rapids
GULL LAKE
NELSON RIVER
Birthday Rapids
Clark Lake
SPLIT LAKE
Carscadden Lake
Butnau Lake
Luke
Willbeach

KEEYASK

0 2.5 5 10 Kilometres
0 1.5 3 6 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Water polygons and fire updates - ECOSTEM Ltd.; Fires - Manitoba Conservation; Highways and rail- NTS.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

Recent Fire History

Figure 3.4-2

N

Moswakot River

280

Looking Back Creek

STEPHENS LAKE

Island

GULL LAKE

Howe Island

William Smith Island

Gull Rapids

Legend

Study Areas

- Project Footprint
- Local Study Area

Mapping

- Habitat Mapping Area

Habitat Broad

- Trembling aspen mixture on mineral soils
- Trembling aspen mixedwood on mineral soils
- Black spruce pure on mineral soils
- Black spruce pure on peatlands
- Black sprcue mixture on mineral soils
- Black spruce mixture on peatlands
- Black spruce mixedwood on mineral soils
- Black spruce pure/ tall shrub on peatlands
- Jack pine pure on mineral soils
- Jack pine pure on peatlands
- Jack pine mixture on mineral soils
- Jack pine mixture on peatlands
- Jack pine mixedwood on mineral soils
- Tamarack pure on peatlands
- Tamarack mixture on peatlands
- Tall shrub on peatlands
- Low vegetation on mineral soils
- Low vegetation on peatlands
- Young regeneration on mineral soils
- Young regeneration on peatlands
- Human features

KEEYASK

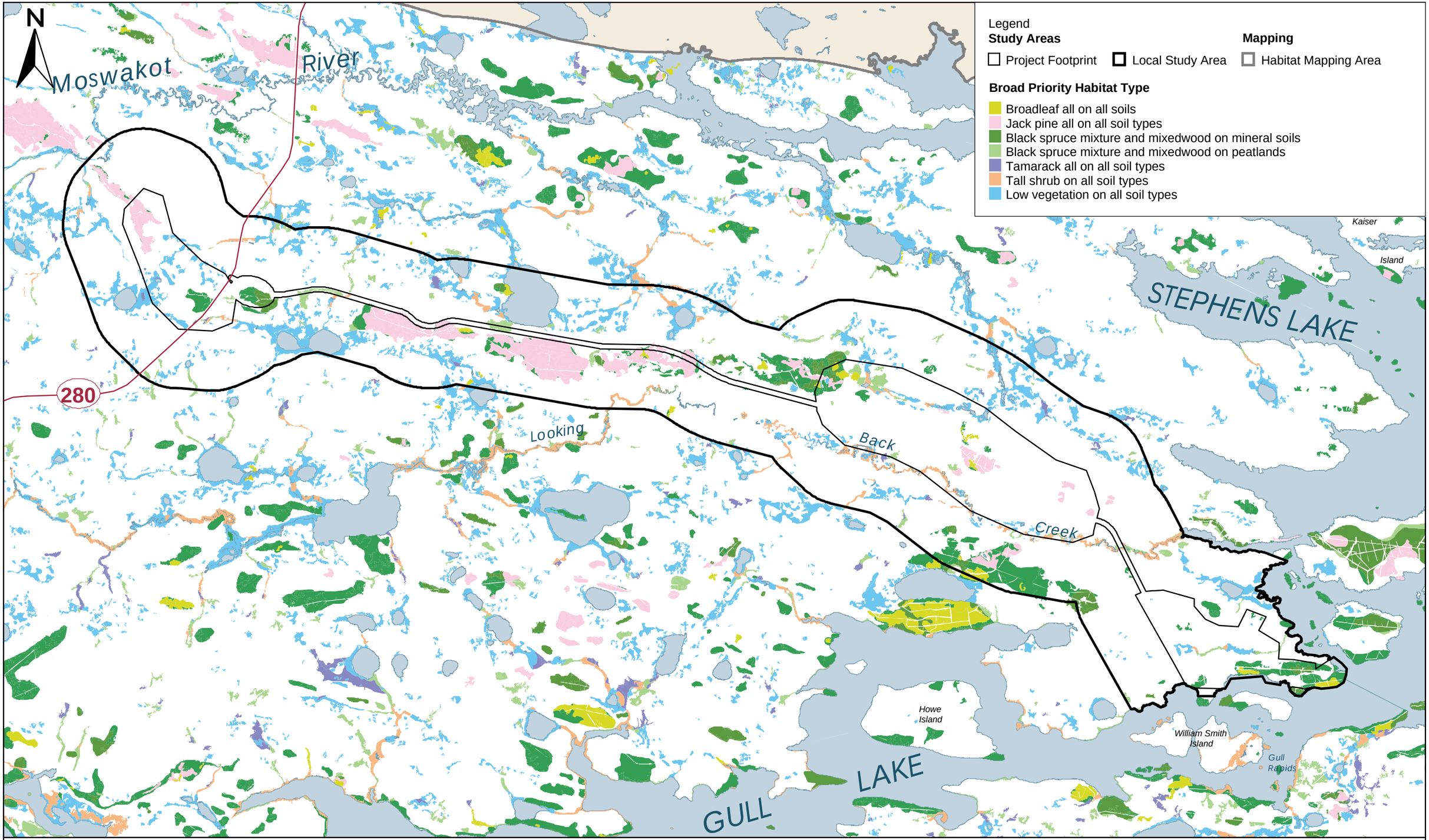
0 1 2 4 Kilometres

0 0.5 1 2 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Habitat, Study Areas, Water and Highway 280 - ECOSTEM Ltd.; Impact Areas - MB Hydro.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

Habitat Composition

Figure 3.4-3



KEEYASK

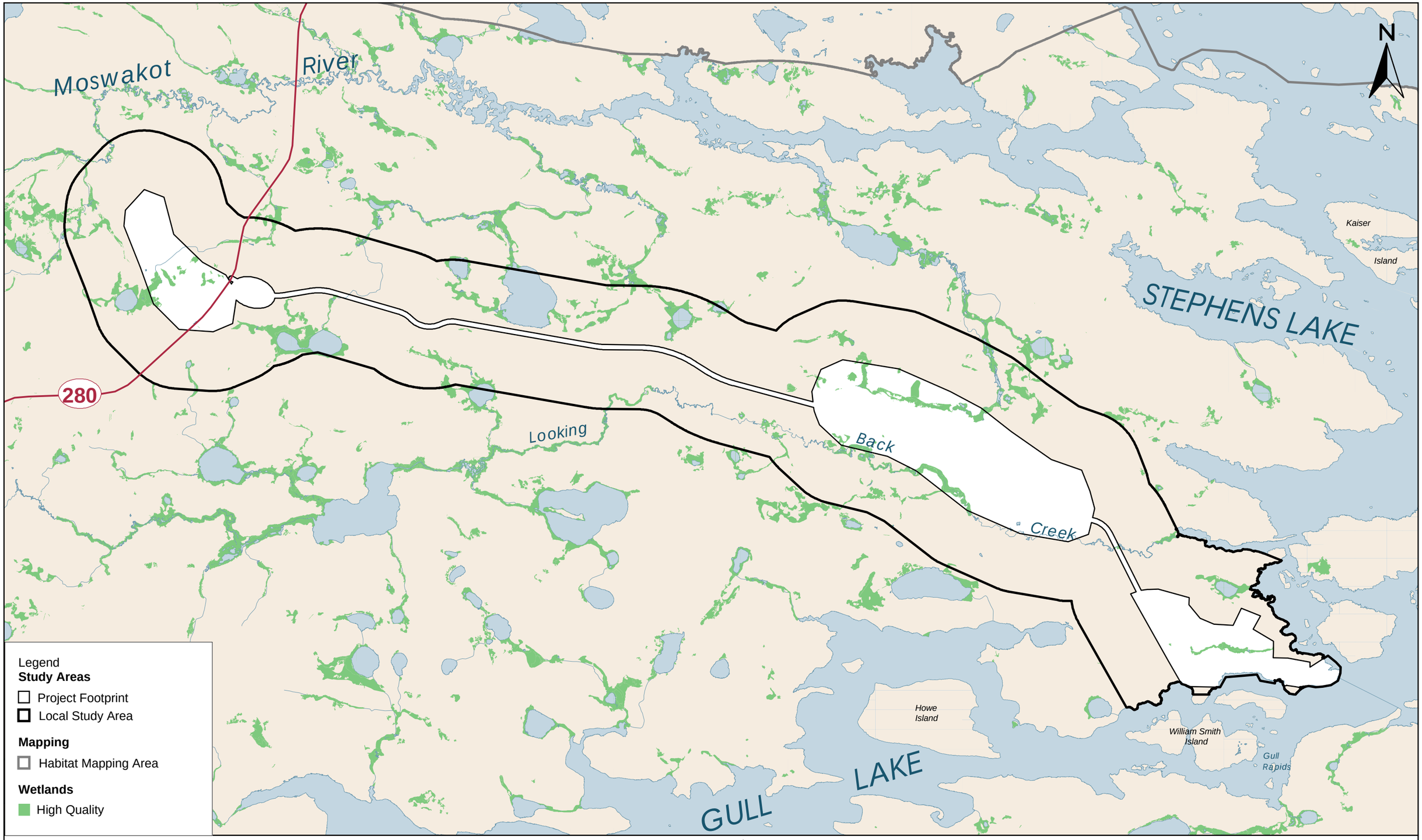
0 1 2 4 Kilometres
0 0.5 1 2 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Habitat, Study Areas, Nelson River and Highway 280 - ECOSTEM Ltd.; Impact Areas- MB Hydro.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

Priority Habitat* Distribution

* Habitat type is plant species rich and/or covers < 1.1% of region land area

Figure 3.4-4



KEEYASK

Projection: UTM NAD 83, Zone 15
Data Sources: Wetlands, Study Areas, Nelson River and Highway 280 - ECOSTEM Ltd.; Impact Areas- MB Hydro.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

High Quality Wetlands

Some high quality wetlands outside of the project footprint are not shown

Figure 3.4-5

Moswakot River

280

Looking Back Creek

STEPHENS LAKE

Kaiser Island

GULL LAKE

Howe Island

William Smith Island

Gull Rapids

N

Common dandelion
Reed canary grass
Narrow-leaved hawks-beard

Common plantain

Wild barley

Wild barley
Common dandelion

Ox-eye daisy
Common dandelion

Legend

Study Areas

- Project Footprint
- Local Study Area

Mapping

- Habitat Mapping Area

Observed Locations

- Non-Native & Invasive Species

Sample Locations

- Priority Plant Transect
- Invasive Plant Transect
- Habitat Characterization Plot

KEEYASK

0 1 2 4 Kilometres

0 0.5 1 2 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Samples, Study Areas, Nelson River, Species locations and Highway 280 - ECOSTEM Ltd.; Impact Areas- MB Hydro.
Created by: ECOSTEM Ltd.
Date Created: July 14, 2009

Invasive and Non-Native Species Locations In the Local Study Area

Figure 3.4-6

Legend

Summer Resident Caribou Calving Habitat

Verified Calving and Rearing Islands

- Caribou Present
- Caribou Absent

Potential Calving and Rearing Complexes

- Complex

Study Areas

- Project Footprint
- Local Study Area

Mapping

- Habitat Mapping Area

LAKE
Limestone River
North Ministik Lake
Crying Lake
Apetowachakamasik Lake
280
Astean River
Ferris Bay
STEPHENS
Wilson Channel
LAKE
Gull Rapids
GULL LAKE
NELSON RIVER
Birthday Rapids
Clark Lake
SPLIT LAKE
Lake
Carscadden Lake
Butnau Lake
Luke
Willbeach
N

KEEYASK

0 2.5 5 10 Kilometres
0 1.5 3 6 Miles

Projection: UTM NAD 83, Zone 15
Data Sources: Potential and known calving complexes and islands - WRCS Ltd.; Study areas, Nelson River and Highway 280 - ECOSTEM Ltd.
Created by: ECOSTEM Ltd.
Date Created: July 22, 2009

Summer Resident Caribou Calving Sites in the Habitat Mapping Area

Figure 3.4-7

4.0 PUBLIC INVOLVEMENT PROGRAM

4.1 PUBLIC INVOLVEMENT

4.1.1 Route Selection Process Summary

This section provides an overview of planning and public involvement activities that informed the route selection process for the road component of the Project. Planning activities related to the route selection process began in 2005 with the formation of the Keeyask North Access Road Technical Sub-Committee. Participants in the route planning process included representatives of First Nations in the vicinity of the proposed Project in their role as potential partners in the Project; Manitoba Hydro and its consultants; and Manitoba Transportation and Government Services (now Manitoba Infrastructure and Transportation). Related public involvement activities included community information and issues identification sessions in Ilford, Gillam and Bird in 2006 as part of the development of access route alternatives. Additional information about these meetings and participants is provided in Appendix D, and details on refinement of the route selection and outcomes from analysis of alternative routes are provided in Appendix A2 of this report.

The planning committee was tasked with meeting to gather relevant background information on alternative routes for a road between PR 280 and Gull Rapids. This included identifying potential physical and biophysical effects of route alternatives. The Committee combined engineering, environmental and local knowledge to evaluate issues affecting route selection. This included stream crossings, terrestrial habitat, sensitive areas, heritage resources and land use. The perspectives expressed an evaluation of alternatives centred around the effects on the road, communities and environment.

The Committee held the first of three meetings on July 7, 2005 (Meeting 1). The key action item arising from that meeting was to expand the Committee's membership to include two members from each of the KCN.

The second Committee meeting was held on July 22, 2005. The goal of this meeting was to develop a plan of action for arriving at a final routing that would be most sustainable. During this meeting, participants started to discuss potential biophysical effects of the route alternatives. At this meeting, it was agreed that a field trip to the proposed Project site would be required to help identify sensitive, heritage and traditional-use sites.

The third Committee meeting was held on August 22-23, 2005. Participants undertook a reconnaissance flight over the proposed route on the first day to identify sensitivities and suggest possible alternatives. A meeting was held on the second day to discuss the following matters:

- Observations from the site reconnaissance;
- Additional information available from mapping and other sources;
- Potential for alternative routes; and
- Other information needs.

Based on the discussions throughout the meeting and the observations during the helicopter reconnaissance, the Committee members concluded that the final route would be close to the original "preferred route" originally identified in route alternative maps. Further discussion produced refinements including a more northerly route option to make use of better terrain conditions.

Further analysis of the alternatives by Manitoba Hydro included three community issue-identification and information meetings (see Appendix D) on June 13, 2006 in Gillam and Ilford (War Lake First Nation) and June 14 in Bird (Fox Lake Cree Nation). Residents expressed concern about current conditions of the provincial roads.

4.1.2 2009 Public Involvement Summary

The Keeyask Hydropower Limited Partnership is currently engaged in a public involvement program for the proposed Project. The public involvement program is intended to provide communities and stakeholders with an interest in the project with the opportunity to identity concerns and offer suggestions. Key activities include:

- Leadership and community meetings in Split Lake, Ilford, York Landing and Bird. Meetings with FLCN members also occurred in Gillam Churchill, Thompson, and Winnipeg.
- Open houses in Thompson and Gillam.
- Individual meetings in Winnipeg with interested ENGOs.

The original intent was to have completed and documented this program for inclusion in this submission. However, due to a number of unforeseen factors, the most notable being concerns about and occurrence of the H1N1 in several of the KCN communities that delayed the holding of community meetings, it was not possible to complete this program as initially intended. The process is underway and will be largely completed by the time of submission, however several sessions will occur shortly afterwards. A report documenting the details of the program and its outcomes will be incorporated in a supplemental submission before the end of August.

5.0 POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION

5.1 ASSESSMENT APPROACH

The approach for the EA has been structured to address the environmental effects that may occur during site preparation and construction of the proposed Project. This EA report focuses on assessing the environmental effects on the physical, aquatic, terrestrial, socio-economic and heritage resource components of the environment.

The assessment conclusions for the proposed Project were determined for residual environmental effects after the application of mitigation actions. The approach considered the nature and magnitude of the residual effect along with its temporal characteristics and spatial boundaries Table 5.1-1. The evaluation also included the likelihood of effects and any associated uncertainty.

Table 5.1-1: Factors Considered in Assessment of Environmental Effects

Factor	Explanation
Nature	
Positive	• Beneficial effect on the environment (e.g., job creation).
Neutral	• No change in the environment.
Adverse	• Negative effect on the environment (e.g., loss of habitat).
Magnitude	
Low	• Effects can be defined using standard practices but are anticipated to be within the range of natural variability. Effects may not be measurable.
Moderate	• Effects exceed natural variability and can be observed or measured with a well-designed monitoring program.
High	• Effects are large or widespread and can be easily described, observed and measured.
Frequency	
Once	• Effects occur once during the life of the Project. • Effects are unique and do not accumulate over the life of the Project.
Sporadic	• Effects occur occasionally but without any predictable pattern during the life of the Project (e.g., vehicle-wildlife collisions along the road). • Effects may accumulate over the life of the Project.
Continuous	• Effects are reoccurring continuously (e.g., vegetation clearing from construction to maintenance) or periodically in a predictable manner during the life of the Project (e.g., vehicle emissions). • Effects may accumulate over the life of the Project.
Duration	
Short term	• Effects occur for a small proportion of the life of the Project (e.g., effects associated with construction, maintenance and decommissioning activities).
Long term	• Effects occur beyond the life of the Project (e.g., borrow pits). • Effects persist beyond any reasonable reclamation effort after decommissioning.

Table 5.1-1: Factors Considered in Assessment of Environmental Effects	
Factor	**Explanation**
Reversibility	
Reversible	• Effects do not persist in the environment after the application of mitigation and rehabilitation.
Not Reversible[1]	• A long-term effect that persists in the environment beyond decommissioning of the Project (i.e., remains indefinitely as a residual effect).[11]
Spatial Boundary	
Project Footprint Study Area	• Area in the immediate vicinity of the physical works or activities (biophysical and socio-economic).
Local Study Area	• Zone of influence of the physical work or activities (biophysical).
Regional Study Area	• A 14,000-km^2 Regional Study Area was selected on the basis that this was the area required to capture natural spatial and temporal variability in habitat composition (biophysical).
KCN Community Study Area	• Area of the four First Nation communities in the vicinity of the proposed Project (socio-economic).
Northern Manitoba Study Area	• Area encompassed by Statistics Canada Census Divisions 22 and 23 (socio-economic).

5.2 ENVIRONMENTAL EFFECTS AND MITIGATION

The following section provides information on the anticipated environmental effects and proposed measures to address adverse effects on the following areas:

- Physical Environment:
  - Atmosphere, air quality and noise
  - Physiography
  - Soil and permafrost
  - Surface water
  - Groundwater
- Aquatic Habitat and Biota:
  - Aquatic habitat
  - Aquatic biota
- Terrestrial Environment:
  - Terrestrial ecosystems and habitat:
    - Ecosystem diversity and habitat types
    - Plant
    - Fragmentation
    - Wetland function
  - Wildlife:
    - Invertebrates

[11] An example of a non-reversible effect would be the removal of borrow materials from a borrow site. The types of materials that previously existed at borrow areas will not be replaced, therefore borrow areas will not be returned to the original condition (effect is not reversible).

    - Amphibians
    - Reptiles
    - Birds
    - Mammals
- Socio-economic Environment:
    - Direct employment and business opportunities
    - Regional supplies and services
    - Resource use
    - Individual and community health, safety and wellness
    - Traffic
    - Access
- Heritage resources

Dealing with effects from construction and maintenance activities will draw heavily from the Preliminary EnvPP. The Preliminary EnvPP is submitted concurrently with this EA report, under separate cover, and an overview of the program is provided in Appendix C. In to referencing the EnvPP guidance on avoiding or reducing adverse effects was gained from the Keeyask Cree Nations Principles Regarding Respect for the Land and measures that would comply with these principles (Appendix C).

5.3 ANALYSIS OF ALTERNATIVES

One of the best methods of managing adverse effects is through mitigation developed during the Project design phase. Manitoba Hydro and the KCN have been working collaboratively for a number of years to discuss the various Project components and various siting and design alternatives were considered during the planning phases of the main Project components (start-up camp, road and main camp (phase one)). Alternatives were also considered for other infrastructure including the stream crossing at Looking Back Creek, potable water supply and waste disposal (sanitary and solid). Appendix A2 contains a summary of the outputs of this process.

5.4 PHYSICAL EFFECTS AND MITIGATION

5.4.1 Atmosphere, Air Quality and Noise

The Project will result in an increase in vehicular traffic (described further in Section 5.7.5) that will increase vehicle emissions of nitrogen oxide, sulphur dioxide and greenhouse gases. Vehicular traffic could also cause local increases in dust (particulates). Vehicles and equipment that are used will be properly maintained to limit the increase of airborne emissions. Acceptable dust control measures will be used on the roadway, as necessary, to limit the amount of airborne dust.

Refuelling of vehicles and storage of fuels and other possible hazardous materials has the potential to cause localized effects. The EnvPP contains standard environmental practices for the storage of fuels and lubricants which will be followed to reduce this risk. Spill-containment measures will be applied and a spill response plan will be developed. The potential contribution of greenhouse gases to the atmosphere from the proposed Project is uncertain but it is expected to be very minor.

No data are available for ambient noise levels; however, existing levels are expected to be low and typical of a relatively undisturbed area. Noise levels from earth-moving equipment and truck traffic will increase during construction and could disturb animals that are hunted or trapped. This could result in a temporary redistribution of animals in the area, but not a reduction in the overall regional abundance. The noise may also affect resource harvesters in the area. Provisions are included in the EnvPP to address Project noise, in particular blasting, including limiting activities during the peak bird breeding season, whenever possible, and minimizing blasting within a 5 km radius of active caribou calving habitats.

Odour from the septic field is a potential effect if normal operation is disrupted and careful management will be required to comply with provincial regulations and guidelines.

Potential environmental effects and mitigation measures are summarized below (Table 5.4-1).

Table 5.4-1: Atmosphere, Air Quality and Noise Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Increased atmospheric emissions from construction vehicles and heavy equipment.	• Limit unnecessary idling • Regular vehicle/equipment maintenance • Limit traffic to construction vehicles/equipment • AMP • EnvPP	Small residual effect; unlikely that emissions would be detectable outside the local area.	Adverse, moderate magnitude, Local Study Area, continuous, short term and not reversible.
Increased fugitive dust levels from construction activities and vehicle/heavy equipment traffic.	• Apply acceptable dust control measures as required • Limit construction vehicle speeds • AMP • EnvPP	Small residual effect; unlikely that dust levels would be detectable outside the local area.	Adverse, low magnitude, Local Study Area, continuous, short term and not reversible.
Increased atmospheric emissions from fuel storage tank facility	• Comply with Manitoba regulations, guidelines and licence conditions • Adhere to CCME guidelines • EnvPP	Minor releases of volatile organic carbons unavoidable during fuelling.	Adverse, low magnitude, Local Study Area, continuous, short-term and reversible.
Disturbance of wildlife and resource users due to construction noise.	• Provide notice of blasting events • Limit blasting and drilling during sensitive periods • EnvPP	Construction noise will occur, but effects during most sensitive periods will be limited.	Adverse, moderate magnitude, Local Study Area, short-term and reversible.
Odours from septic field	• Comply with Manitoba regulations, guidelines and Licence conditions • EnvPP	Minor odours may occur if normal operation is disrupted.	Adverse, low magnitude, Local Study Area, sporadic, long-term and reversible.

5.4.2 Physiography and Topography

The proposed road route follows an existing winter trail along the top of the Gull Esker for much of its length. Eskers are uncommon in northern Manitoba. Animal habitats and heritage resources are often located along eskers (Sections 3.4.2.5 and 3.6.2). To reduce the effects of road construction on the esker, the road route was moved to the edge of the esker for much of its length as part of the route selection process (Appendix A2).

Potential residual effects of the proposed Project on physiography and topography are expected to be adverse, confined to the Project Footprint, occur once, long term, low to moderate in magnitude and not reversible (Table 5.4-2).

Table 5.4-2: Physiography and Topography Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Alteration to a local esker due to road ROW, borrow areas and infrastructure locations.	• Road route moved to the edge of the esker for portion of route • Recontour/regrade borrow areas • Minimize extent of infrastructure clearing • EnvPP	Configuration of the esker will be permanently altered.	Adverse, low to moderate magnitude, Project Footprint, long term, occurs once and not reversible.

5.4.3 Soil and Permafrost

Project activities will create the potential for erosion of the soils that are cleared of vegetation during construction activities. Soils on slopes will be particularly susceptible to erosion. To reduce the effects of erosion on soils, sediment erosion and sediment control practices will be employed, as described in the EnvPP. This will include maintaining gentle grades, applying geotextile and other erosion-control methods (e.g. erosion control mats, silt fences, settling basins) as required on a site-specific basis. Vehicular access will be limited to the ROW and other existing trails to minimize soil compaction and disturbance. Clearing will take place in winter months and existing drainage patterns will be maintained. The contractor will suspend construction activities during periods of extreme weather or wet conditions. Extra precautions will be taken in areas that are more susceptible to soil erosion.

Vegetation clearing, surface organic layer removal, compaction and/or rutting contribute higher soil temperatures which increase the chance of permafrost thaw. Permafrost thaw could lead to settling of soils and may cause subsidence and slumping at the ground surface (Dingman and Koutz 1974, Shuhua *et al.* 2007). Erosion associated with permafrost thaw and shifts in surface soils has been shown to increase sediment, nutrient and carbon loading in nearby aquatic ecosystems with the ultimate effect of reducing abundance of organisms and biodiversity (Wrona *et al.* 2006). Road construction techniques have been developed to address permafrost areas. Erosion control methods including geotextile mats may reduce the loss of insulation following vegetation removal. Potential

effects on permafrost will be avoided or minimized through EnvPP measures such as clearing after the ground is solidly frozen to avoid rutting and machines sinking, minimizing clearing and disturbance to the extent feasible and maintaining vegetation and ground cover to the extent feasible.

The potential residual effects of the proposed Project on soil and permafrost are expected to be adverse, confined to the Project Footprint, low magnitude, sporadic, short term and not reversible (Table 5.4-3).

Table 5.4-3: Soil and Permafrost Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Contamination of soils from spills of oil, fuels, lubricants and solvents (fuel storage facility, fuel spills/releases, accidents).	• Use approved storage tanks/ containers • Provide spill prevention measures and procedures • Follow Manitoba Hydro Hazardous Material Handbook • Follow fuelling procedures as per EnvPP and maintain records • Emergency response plan with spill containment/cleanup procedures • EnvPP	Small residual effect; minor residues after spill containment and cleanup.	Adverse, low magnitude, Project Footprint, sporadic, short term and not reversible.

Table 5.4-3: Soil and Permafrost Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Erosion of soils due to clearing and construction activities.	• Minimize clearing and soil disturbance to the extent possible • Limit vehicle/equipment use to the road ROW • Maintain natural drainage and regrade disturbed areas to limit risk of future erosion • Use erosion control mats, geotextiles, silt fences and other methods to control erosion and limit sedimentation • Conduct clearing during winter months to the extent feasible • Preserve vegetation buffers around waterbodies • Suspend construction activities during extreme weather events • Revegetate disturbed areas not required for Project infrastructure • EnvPP	Small residual effect; minor erosion of soil is likely.	Adverse, low magnitude, Project Footprint, sporadic, short term and not reversible.
Permafrost thawing and slumping of soils due to clearing and construction activities.	• Minimize clearing and soil disturbance to the extent possible • Apply knowledge regarding known permafrost locations in the ROW to modify construction and clearing to reduce impact to these areas • EnvPP	Moderate residual effect; permafrost thawing and slumping are likely in some locations given the permafrost body size and degree of clearing.	Adverse, low magnitude, Local Study Area, sporadic, potentially long term depending on permafrost body size, and not reversible.

5.4.4 Surface Water

The proposed Project could potentially affect the surface water regime and quality in the Project Footprint with the possibility of effects in the Local Study Area. Potential environmental effects include changes to surface water regime from crossing Looking Back Creek, modification of surface water drainage from culvert placement and increased sediment levels in streams from clearing and grubbing, and bridge and culvert placement. Proposed mitigation measures include adhering to federal, provincial and Manitoba Hydro guidelines, providing erosion and sediment control measures and following good management practices. Follow-up includes implementation of the EnvPP.

The potential residual effects of the proposed Project on surface water regime and quality are expected to be minimal or not applicable given the measures used to manage them (Table 5. 4-4).

Table 5.4-4: Surface Water Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Changes to surface water regime from construction of bridge crossing on Looking Back Creek.	• Adhere to Department of Fisheries and Oceans Operational Statement on Clear-Span Bridges • Follow Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat • EnvPP	No residual effect on surface water regime with clear-span bridge design.	Not applicable.
Modification of surface water drainage patterns from culvert placement at unnamed tributary creek.	• Follow Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat • EnvPP	Minor local modifications to surface water regime expected during spring and from beaver activities.	Not applicable.
Increased sediment levels in streams during infrastructure construction activities.	• Use erosion control and sediment management measures to prevent sediments from entering streams from construction site or local runoff • Follow Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat • EnvPP	Small amounts of sediments may periodically be introduced into the streams at the two crossings during construction.	Minimal risk.
Increased presence of hydrocarbons in streams during construction from equipment operation, surface runoff and potential spills/ releases.	• Locate fuel storage 100 m away from surface waters • Prohibit maintenance and fuelling within 100 m of waterbodies • Regular vehicle maintenance of oil leaks • EnvPP	None, given proposed mitigation.	Not applicable.

5.4.5 Groundwater

The proposed road route may traverse some permeable soils that could be more susceptible to localized groundwater contamination from spills of oil, fuels or solvents. The potential for similar effects to occur as a result of road construction, such as oil spills and vehicle emissions is small, site-

specific and primarily dependant on occasional occurrences of accidental events (e.g., fuel/oil spills). Spill prevention and implementing petroleum handling procedures as outlined in the EnvPP will minimize the risk of spills and manage consequences (Appendix C). To reduce the risk of groundwater contamination, standard environmental practices will be followed for the proper handling of fuels, solvents and other hazardous materials. Spill containment equipment will be available on-site and the contractor will follow the EnvPP to ensure proper practices are used.

There is some potential for septic field operation to cause local groundwater contamination. The risk is considered to be very low and provincial regulations require careful management of operations.

Use of the groundwater well for drinking water at the start up camp could depress the local aquifer, but this will be managed by regular monitoring and adherence to provincial regulations.

Potential residual effects of the proposed Project on groundwater quality and quantity are expected to be adverse, confined to the Project Footprint, low magnitude, sporadic, short term and not reversible (Table 5.4-5).

Table 5.4-5: Groundwater Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Contamination of groundwater from spills of oil, fuels, lubricants and solvents (fuel storage facility, fuel spills/ releases, accidents).	• Use approved storage tanks/containers • Provide leak detection, spill prevention measures and procedures • Follow Manitoba Hydro Hazardous Materials Handbook • Follow fuelling procedures as per EnvPP and maintain records • Emergency response plan with spill containment/cleanup procedures • EnvPP	Very low risk of minor groundwater quality impairment.	Adverse, low magnitude, Project Footprint to Local Study Area, sporadic, short term and not reversible.
Contamination of groundwater from septic field	• Comply with Manitoba regulations, guidelines and Licence conditions • Locate septic field down gradient from potable water wells • EnvPP	Very low risk of groundwater quality impairment.	Adverse, low magnitude, Project Footprint to Local Study Area, sporadic, short term and not reversible.
Modification of groundwater regime due to pumping of water.	• Limit water use to degree necessary. • Testing of well/aquifer to ensure adequate water supply available • Allow for reasonable return period. • EnvPP	Locally depressed aquifers.	Adverse, low magnitude, Project Footprint to Local Study Area, short-term and reversible.

5.5 AQUATIC EFFECTS AND MITIGATION

5.5.1 Potential Environmental Effects

Watercourse crossings are proposed to include a clear-span bridge at Looking Back Creek and a through-grade culvert at the unnamed tributary. Potential environmental effects associated with construction of these crossings may include:

- Physical disturbance or damage to in-stream and riparian habitat;
- In-filling of stream channel from placement of culvert and roadbed material;
- Reduced productive capacity or food supply for fish due to damage or disruption of riparian habitat or in-stream invertebrate communities;
- Introduction of runoff and sediment into watercourses during construction or reclamation, resulting in water quality degradation and sedimentation of downstream habitats;
- Introduction of hydrocarbons (e.g., oil, gasoline, lubricants or hydraulic fluids) from construction equipment;
- Blockage or alteration of watercourse flow, impeding fish movement and passage; and
- Stranding of fish during watercourse flow isolation for excavating and installing the culvert crossing and constructing bridge abutments.

5.5.2 Proposed Mitigation Measures

Potential effects on aquatic habitat and biota at the two stream crossings will be mitigated by the following measures:

- Follow the Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (Fisheries and Oceans Canada and Manitoba Natural Resources 1996);
- Follow the Fisheries and Oceans Canada Operational Statement for Timing of Work for Construction of Stream Crossings (winter construction (Fisheries and Oceans Canada 2007d);
- Follow the Fisheries and Oceans Canada Operational Statement for Beaver Dam Removal, Version 3 (if required) (Fisheries and Oceans Canada 2007e);
- Install a clear-span bridge at the Looking Back Creek crossing with all work conducted above the high water mark to avoid any infilling and loss or alteration of fish habitat;
- Follow Fisheries and Oceans Canada Operational Statement for Clear-Span Bridges, Version 3 (Fisheries and Oceans Canada 2007b). Key design features include:
  - Placing the bridge entirely above the ordinary high water mark;
  - Not locating the bridge on meander bends, braided streams, alluvial fans, active flood plains, or any other area that is inherently unstable and may result in the alteration of natural steam functions or erosion and scouring of the bridge structure;
  - Constructing the bridge no greater than two lanes in width and not encroaching on the natural channel width because the placement of abutments, footings or rock armouring will be placed above the high water mark;
  - No realignment of the watercourse;
  - No alteration of the streambed or banks or infilling of the channel; and

  - Incorporation of measures to protect fish and fish habitat.
- Stabilize banks where work occurs close to the shoreline to avoid bank erosion and downstream sedimentation (Fisheries and Oceans Canada and Manitoba Natural Resources 1996);
- Prevent sediment-laden runoff from roadside ditches from entering the watercourse;
- Apply permanent erosion measures (Fisheries and Oceans Canada and Manitoba Natural Resources 1996); and
- Follow the EnvPP measures and best management practices for erosion and sedimentation control.

Summary of Effects

Implementation of the mitigation measures will address predicted adverse effects on aquatic biota and habitat within the streams as a result of the input of substances (e.g., sediment). By following the criteria listed in the Operational Statement for Clear-Span Bridges, Version 3 (Fisheries and Oceans Canada 2007b), any effects to the fish community at Looking Back Creek will be avoided, in terms of habitat loss or alteration to fish movements. No measurable effect on fish production from the unnamed tributary is expected as a result of installation of a culvert at this crossing location. Only a small area of habitat within the stream will be covered by the culvert and associated infill, and the affected habitat is classified as low sensitivity fish habitat (potentially used by small-bodied species and not used by large-bodied species due to lack of access and overwintering habitat). Potential residual effects are associated with small, episodic inputs of sediments during crossing construction. This crossing would be classified as low risk under the Department of Fisheries and Ocean's risk management framework (Fisheries and Oceans Canada 2007a) due to the combination of a low scale of effect on a low sensitivity habitat. Environmental effects and mitigation within such environments are well understood, resulting in a high degree of certainty.

Potential residual effects of the proposed Project on the fish community in the unnamed tributary are expected to be adverse, confined to the Project Footprint, low in magnitude, sporadic, short-term and reversible. No effects on the fish community in Looking Back Creek are expected (Table 5.5-1).

Table 5.5-1: Aquatic Biota and Habitat Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
• Impairment of water quality. • Physical alteration or loss of in-stream and riparian aquatic habitats affecting productive capacity of fish habitat. • Impediment to fish movement due to blockage or alteration of stream flow. • Stranding of fish during stream flow isolation during excavating and installation of culvert.	• Installation of a clear-span bridge at Looking Back Creek • Follow DFO Operational Statement for Clear-Span Bridges • Follow Manitoba Stream Crossing Guidelines for Protection of Fish and Fish Habitat • Follow DFO Operational Statement for Timing of Work for construction of stream crossings • Conduct salvage fishery(ies) if portions of stream channel are dewatered during construction • EnvPP	No effects on fish community in Looking Back Creek.	Not applicable.
		Loss of habitat within footprint of culvert will not cause detectable change in fish community in the unnamed tributary in the vicinity of the culvert. Episodic inputs of sediments during construction may cause a local shift in fish distribution to avoid sediment plumes.	Adverse, low magnitude, Project Footprint, sporadic, short term and reversible.

5.6 TERRESTRIAL EFFECTS AND MITIGATION

5.6.1 Terrestrial Ecosystems and Habitat

5.6.1.1 Ecosystem Diversity

The Project Footprint could directly and indirectly affect up to 2,597 ha of terrestrial habitat, which is calculated as 0.24% of Regional Study Area land area (Appendix B2). Two-thirds of the affected area consists of young regeneration on peatlands and black spruce communities on peatlands, which are common in the region. Most of the remaining area is young regeneration on mineral soils, low vegetation on all soils, black spruce communities on mineral soil, jack pine mixture communities on all soils, black spruce mixtures and mixedwoods on all soils and tall shrub communities on peatlands.

Based on the total percentage of terrestrial habitat loss, residual Project effects on **ecosystem** diversity are expected to be low. Relocating the road from the top to the bottom of the esker along the western portion of the route and limiting clearing to the road ROW along this segment avoided substantial effects on habitat composition. The Project Footprint could permanently remove up to 0.16% of terrestrial habitat in the Regional Study Area. The actual area affected is expected to be substantially lower than this because the refined borrow area footprints are much smaller than the

borrow area zones (Figure 1.4-3) used for the assessment. The borrow area zones reflect the originally anticipated extent of potential borrow area use when the quantitative habitat effects assessment was completed. Subsequent engineering analysis has reduced the anticipated borrow area extents to those shown in Figure 2.1-1.

Indirect and other direct Project effects could extend up to 150 m beyond the Project Footprint in some areas. In the unlikely scenario that all of the habitat within 150 m of the Project Footprint and borrow area zones is altered, indirect and other direct habitat effects would only increase to 0.24% of the Regional Study Area land area. As already noted, actual borrow area use is expected to be substantially than what was considered in the assessment. Clearing within the ROW will be minimized to the extent possible, which could further reduce the total area affected.

Total terrestrial habitat loss as a percentage of total land area can be a misleading indicator of Project effects if some habitat types are disproportionately affected. The proposed Project will not reduce the total number of habitat types and is not expected to substantially change the proportion of any common or uncommon habitat type (Appendix B2). Potential effects on the very uncommon habitat types are considered in Section 5.6.1.2. The total area affected would be less than assessed because the refined borrow footprints are smaller than those used in the assessment; further, minimizing clearing within the ROW to the extent possible could also reduce the area affected.

5.6.1.2 Habitat Types

Predicted environmental effects on **priority habitat types** will be mitigated by a number of measures. Two important measures that substantially reduced- potential effects on priority habitat types were relocating the proposed road from the top to the bottom of the esker in the western half of the route and limiting clearing to the road ROW along this segment. Considering these mitigation measures, the Project could directly and indirectly affect more than 1% of the Habitat Mapping Area for 15 of the 30 priority habitat types in the highly unlikely event that the full extent of the borrow area zones are used (Appendix B2).

The EnvPP includes the following three measures specifically directed towards further reducing potential project effects on priority habitats:

- Clear only within the road, camp, and refined borrow area footprints;
- All priority habitat patches identified for avoidance (EnvPP) will be clearly marked prior to construction; and
- Existing trails through or near the priority habitat patches identified for avoidance will be blocked at potential access points along cleared areas.

These mitigation measures are expected to reduce potential Project effects to 1% or less of the Habitat Mapping Area for the majority (26 of 30) of the priority habitat types and to 3% or less for the remaining types. The portions of the Regional Study Area outside of the Habitat Mapping Area are expected to contain sufficient area to reduce regional effects below 1% for the remaining four priority habitat types. Limiting clearing within the road ROW to the maximum extent possible could further reduce area affected for some priority habitat types.

In extreme cases a single accidental fire could either extirpate a habitat type or substantially reduce its abundance, depending on the nature of the fire. Some of the potential effects of accidental fires, such as degrading site conditions, could persist over the long term. The risk that such a fire may occur, or that the proposed Project will affect fire intensity and/or severity will be minimized through EnvPP measures such as:

- Maintaining existing and natural fire guards;
- Carry out fire prevention practices during construction; and
- Providing fire suppression equipment on-site.

Potential residual effects of the proposed Project on ecosystem diversity and priority habitats are expected to be adverse, local, low in magnitude, continuous, long term and not reversible (Table 5.6-1).

Table 5.6-1: Ecosystem Diversity and Habitat Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Possible reduction in the total number of habitat types and possible substantial change in the proportion of habitat types.	• Road relocated from top to bottom of esker along western portion of route • Clear only within the road, camp, and refined borrow area footprints • Limit clearing within road ROW and infrastructure footprints to the maximum extent possible • EnvPP • AMP	No change in the number of habitat types. No substantial change in the proportions of habitat types.	Adverse, low magnitude, Local Study Area, long term, continuous and reversible.
Loss and alteration of some habitat types due to road, infrastructure and borrow area footprints and related incidental disturbance and indirect effects.	• Road relocated from top to bottom of esker along western portion of route • Clear only within the road, camp, and refined borrow area footprints • Limit clearing within ROW to the maximum extent possible • All priority habitat patches identified for avoidance (EnvPP) will be clearly marked prior to construction • Block existing trails through or near priority habitat patches identified for avoidance in areas that will be cleared • EnvPP • AMP	Loss less than 1% of region for every habitat type. Small proportion of occurrences of each habitat type affected.	Adverse, low magnitude, Local Study Area, long term, continuous and not reversible.

Table 5.6-1: Ecosystem Diversity and Habitat Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Possible extirpation or substantial reduction of some habitat types due to fires. Possible alteration of terrestrial habitat composition and ecosystem diversity due to fires.	• Maintain existing/natural fire guards • Carry out fire prevention practices during construction • Develop Emergency Response Plan • Provide fire suppression equipment on-site • EnvPP	No change.	Minimal risk of an accidental fire.

5.6.1.3 Wetland Function

Changes to peatland composition, high quality wetland composition and local hydrology are used as a proxy for potential effects on wetland function. Peatland composition is serves as a proxy for carbon storage since most carbon is stored in peatlands in the region.

Substantial changes to wetland function are not anticipated. Substantial effects on carbon storage in soils are not expected since the proposed Project would affect less than 0.5% of regional peatland area. As well, the Project is expected to have little effect on hydrology and high quality wetlands. The road and other Project footprints will be designed to avoid altering existing surface and subsurface drainage patterns. Before mitigation, approximately 11 ha, or less than 0.5%, of high quality wetlands in the region could be affected by the Project if all of the potential borrow area zones are used. Potential effects will be lower than this for two reasons. First, most of the high quality wetlands in the borrow area zones are outside of the refined borrow area footprints. Second, some of the high quality wetland patches are also priority habitat patches that will be avoided (Section 5.6.1.1).

Potential residual effects of the proposed Project on function are expected to be adverse, local, low in magnitude, continuous, long term and not reversible (Table 5.6-2).

Table 5.6-2: Wetland Function Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Loss and alterations of peatlands from direct and indirect effects of clearing and infrastructure.	• Design road and other footprints to avoid altering existing surface and subsurface drainage patterns • Limit clearing within the footprints to the maximum extent possible • Re-vegetate disturbed areas not required for Project infrastructure • EnvPP • AMP	Less than 0.5% of affected regional peatlands would be affected. No measurable change to wetland function.	Adverse, low magnitude, Local Study Area, continuous, long term and reversible.
Possible loss or impairment of high quality wetlands in the region if all borrow areas are excavated.	• Design road and other footprints to avoid altering existing surface and subsurface drainage patterns • Clear only within the road, camp, and refined borrow area footprints • Limit clearing within the footprints to the maximum extent possible • All priority habitat patches identified for avoidance (EnvPP) will be clearly marked prior to construction • Block existing trails through or near priority habitat patches identified for avoidance in areas that will be cleared • EnvPP	Less than 11 ha, or less than 0.5%, of high-quality wetlands in the region would be affected. No measurable change to wetland function.	Adverse, low magnitude, Local Study Areal, continuous, long term and not reversible.

5.6.1.4 Plant Species

No plant species listed by MESA, SARA (Schedule 1) or COSEWIC were found during field studies in the Local Study Area. No listed species have a high potential to occur based on observations elsewhere in the surrounding region.

Some species of high provincial conservation concern may be present but were not detected in the Local Study Area. Pre-construction surveys will be conducted in footprint areas not previously surveyed that have high potential for including plant species ranked as S1 to S2 by the CDC. Within the borrow areas, the boundaries of any locations that support populations of S1 species will be clearly marked and avoided. The boundaries of any areas that support populations of S2 species will be flagged and avoided to the extent feasible.

Substantial effects on plant species that may be near a range limit are not expected. Only two of nine known locations of hairy goldenrod may be affected by the proposed Project. It is likely that there are other hairy goldenrod locations in the Local Study Area and the surrounding region. The known

locations for the remaining three range limit species are either outside of the Project Footprint or are within the priority habitat patches that will be flagged and avoided (Section 5.6.1.1).

Accidental fires could affect priority plants in a manner similar to priority habitats. The risk that a fire may occur or that the proposed Project will affect fire intensity and/or severity will be minimized through the same EnvPP measures identified in Section 5.6.1.1.

Reed canary grass and white sweet clover are the only invasive species known to be present in the area. The Canadian Botanical Conservation Network (2008) considers both of these species to have low invasive potential beyond small areas. White sweet clover appears to be confined to disturbed areas where the organic topsoil has been removed. Measures to minimize the risk of introducing or spreading invasive and/or non-native plants in the EnvPP will include the following:

- Contractors utilizing equipment and machinery that was recently used more than 150 km from the Project area will wash that equipment and machinery prior to transport to the Project area; and
- Areas that are rehabilitated using a seed mixture will be seeded with a mixture that only contains native and/or non-invasive introduced plant species.

Potential residual effects of the proposed Project on plant species are expected to be adverse, local, low in magnitude, continuous, long term and reversible (Table 5.6-3).

Table 5.6-3: Plant Species Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Possible loss of priority plant species due to clearing, disturbance and indirect effects.	• Road relocated from top to bottom of esker along western portion of route • Clear only within the road, camp, and refined borrow area footprints • Limit clearing within ROW to the maximum extent possible • Clearly mark designated priority habitat patches and avoid to the maximum extent possible • Block existing trails through or near priority habitat patches identified for avoidance in areas that will be cleared • Conduct pre-construction surveys in footprint areas that have high potential Clearly mark and avoid S1 plant areas if identified in pre-construction borrow area surveys • Clearly mark S2 plant areas if identified in pre-construction borrow area surveys and avoid to the extent feasible. • Limit clearing activities to the extent possible • EnvPP	Not measurable.	Adverse, low magnitude, Project Footprint, continuous, long term and reversible.
Possible extirpation or substantial reduction of priority plant species due to fires.	• Maintain existing/natural fire guards • Carry out fire prevention practices during construction • Provide fire suppression equipment on-site • EnvPP	No change.	No effect. Minimal risk of an accidental fire.
Possible introduction or spread of invasive and/or non-native plant species.	• Contractors utilizing equipment and machinery that was recently used more than 150 km from the Project area will wash that equipment and machinery prior to transport to the Project area. • Areas that may be seeded to assist rehabilitation and prevent erosion will be seeded with a mixture that only contains native and/or non-invasive introduced species. • EnvPP	Not measurable if mitigation and follow-up are effective.	Adverse, low magnitude, Project Footprint, continuous, long term and reversible.

5.6.1.5 Fragmentation

The Project would increase road density from 0.03 to 0.05 km/km^2, which is well below the 0.16 km/km^2 benchmark used for one of the North American animal species that are most sensitive to roads (Appendix B2). Quantitative results are only available for the central portion of the Habitat Mapping Area, but the final conclusion is unchanged since the expectation is that Regional Study Area road density is lower than that of the Habitat Mapping Area.

Potential residual effects of the proposed Project on fragmentation are expected to be adverse, local, low in magnitude, continuous, long term and not reversible (Table 5.6-4).

Table 5.6-4: Fragmentation Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Increased fragmentation and linear disturbance.	•No mitigation identified	Habitat Mapping Area road density increases from 0.03 km/km^2 to 0.05 km/km^2 (below the 0.16 km/km^2 benchmark for sensitive animal species).	Adverse, low magnitude, Local Study Area, continuous, long term and not reversible.

5.6.2 Wildlife

The effects of the proposed Project on wildlife are based on the assessment conclusions for terrestrial ecosystems and habitats in Sections 5.6.1. The following sections assess potential effects on invertebrates, amphibians, birds and mammals. Mitigation measures are proposed to avoid or minimize adverse effects on wildlife.

5.6.2.1 Invertebrates

Given the small scale of most invertebrate home ranges and the associated abundance of microhabitat available to individuals and communities within the Project Footprint, potential adverse effects are not measurable, given very high and widely distributed population levels and high recruitment rates that are most often associated with invertebrate species.

No terrestrial invertebrate species at risk (MESA or SARA (Schedule 1) are known to occur in the region or within the Hayes River Upland Ecoregion surrounding this area. Mitigation measures developed for other affected environmental components will also address potential effects on invertebrates.

Potential residual effects of the proposed Project on invertebrate populations are expected to be adverse, confined to the Project Footprint, low in magnitude, short term and reversible.

5.6.2.2 Amphibians

Amphibian species potentially affected by the proposed Project include the wood frog, boreal chorus frog and northern leopard frog, although the latter has not been observed during any project-related amphibian surveys (Section 3.4.2.2).

Most of the Project Footprint to be disturbed is located in black spruce pure on peatland habitat (Figure 3.4-3). This habitat type generally provides suitable foraging habitat for frogs. The small, long-term loss of amphibian habitat due to construction activities will be partially offset by slight improvements in other habitats, where increased ponding may occur in low areas adjacent to the road and borrow area.

The risk of collision with construction vehicles could be an issue of concern in areas adjacent to wetlands. Studies will be conducted to confirm whether this is an issue during the construction period, but it is not expected to be substantial.

Hydrocarbon residues, salts and sediment from road runoff can have adverse effects on amphibian populations (Carr and Fahrig 2001). The potential for adverse effects to occur as a result of fuel spills is small, site-specific and primarily dependant on the occurrence of accidental events (e.g., fuel/oil spills).

The potential effects of the Project on amphibians will be reduced by minimizing the amount of clearing, clearing during the winter, retaining a minimum 30-m buffer of shrubs and trees near streams and other waterbodies, and using silt fences to minimize in-stream siltation. Placement of slash away from streams and the development of culverts at crossings will help to maintain corridors between breeding wetlands and year-round frog habitat.

Species at Risk

The northern leopard frog has the potential to occur in the region and is listed as a species of special concern by SARA and COSEWIC. Some high quality wetlands near the proposed road may support higher amphibian populations; however, none of these wetlands occur within the proposed road ROW or within the refined borrow areas (Figure 3.4-5). In addition, there are high quality wetlands present within the surrounding Local Study Area and Regional Study Area (Figure 3.4-5) that would be suitable habitat for this species. As the overall habitat loss for this group of species will be minimal near the proposed road, and these habitats are available elsewhere, the Project is highly unlikely to have a measurable effect on individuals which may reside in the Local Study Area, or to the regional populations of the northern leopard frog.

Summary of Effects

Potential effects of the proposed Project on amphibians are associated with clearing of habitat for infrastructure, fragmentation affecting frog breeding and over-wintering habitat, mortality associated with construction vehicles, and creation of breeding habitat in low-lying areas. Potential residual effects of the proposed Project on amphibian populations are expected to be adverse, confined to the Project Footprint, low in magnitude, continuous, long term and reversible (Table 5.6-5).

Table 5.6-5: Amphibian Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Removal of frog habitat due to clearing, blasting and other construction activities.	• Limit clearing and blasting (if any) to the extent feasible • Limit clearing activities within the road ROW • Limit clearing activities to the winter months • Retain a 30-m buffer of trees and shrubs adjacent to waterbodies • Place clearing debris away from waterbodies • Revegetate disturbed areas not required for Project infrastructure • EnvPP	Small loss of some frog habitat.	Adverse, low magnitude, Project Footprint, long term, continuous and reversible.
Fragmentation of frog breeding and over-wintering habitats from road and other infrastructure development.	• Limit clearing and blasting (if any) to the extent feasible • Retain a 30-m buffer of trees and shrubs adjacent to waterbodies • Install through-grade culverts to maintain corridors drainage between wetlands • Revegetate disturbed areas not required for Project infrastructure • EnvPP	Small loss of frog habitat.	Adverse, low magnitude, Project Footprint, long term, continuous and reversible.
Increased mortality rate and habitat impairment due to road runoff containing hydrocarbon residues, salts and sediments.	• Use erosion control mats, geotextiles, silt fences and other methods to control erosion and limit sedimentation • Use approved dust control measures • EnvPP	Small increase in frog mortality.	Adverse, low magnitude, Project Footprint, long term, continuous and reversible.
Contamination of breeding ponds due to accidental spills of fuels, lubricants, solvents, etc.	• Locate fuel storage away from surface waters • Store fuels in approved storage tanks and follow storage procedures • Prohibit fuelling within 100 m of waterbodies • Use approved storage tanks/ containers • EnvPP	Small increase in frog mortality.	Adverse, low magnitude, Project Footprint, long term, sporadic and reversible.

Table 5.6-5: Amphibian Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Increased adult frog mortality due to vehicle collisions.	• Limit vehicle speed on road • Post signs warning drivers about wildlife collisions • AMP • EnvPP	Small increase in frog mortality.	Adverse, low magnitude, Project Footprint, long term, sporadic and reversible.

5.6.2.3 Reptiles

The effects of the proposed Project on reptiles are not expected to be an issue of concern because the region is outside the known distribution range of reptiles and there is no evidence or sightings of reptiles in the area (Section 3.4.2.3).

5.6.2.4 Birds

Bird species that will be affected by the proposed Project are primarily forest-dwelling species that breed within plant communities of the Local Study Area (i.e., younger regenerating and moderate-age black spruce-dominant forests and woodlands; Section 3.4.1.1; Figure 3.4-1). These plant communities and the birds that breed within those habitats are common throughout the northern boreal region of Manitoba (Erskine 1977).

Songbirds (Passerines)

Based on studies undertaken in support of this EA report, the most abundant birds found within the region during spring are songbird species. Several of these species are experiencing possible long-term population declines that are due in part to destruction of breeding and overwintering habitat (e.g., Blancher 2003). The footprint of the proposed Project will remove a maximum of approximately 1,766 ha of potential bird habitat, which is approximately 1.2% of the Regional Study Area (Section 5.6.1). Birds breeding and foraging adjacent to the construction activity areas may seek alternative cover in the Local Study Area for breeding/foraging as a result of construction disturbance. Project development will provide suitable habitat for some species of songbirds and have adverse effects on others. Species that breed in areas with edge habitat would benefit from the increased structure and food resources, but may be adversely affected by the increased risk of nest predation by other birds such as the American crow and common raven and mammals such as squirrels (Yahner and Scott 1988). Positive effects include increased diversity of nesting structure (i.e., presence of shrubs, young trees and grasses) and food sources (e.g., insects, berries, seeds) associated within reseeded and regenerating cleared areas.

Gamebirds

Forest-dwelling upland gamebirds (e.g., spruce grouse and ruffed grouse) will potentially experience some loss of terrestrial habitat from construction activities. The activities will result in less cover and

less breeding and foraging habitat. Although clearing at borrow areas will initially result in the loss of upland gamebird habitat, rehabilitation of disturbed areas will result in more open areas of young regenerating vegetation, providing suitable habitats for ptarmigan and sharp-tailed grouse (Storch 2000). Newly created edges due to clearing activities are often colonized by hardwood shrubs, which provide foraging habitat for ruffed grouse (Rusch *et al.* 2009).

Gamebirds may also limit habitat use within the vicinity of construction areas due to noise and presence of machinery and people (e.g., Baydack and Hein 1987). Additional hunting pressure due to increased access for hunters via the road could also affect grouse populations. Implementation of the Access Management Plan is expected to mitigate the adverse effects of hunting.

Raptors

Many raptor species, including members of the hawk, falcon and owl families, use edge habitats and clearings for hunting purposes. The proposed Project would create edge habitat and forest clearings, which would create some raptor foraging habitat. This benefit may be somewhat offset, as there may be long-term removal of some nesting and perching habitat (e.g., trees). Great gray owls are known to be adversely affected by forest clearing activities. This species may be present in the Project Footprint (Bull and Duncan 1993). Artificial perches have not proven to completely replace natural perching/nesting trees for great gray owls. Therefore, this species is less common in areas that have been cleared (Bull and Duncan 1993). With the exception of ground-nesting snowy owls, short-eared owls and northern harriers, all of the raptor species observed and expected to be present in the Regional Study Area nest in trees (Alsop 2001, Houston *et al.* 1998, Duncan and Duncan 1998, Marks *et al.* 1994, Holt and Leasure 1993, Bull and Duncan 1993).

Shorebirds

Some species of shorebird (e.g., lesser yellowlegs) use wooded muskeg areas for nesting and foraging purposes (Tibbitts and Moskoff 2009). Areas cleared for the Project infrastructure would remove or degrade some of this habitat. At least one species of shorebird (e.g., killdeer) forages along roadsides, and often nests on gravel edges of roads and at open gravel areas such as borrow pits (Jackson and Jackson 2009). The Project may create some foraging and nesting habitat for killdeer.

Waterbirds

Although the majority of proposed Project clearing and construction activities will occur away from waterbodies, the road will pass adjacent to several ponds and will come in the vicinity of Gull Lake at Gull Rapids. Waterbirds potentially affected by construction activities include birds using the Gull Lake area near Gull Rapids (e.g., nesting gulls at Gull Rapids), ducks and geese using the lake and inland ponds, and cranes, rails and bitterns using bogs and fens adjacent to construction activities. Bird surveys undertaken in support of this EA report have indicated that waterbird activity is minimal in the immediate vicinity of the proposed road and main camp (phase one) at Gull Lake. Waterbird use of the area is concentrated at exposed rock reefs at Gull Rapids where up to 600 pairs of gulls nest. Gull nesting colonies at Gull Rapids are unlikely to be substantially disturbed by construction activities because the proposed road and camp areas are 0.5 km away.

Given that the region is not recognized by the Canadian Wildlife Service for providing important breeding, migration or staging habitat for waterbirds (Poston *et al.* 1990), the potential effects of road construction on waterbird populations is anticipated be site-specific and minor.

Species at Risk

A number of the listed bird species use similar wetland habitat. The yellow rail is listed as a species of special concern under SARA (Schedule 1) that may occur in grassy marsh/fen habitat in the region (Bookhout 2009). The short-eared owl, which is listed as a species of special concern by COSEWIC, also requires large grassy marsh/fen areas for breeding (Holt and Leasure 2009). The rusty blackbird, listed as a species of special concern under Schedule 1 of SARA, nests along marshy lake margins, slow-moving streams, peat bogs and beaver ponds. These wetland habitats, although they do occur to a limited extent in the Project Footprint and Local Study Area, are considered common and widely distributed in the surrounding area (Figures 3.4-3 and 3.4-5). As the overall habitat loss for this group of species will be minimal near the proposed road, and these habitats are available elsewhere, the Project is highly unlikely to have a measurable effect on individuals which may reside in the Local Study Area, or to the regional populations of the yellow rail, the short-eared owl, and the rusty blackbird.

The common nighthawk, listed as threatened by COSEWIC, is known to occur and likely nests in the Regional Study Area, based on studies undertaken in support of this EA report. This species nests on bare rock or gravel and forages along rock outcrops, recent burns and other forest clearings (Poulin *et al.* 2009). Recently burned, regenerating habitat is widespread throughout the Local Study Area (Figure 3.4-3), and is considered to be high quality habitat for this species. As common nighthawks prefer edge habitat, openings, and nest on bare rock, there could actually be a small gain in foraging and roosting/nesting habitat following the Project (i.e., in cleared borrow areas once human activities have ceased) for this species. Nesting opportunities for common nighthawk may be temporarily limited due to disturbances during the construction period, but the creation of small forest clearings and remaining rock outcrops would increase habitat in the longer term. Similar to songbirds, species at risk that may breed and forage adjacent to the construction activity areas may seek alternative cover in the Local Study Area for breeding/foraging as a result of construction disturbance.

The olive-sided flycatcher, a threatened species under COSEWIC, uses recent burns, clearings, riparian zones and forest edges and nests in conifers (Manitoba Naturalists Society 2003). This species is often found in wet forest areas with standing dead trees, typical of recent burns present in the Local Study Area. As often occurs in northern Manitoba following burns (where the fire is severe enough to remove surface organic material), there can be melting of ground ice resulting in pooling of water at the soil surface. Recently burned, regenerating habitat is widespread throughout the Local Study Area (Figure 3.4-3), and is considered to be high quality habitat for the olive-sided flycatcher.

The peregrine falcon may occur as a transient migrant within the Regional Study Area, but not as a breeder, as optimal nesting habitat for this species (i.e., high nesting cliffs) does not occur in the area. As such, it is not expected that the Project will have any effects on this species.

Summary of Effects

The potential effects of Project construction activities on birds are anticipated to be small and localized because the vegetated areas to be disturbed are widely available in the areas surrounding the Project Footprint. The effects on birds will be reduced through minimizing the amount of clearing to the extent possible, clearing during winter prior to the peak breeding season (May, June, July), and retaining buffers of shrubs and trees for cover and nesting habitat near streams and other waterbodies. Other effects on birds related to construction activities include occasional construction vehicle strike mortalities, hunting pressure from construction workers and increased access to the area by local hunters. These potential effects will be mitigated in part through the Access Management Plan (Appendix E). Speed restrictions for construction vehicles and limiting access to the road will reduce bird mortalities due to vehicle collisions and hunting during construction.

Spills or leaks of hazardous substances such as petroleum products (e.g., fuels, oils, lubricants) during construction may adversely affect terrestrial and aquatic habitat in areas where birds forage and nest. The effects of petroleum product spills on birds would generally be very small and site-specific if they occur in terrestrial habitat. The risks and magnitude of potential effects of hazardous material spills are expected to be minimized through the implementation of measures outlined in the EnvPP (e.g., proper containment and storage of fuels away from waterbodies and other potentially sensitive sites).

Potential residual effects of the proposed Project on bird populations are expected to be adverse, confined to the Project Footprint, low in magnitude, short term, sporadic to continuous and reversible (Table 5.6-6).

Table 5.6-6: Bird Population Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Removal of bird habitat due to clearing for Project infrastructure.	• Clearing will occur outside the peak bird breeding season (April - July) to the extent feasible • Clearing will be limited to the extent feasible • Disturbed areas not required for Project infrastructure will be revegetated • EnvPP	Minimal, local loss of bird habitat.	Adverse, low magnitude, Project Footprint, continuous, long term and reversible.

Table 5.6-6: Bird Population Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Bird avoidance of Project areas due to clearing, blasting and other construction activities.	• Clearing and blasting (if any) will occur outside of peak bird breeding season (April – July**) to the extent feasible • Limit clearing and blasting (if any) to minimum extent possible • EnvPP	Avoidance of some local areas by some birds.	Adverse, low magnitude, Local Study Area, continuous, long term and reversible.
Increased bird mortality due to vehicle collisions along the road.	• Limit vehicle speed on the road • Post signs warning drivers about wildlife collisions • Educate drivers about avoiding wildlife collisions • EnvPP • AMP	Minimal increase in bird mortality.	Adverse, low magnitude, Project Footprint, continuous, long term and reversible.
Increased game bird mortality due to increased hunter access.	• Limit road access by hunters and trappers • Post 'no hunting' signs in the Project area • EnvPP • AMP	No residual effects expected due to access restriction on the road.	Not applicable

5.6.2.5 Mammals

Ungulates

Ungulates in the Regional Study Area use a wide variety of habitats that include forested areas, sparsely treed peatlands and riparian areas. Winter and summer food and cover for moose and caribou range from uncommon to common in the Local Study Area and in the surrounding region. Burned habitats in the Local Study Area tend to attract moose (Franzmann and Schwartz 2007), while caribou avoid these habitats until foods such as lichens re-grow (Schaefer and Pruitt 1991, Dunford 2003). In the Local and Regional Study Areas, priority habitat includes calving habitat complexes and islands. Other habitats are not expected to be as important, or potentially limiting, to caribou or moose populations in the Local Study Area, and the surrounding region. Although physical habitat losses may occur during clearing of the ROW and construction of the road which may result in further habitat alienation, substantial effects are not expected for these species as habitat availability does not appear to be a limiting factor for these populations.

Although there is potential for the esker to be used as a short-distance travel corridor by moose and caribou, there is little evidence to indicate that the Local Study Area is an important migration corridor. Qamanirjuaq and Cape Churchill animals tend to move mainly in a north/south direction

in the region. While the Pen Islands caribou tend to move in an east/west direction, these movements occur mainly to the south of the Nelson River, and not in the Local Study Area, based on studies undertaken in support of this EA report.

Mammals such as moose are often attracted to habitat edges to forage, including road ROWs (James *et al.* 2004). Consequently, there may be increases in wildlife-vehicle collisions as well as higher mortality through increased accessibility for hunters and predators. Multiple factors may limit populations at various measurable scales (Dussault *et al.* 2005). As hunting and trapping is expected to increase adjacent to the proposed road, this may result in an increased mortality rate for some mammal species. Priority species such as moose and caribou that generally have low population recruitment rates are most likely to be adversely affected by the proposed road (James *et al.* 2004), particularly if the additive overall mortality rate exceeds sustainable levels for small populations.

Furbearers

Broadleaf habitats are often found on mineral soil (e.g., trembling aspen mixture on mineral soil, jack pine mixedwood on mineral soil and tamarack mixture on mineral soil). Terrestrial furbearers and small mammals tend to occur at higher densities in these uncommon habitat types. Mitigation measures include minimizing the loss of uncommon habitats in borrow areas. Where habitats cannot be avoided in the ROW, a few mammal populations may experience marginal declines in abundance resulting from this habitat loss. These potential changes are likely to be small (i.e., not measureable at the population level).

The construction of the proposed road and associated infrastructure may result in increased human-wildlife encounters that may require management actions, typically for beaver and black bear. Standard mitigation measures to minimize these potential effects include consultation with Natural Resource Officers, keeping garbage away from wildlife, properly managing grey water, not feeding wildlife, and educating construction personnel and the public.

Species such as beaver, with high population recruitment rates are least likely to be adversely affected from increased access. An Access Management Plan is expected to reduce the potential effects of hunting and trapping that may be attributed to increased access along the proposed road.

Potential effects, including decreased habitat effectiveness, habitat fragmentation and wildlife-vehicle collisions, are similar to those discussed for ungulates. These effects are also anticipated to be small for furbearers.

Potential residual environmental effects of the Project on furbearer species including beaver are expected to be adverse, local to regional, low magnitude and long term.

Physical habitat losses may occur for some priority mammal species during clearing of the ROW and construction of the road, which may result in habitat alienation. Substantial effects are not expected for species that may be near their range limit (i.e., wolverine, raccoon and porcupine), where animals may be uncommon due to large home range size or where habitat is limited. It is unlikely that important habitats for these species would be adversely affected by the road.

Consideration of priority and wetland habitats during routing of the road and mitigation measures prescribed in Sections 5.3.1.2, 5.3.1.3 and 5.3.1.5 ensures that minimal amounts of habitat will be affected.

Small Mammals

Mammals with small home ranges (e.g., mice, voles or shrews) may experience higher levels of habitat fragmentation (Andren 1994), but these potential adverse effects are not measurable, given very high and widely distributed population levels and high recruitment rates that are most often associated with small mammal species.

Species at Risk

For the purposes of this environmental assessment, summer resident caribou (and their respective habitats) are treated as a woodland caribou ecotype. For this group of animals, important and critical habitat losses are expected to be small to none. The Local Study Area has a small amount of caribou calving habitat compared to the surrounding region. One moderate quality potential caribou calving complex and four low quality potential calving complexes are present in sparsely treed peatlands adjacent to the ROW for the proposed road. Potentially significant adverse effects on caribou calving habitat in the Local Study Area were mitigated by adjusting the alignment of the road. This mitigation avoids caribou habitat and, as measured to the nearest potential calving island, provides a 500 m or greater buffer against sensory disturbances and possible habitat alienation.

Edge habitat along roads can facilitate the movement of mammals, especially during winter when snow can impede travel (Forman and Alexander 1998, James *et al.* 2004, Belisle 2005). Conversely, large **berm**s (e.g., snow, debris, earth piles) may act as barriers to movements (Belisle 2005). Although the road may act as a semi-permeable barrier, most mammals with moderate to large home ranges such as caribou and moose will continue to cross the road (Dyer *et al* 2001, Belisle 2005). Furthermore, predators such as wolves may also use the roads and trails associated with the proposed Project as they may act as conduits for travel (James *et al.* 2004). If this occurs, predation rates could increase and vulnerable species such as woodland caribou may be affected. The proposed Project is predicted to increase the road density from 0.03 km/km^2 to 0.05 km/km^2; therefore, potential effects on the movements and distribution of wolves and other mammal populations are anticipated to be small.

Vehicle traffic along the road and increased vehicle traffic along PR 280 may result in an increased risk of wildlife-vehicle collisions. Measures to reduce wildlife-vehicle collisions include reducing traffic speeds, posting wildlife warning signs and careful planning to allow for increased visibility along the ROW.

Summary of Effects

The presence of humans and machinery along the road and in the borrow areas may influence habitat effectiveness through sensory disturbances, including physiological stress related to auditory, visual and physical stimuli (Jalkotzky *et al.* 1998, Dyer *et al* 2001). Habitat effectiveness measures the degree to which identified quality habitat will be used by a species after accounting for human

disturbance (Dykstra 2004). The loss of habitat effectiveness is not anticipated to extend beyond one kilometre on either side of the ROW and borrow areas in most circumstances. Portions of one moderate quality and four low quality potential caribou calving complexes may be affected by sensory disturbances within one kilometre of the road. As the surrounding region contains more than 100 potential calving complexes in bogs and at least 33 additional verified calving islands in lakes, these potential effects are considered small given the quantity of available habitats in the region. Mitigation measures proposed to reduce these effects include limiting access to construction traffic and planning initiatives such as limiting blasting (if any) to outside sensitive periods (mid-May to early July). Buffers may be used to provide protection against sensory disturbances in proximity to sensitive habitat types. The summer resident caribou may require additional protection. Prior to blasting, the level of calving activity will be verified in the Local Study Area. Mitigation measures include no blasting (to the maximum extent possible) within a 5 km radius of active calving habitats and limiting borrow activity within two kilometres of adjacent calving sites from mid-May to early July.

The proposed Project is not expected to substantially affect habitat fragmentation as measured by road density. As described previously, the total road density increases from 0.03 km/km^2 to 0.05 km/km^2 which is well below the 0.16 km/km^2 benchmark used for one of the North American animal species that are most sensitive to roads. Past studies that have used benchmarks for linear feature density focused on road density. In other regions, road densities below 0.16 km/km^2 are not expected to affect grizzly bears, which are considered to be one of North America's most sensitive species to roads. Even though grizzly bears are not expected in the study area (COSEWIC 2002), this species is often used as a benchmark for assessing the effects that a road may have on other wildlife species that are likely less sensitive to fragmentation. The regional predicted post-construction road density is well below this benchmark; consequently, the expected level of fragmentation by the road should not have a measurable effect on other mammal species found in the Regional Study Area.

Potential residual effects of the proposed Project on protected and other priority mammal species are expected to be adverse, local to regional, low magnitude and long term. Substantive environmental effects are not expected for any other mammal species or their habitats given the mitigation measures identified. A summary of the effects of the proposed Project on mammals is provided in Table 5.6-7. Follow-up will be implemented to ensure that mitigation measures implemented are effective.

Table 5.6-7: Mammal Population Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
Removal of mammal habitat due to clearing for Project infrastructure. Loss of mammal habitat: 1.6% to 7.1% of Local Area and 0.16% - 0.71% of region.	• Limit clearing to the minimum extent feasible • Revegetate disturbed areas not required for the Project infrastructure • EnvPP	Minimal loss of mammal habitat.	Adverse, low magnitude, Project Footprint to Regional Study Area, continuous, long term and reversible.

Table 5.6-7: Mammal Population Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Fragmentation of mammal habitat due to clearing for the road and other infrastructure. Region road density increases from 0.03 km/km^2 to 0.05 km/km^2 which are well below the 0.16 km/km^2 benchmark.	• Limit clearing to the minimum extent feasible • Revegetate disturbed areas not required for Project infrastructure • EnvPP	Effects not measurable for small mammal species.	Adverse, low magnitude, Project Footprint to Regional Study Area, continuous, long term and reversible.
Mammal (esp. summer resident caribou) avoidance of Project area due to increased sensory disturbance, including physiological stress related to auditory, visual, and physical stimuli.	• Schedule construction so as to minimize blasting (if any) to the maximum extent during sensitive young-rearing months (mid-May to early-July) • Limiting access to construction traffic • Limit construction vehicle speeds • EnvPP • AMP	Minimal avoidance of the Project area.	Adverse, low magnitude, Project Footprint to Regional Study Area, sporadic, short term and reversible.
Modified movement patterns for mammal species – both predator and prey species.	• Limit clearing to the minimum extent feasible • Prohibit use of salt for dust and ice control • EnvPP	Minimal risk of changes to mammal population movement patterns.	Adverse, low magnitude, Project Footprint to Regional Study Area, continuous, long term and reversible.
Increased mammal mortality due to vehicle collisions along the road.	• Limit vehicle speed on the road • Post signs warning drivers about wildlife collisions • Educate drivers about avoiding wildlife collisions • EnvPP • AMP	Minimal risk of mammal mortality.	Adverse, low magnitude, Project Footprint to Regional Study Area, sporadic, short term to long term and reversible.
Increased mammal mortality due to increased access for hunters and trappers.	• Limit road access by hunters and trappers • Post 'no hunting' signs in the Project area • EnvPP • AMP	No residual effects expected due to road restriction.	Not applicable

Table 5.6-7: Mammal Population Effects Assessment Summary			
Potential Environmental Effect	**Mitigation Measures**	**Residual Environmental Effect**	**Evaluation of Residual Effect**
Increased mammal mortality due to human-wildlife encounters with problem wildlife.	• Consult with Natural Resources Officers, if required • Use proper garbage handling and disposal procedures • Use proper grey water management procedures • Prohibit feeding of wildlife • Educate construction personnel to avoid creating problem wildlife • EnvPP • AMP	Negligible reduction in mammal populations.	Adverse, low magnitude, Local to Regional Study Area, sporadic, short term and reversible.
Increased physiological stress on summer resident caribou during calving and rearing season.	• Road alignment designed to avoid sensitive caribou habitat • Schedule and limit construction so as to minimize blasting (if any) to the maximum extent possible within 5 km of active calving habitats from mid-May to early July • Limit borrow activity within 2 km of active calving sites from mid-May to early July • EnvPP	Minimal risk of mammal mortality.	Adverse, low magnitude, Regional Study Area, sporadic, short term and reversible.

5.7 SOCIO-ECONOMIC EFFECTS AND MITIGATION

5.7.1 Direct Employment and Business Opportunities

This section examines the direct employment and business effects of the proposed Project on the four First Nation communities in the KCN Community Study Area. It examines the nature and timing of the employment opportunities that will be available, identifies key factors that will influence the ability of KCN residents to participate in these opportunities, and assesses the potential extent of their involvement in these opportunities. Where relevant, employment effects on other groups, in particular northern Aboriginal residents beyond the KCN communities, will be noted. Only construction employment effects are considered as Project jobs are concentrated in this period of the work. Operation and maintenance employment opportunities will be minimal.

5.7.1.1 KCN Community Study Area Direct Employment Effects

Overview

The KCN communities have higher than average unemployment levels and the labour force will continue to grow as a result of the high proportion of youth in the communities. A number of converging factors would enable KCN Community Study Area residents to secure a high proportion of the jobs available from the proposed Project. These factors are as follows:

- Occupation mix;
- Pre-project training;
- Hiring process; and
- Capacities to meet DNC requirements.

Occupational Mix

Project workforce requirements include occupations in which KCN Community Study Area residents have relevant experience or training acquired through work on local construction projects, such as house or road building, employment on construction of other hydroelectric projects, such as Wuskwatim or Limestone, or completion of Keeyask Pre-Project Training. Table 5.7-1 presents a summary breakdown of the person-years of employment by broad occupational category and notes those categories where KCN participation could be high (e.g. construction support, non designated and selected designated trades). These categories account for 73% of the person-years of Project construction employment. The remaining three categories would likely have some positions that could also be filled by KCN members.

Table 5.7-1: Occupations Where KCN Participation Could Be High

Labour	Quarterly Peak Employment Opportunities	Person Years of Employment	% of Total Person Years	Potential for High Local Region Participation
NON-DESIGNATED TRADES (CONSTRUCTION, TRANSPORTATION AND INDUSTRIAL)				
All Occupations	60	80	43%	✔
DESIGNATED TRADES (CONSTRUCTION, TRANSPORTATION AND INDUSTRIAL)				
Carpenter, Electrician, Plumber	13	14	8%	✔
Other Non Designated Trades	8	9	5%	
SUPPORT OCCUPATIONS				
Catering, Security, First Aid, Employee Retention Support	22	41	22%	✔
Other Support Occupations	4	4	2%	
OTHER				
All Occupations	19	36	19%	
Infrastructure Project Estimated Workforce	126	184	100%	73%

*Source: Derived from Figure 5.7-1 and Appendix A3.

Pre-Project Training

Since 2001, the KCN communities have been undertaking Pre-Project Training programs heavily oriented towards Wuskwatim and Keeyask (proposed) construction employment opportunities, as part of the Hydro Northern Training and Employment Initiative. These programs have provided training to prepare KCN residents for:

- Designated trades that would be locally useful after construction (e.g. carpenter, electrician, plumber) as well some specialized construction trades (e.g. crane operator);
- Non designated trades (e.g., heavy equipment operator, truck drivers); and
- Construction support occupations (e.g., security, catering).

More than 200 KCN residents have completed their course work in construction trades and occupations providing a pool of people who would be interested in, and partially or fully qualified for Project related jobs.

Hiring Process

Under the Burntwood Nelson Collective Agreement, which governs wages and working conditions, including hiring processes, northern Aboriginal businesses that have negotiated contracts can directly hire northern Aboriginal residents for their workforce. This means the direct hire process applies to 10 of the 11 contract packages that are part of the proposed Project. The DNCs with each KCN are being undertaken by contractors whose majority ownership is from a KCN community. The ability of these contractors to direct hire maximizes the likelihood of qualified Aboriginal residents of KCN communities being hired for a Project related job before someone else is hired.

For the competitively bid bridge contract, Aboriginal residents of KCN communities will share first hiring preference with other northern Aboriginal residents living in communities in the vicinity of the Churchill, Burntwood and Nelson Rivers. Hiring for this contract will be done through the job order process set out in the Burntwood Nelson Collective Agreement. Manitoba Hydro staff will be hired using the Corporation's standard hiring process which includes employment equity criteria.

In addition to these factors, participation in Project employment opportunities will be influenced by how interested and willing KCN residents are to pursue these jobs. Job seekers will be motivated by the opportunity to earn substantial income in a short period of time, to improve their future employment prospects and to be employed rather than unemployed. Some KCN residents may be deterred by having to work in unfamiliar conditions away from their family for extended periods of time, by lack of adequate day care, or by concerns about experiencing discrimination.

Level of Participation in Project Employment Opportunities

Most of the proposed Project's employment opportunities are likely to be filled by KCN residents. Based on the factors discussed above, KCN residents could participate in a majority of these opportunities. This could result in an as much as 110 person-years of work for residents of the region, a sizeable contribution to the local economy. This level of participation is associated with a high level of interest in Project jobs by qualified KCN residents and the assumption that KCN

communities will be able to secure the DNC contracts that are available to them. Uptake by KCN residents would lower at lesser levels of interest, resulting in less than full realization of the DNC contracts by KCN communities. Uptake by some KCN residents (e.g., York Factory First Nation and War Lake First Nation) could also be lower due to logistical challenges faced by community members in traveling to the Project location. This is of particular concern during the "shoulder seasons" in spring and fall when access by ferry or winter road is not available. For the remaining times of the year, community members could travel to Split Lake or Gillam where bussing to the Project site may be available.

Due to the direct and preferential hiring provisions, other northern Aboriginal residents would also benefit from Project related employment. This group is larger and has a wider range of construction skills than in the KCN Community Study Area. Other northern Aboriginal residents would fill the jobs available when the pool of interested and qualified KCN residents is depleted. The combination of KCN residents and other northern Aboriginal residents could account for up to 75% of construction employment opportunities.

Effects of Project Employment

Those employed on the proposed Project will benefit from higher incomes, as well as contributing to increased business activity and induced employment in their home communities and in the regional service centers of Thompson and Gillam. KCN community members who are able to secure jobs will obtain work experience that will enhance their ability to access future potential Keeyask GS construction jobs as well as other construction jobs in their community and elsewhere in northern Manitoba. There may also be some adverse effects, including unpleasant work experiences leading to voluntary quitting or involuntary discharge, easier access to drugs or alcohol, and disruption of family and community life from being away from home.

A summary of effects of the proposed Project on KCN Community Study Area employment is provided in Table 5.7-2 below.

Table 5.7-2: KCN Community Study Area Employment Effects Assessment Summary

Potential Socio-Economic Environmental Effect	Mitigation Measures	Residual Socio-Economic Environmental Effect	Evaluation of Residual Effect
Increased KCN employment as well as increased pre-project training and northern Aboriginal employment.	• DNCs will help enhance Project employment opportunities for KCN residents and other northern Aboriginal residents.	Increased construction related employment for KCN residents and other Northern Aboriginal Residents.	Positive, moderate magnitude, short term, KCN Community Study Area, Northern Manitoba Study Area.

Table 5.7-2: KCN Community Study Area Employment Effects Assessment Summary			
Potential Socio-Economic Environmental Effect	**Mitigation Measures**	**Residual Socio-Economic Environmental Effect**	**Evaluation of Residual Effect**
Increased stress and anxiety for workers in new environments and away from families and home communities for extended periods.	• Support services and employee retention services will be available. • Ongoing communication with KCN communities to identify and address issues.	Some degree of stress and anxiety due to new work situations and periods away from home will persist.	Adverse, moderate magnitude, short term, KCN Community and Northern Manitoba Study Areas.
Increased worker exposure to drugs and alcohol.	• Camp rules and policies • Support services and employee retention services will be available. • Worker education. • Ongoing communication with communities to identify and address issues. • Liaison with local RCMP • EnvPP	Some potential for exposure to drugs and alcohol and drug and alcohol abuse will remain.	Adverse, low magnitude, short term. KCN Community and Northern Manitoba Study Areas.

5.7.1.2 KCN Community Study Area Business Opportunities

With 10 of the 11 work packages for the construction of the Project being DNC's provided to businesses largely owned by KCN communities, nearly all of the direct business opportunities from the proposed Project will accrue to KCN businesses. The experience gained from working on these contracts could result in long-term benefits through enhanced capacity to compete on future contracts. A summary of effects of the proposed Project on business opportunities is provided in Table 5.7-3 below.

Table 5.7-3: KCN Community Study Area Employment Effects Assessment Summary			
Potential Socio-Economic Environmental Effect	**Mitigation Measures**	**Residual Socio-Economic Environmental Effect**	**Evaluation of Residual Effect**
Increased KCN Community Study Area Business Activity. Increased employment income will induce business activity in the KCN communities.	• DNCs will help maximize KCN community business opportunities.	Increased direct and induced business activity in KCN communities.	Positive, moderate magnitude, short term, KCN Community Study Area.

5.7.2 Regional Supplies and Services

Increased demand for supplies and services in the regional service area, primarily Thompson and Gillam, will be created by purchases by Manitoba Hydro and Project contractors and spending by workers visiting these communities during time off. Services and facilities most likely to experience effects would include community recreation services, restaurant/hospitality services, health services, social services, and policing and enforcement services. Services and facilities with unused or under-utilized capacity will benefit from higher demand while those beyond the limits of their capacity may be adversely affected. Even in the heated economy that Thompson is currently experiencing, the magnitude of effect is expected to be low due to the relatively small scale and short duration of the proposed Project.

A summary of effects on regional supplies and services is provided in Table 5.7-4 below.

Table 5.7-4: Regional Supplies and Services Effects Assessment Summary

Potential Socio-Economic Environmental Effect	Mitigation Measures	Residual Socio-Economic Environmental Effect	Evaluation of Residual Effect
Increased demand for services and facilities in Thompson and Gillam.	• Maintain communication with communities including providing information about construction activities and timing.	Some additional demand for local supplies and services.	Both positive and adverse, moderate magnitude, sporadic, short term, Northern Manitoba Study Area.

5.7.3 Resource Use

5.7.3.1 Community and Domestic Resource Use

The proposed Project will displace and disrupt community/domestic resource use in the Project Footprint Study Area for the life of the Project. This may lead to increased pressures on resource use activities in areas outside of the Project Footprint. In the event the infrastructure is decommissioned, the Project Footprint will be rehabilitated and resource use activities could be restored in the area.

Manitoba Hydro on behalf of the Limited Partnership has negotiated separate Adverse Effects Agreements with Tataskweyak Cree Nation, War Lake First Nation, Fox Lake Cree Nation and York Factory First Nation. The agreements have been ratified and signed by each community. Adverse effects on resource use that arise from this Project will be addressed through offsetting program arrangements set out in these Agreements with any required program adjustments agreed to by the parties to each Agreement.

The Adverse Effects Agreements deal with the negative consequences of the planning, construction and operation of the proposed Project, either direct or indirect, which effect or change the physical, chemical or biological quality of the environment and includes, without limitation, risks or injuries to the health, safety, well-being, comfort or enjoyment of the First Nations and their members and impacts on interests in lands, pursuits, activities, opportunities, lifestyles and assets of the First Nations and their members. The agreements provide for releases from losses or damages related to the foreseeable adverse effects of the proposed Project.

Funding is provided for offsetting programs. The purpose of the offsetting programs is to provide appropriate replacements, substitutions and opportunities to offset unavoidable Keeyask adverse effects on the practices, customs and traditions integral to the distinctive cultural identity of the First Nations, including social, cultural, health and economic impacts.

5.7.3.2 Commercial Resource Use

The proposed Project may displace and disrupt trapping activities in the Project Footprint Study Area for the life of the Project. The proposed Project is not anticipated to have adverse effects on other forms of commercial resource use.

Although there is currently no registered holder of Trapline 15, there are a number of Tataskweyak Cree Nation families who use the area for trapping. Manitoba Hydro, on behalf of the Limited Partnership, intends to negotiate arrangements with affected trappers to compensate for any loss of commercial trapping income and damage to personal property that may arise from Project construction. It is seeking to have agreements and releases in place with trappers impacted by the proposed Project before construction begins.

While forested areas will be cleared and a volume of potentially useable timber will be removed, this will have no effect on the forest industry in Manitoba or the land base under forest management by the Province because the Project Footprint is outside the commercial forest zone. Historically, there has been no commercial scale timber demand in the region, nor is there any currently. The effect of clearing this forest area to the local timber supply is minimal as the affected area is far removed from any communities. Timber supplies required primarily for heating purposes in surrounding communities are readily available in closer proximity to all communities. Although the effect of clearing forestry resources is not reversible for the life of the proposed Project and therefore long term in nature, clearing is limited to the Project Footprint and comprises only a very small portion of the KCN Community Study Area.

A summary of effects on resource use is provided in Table 5.7-5 below.

Table 5.7-5: Resource Use Effects Assessment Summary			
Potential Socio-Economic Environmental Effect	**Mitigation Measures**	**Residual Socio-Economic Environmental Effect**	**Evaluation of Residual Effect**
Community/domestic resource use displaced and disrupted in the Project Footprint.	• Implementation of offsetting programs as set out in Keeyask Adverse Effects Agreements with program adjustments made as required. • EnvPP.	Minimal. Displaced / disrupted community domestic resource use offset by implementation of offsetting programs to create appropriate replacement resource use opportunities.	Residual adverse effects of low magnitude following implementation of offsetting programs, Project Footprint.
Commercial trapping displaced and disrupted in the Project Footprint.	• Compensation for loss or damage to be agreed to with affected trappers. • EnvPP. • AMP.	Minimal. Income loss or damage to personal property will be compensated for in agreements with affected resource users.	Residual adverse effects of low magnitude after compensation agreements resolved, Project Footprint Study Area.
Forested areas will be cleared but no effects on commercial forest industry; minor effects on local wood supply.	• Timber salvage to the extent feasible. • EnvPP.	None on commercial forestry; minor on local wood supply.	Adverse, low magnitude, long term, Project Footprint Area, not reversible.

5.7.4 Individual and Community Health, Safety and Wellness

The proposed Project could directly and indirectly affect the wellness, health and safety of both workers and members of the public in communities near the construction site. These effects, which could be positive as well as negative, may occur as a result of working on the Project, workers being away from their families and communities for weeks at a time and the off hours interaction of Project workers with community members. Effects can be summarized as follows:

- Accidents and injuries could occur in the workplace although there are strong preventative and response measures in place in this regard.

- The added income and self esteem that arise from being employed on the Project can have a beneficial effect on the well-being of Project workers and their families, while being away from home for extended periods can place strains on workers and families. Increased exposure or access to alcohol and drugs from having more money or a greater presence of people selling these products is another potential avenue for impacts on worker and family well-being.
- Concerns have been expressed about workers interacting or developing inappropriate relationships with young women from nearby communities during off-hours visits to these communities. Fox Lake Cree Nation members in the Gillam area have experienced this effect during construction of past hydroelectric projects taking place nearby (Fox Lake Cree Nation 1997).

First Nation communities have also identified effects at the community and individual level related to the stress and anxiety associated with becoming proponents in the Project. These effects are not easy to describe or assess. The proponents recognize and respect this and have worked to address their concerns through their planning, comments, and membership involvement, and current and future programming. Nevertheless, some stress and anxiety remains.

Adherence to Manitoba health and safety legislation, Manitoba Hydro safe construction practices and appropriate camp rules and policies, along with on-site worker education and support programs and communication with local communities to identify and address issues will minimize the likelihood and severity of potential effects. Elements of programs identified in Fox Lake Cree Nation's Adverse Effects Agreement may be useful in addressing adverse worker interaction issues.

A summary of effects on health, safety and wellness is provided in Table 5.7-6 below.

Table 5.7-6: Health, Safety and Wellness Effects Assessment Summary

Potential Socio-Economic Environmental Effect	Mitigation Measures	Residual Socio-Economic Environmental Effect	Evaluation of Residual Effect
Potential effects on worker health and safety while working on the Project and at the camps.	• Adherence to provincial workplace health and safety legislation and regulations. • Manitoba Hydro safe construction practices. • Camp security measures. EnvPP..	Some potential for construction accidents and injuries as well as security issues at the camp will remain.	Adverse, low magnitude, sporadic, short term, KCN Community and Northern Manitoba Study Areas.
Improvements to well-being from employment income and the self-esteem associated with being employed.	• Covered in Section 5.7.1on employment effects.	Enhanced well being from employment income and self-esteem of being employed.	Positive, moderate magnitude, short term, KCN Community and Northern Manitoba Study Areas.

Table 5.7-6: Health, Safety and Wellness Effects Assessment Summary			
Potential Socio-Economic Environmental Effect	**Mitigation Measures**	**Residual Socio-Economic Environmental Effect**	**Evaluation of Residual Effect**
Potential effects on workers and their families from workers being away from home and from increased exposure to alcohol and drugs.	• .Support services and employee retention services will be available. • Camp rules and policies. • Worker education. • Ongoing communication with communities to identify and address issues. • Liaison with local RCMP.	Some potential for effects on workers and their families.	Adverse, low to moderate magnitude following mitigation, short term, KCN Community and Northern Manitoba Study Areas.
Potential effects of workers interacting inappropriately with community members, especially young women, during off-hours visits to Gillam and Thompson.	• Camp rules and policies. • Worker education and cross-cultural training. • Implementation of Fox Lake Cree Nation Adverse Effects Agreement with adjustments made as required. • Offsetting programs that address adverse effects associated with an influx of workers. • Maintaining communication with surrounding communities to identify concerns.	Some potential for incidents will remain.	Adverse, moderate magnitude following mitigation, short term, KCN Community and Northern Manitoba Study Areas.

5.7.5 Traffic

The Project will increase traffic volumes on PR 280 between Thompson and Gillam. Additional trips will be generated to move freight, supplies, people and providers of incidental services such as mail to and from the Project site. In the absence of the Project, two way traffic volumes on PR 280 are projected to average between 77 and 335 vehicles per day in 2009, with lowest volumes occurring at the junction of PR 280 and PR 290 in the Gillam area and the highest occurring in the vicinity of the Split Lake turnoff.

It is estimated that the proposed Project could generate an average of 50 to 58 trips per day. Freight traffic would account for 6 to 8 trips, incidental service traffic for 12 trips and personnel shuttles and personal vehicles for 32 to 38 trips. An estimated 42 to 48 of these trips would originate from Thompson and Split Lake. The remaining 8 to 10 trips would be coming from and returning to Gillam. The impact of this project-related traffic on PR 280 traffic levels varies by location. The 42 to 48 daily trips originating in Thompson and Split Lake would increase average daily traffic in the

vicinity of the Split Lake turnoff about 13–14 %. Traffic levels at the junction of PR 280 and PR 290 would increase about 10 to 13%.

While this increase in volume will be visible to others travelling along this route, the overall increase in traffic levels from the proposed Project should not materially affect the level of safety or operational characteristics of the roadway nor increase collision rates. The proportion of collisions to traffic volume and severity distribution is expected to remain about the same as currently exists. Project summer peak traffic levels are within the range identified for a Secondary Highway (i.e., under 500 AADT)[12].

While this traffic volume is within the capacity of this type of facility, many areas requiring improvement have been identified along this section of PR 280. A road improvement program has been approved for funding, with work currently scheduled for 2011. Improvements include curve shaving, widening and grade improvements at numerous locations between Thompson and the access road turnoff.

A summary of effects on traffic is provided in Table 5.7-7 below.

Table 5.7-7: Traffic Effects Assessment Summary

Potential Socio-Economic Environmental Effect	Mitigation Measures	Residual Socio-Economic Environmental Effect	Evaluation of Residual Effect
Increased number of traffic accidents on PR 280.	• Safe driving practices for construction workers and service vehicles. • Improvements (e.g., bypass lane) at junction of PR280 and access road.EnvPP. • Where appropriate, bussing of workers to / from local and regional centres. • Use of borrow sources near the Project, reducing extent of on road hauling.	Added traffic accidents on PR 280 at similar rate as without the Project.	Adverse, moderate magnitude, short term, reversible, KCN Community and Northern Manitoba Study Areas.

5.7.6 Access

Access created by the existence of the ROW will have effects on the pursuit of traditional resource use activities. It will be important to provide safe, coordinated access to the proposed Project site for authorized users and to support sustainable use through the protection of the area's natural resources. The ROW may also enable others from outside the communities to access these areas. Particular concerns include ATV and snowmobile use by construction workers. A Preliminary

[12] AADT: Average Annual Daily Traffic is defined by Manitoba Infrastructure and Transportation as the number of vehicles passing a point on an average day of the year.

Access Management Plan has been prepared (Appendix E) to address issues of concern. This Plan includes provisions for general security protocols (e.g. security gate and guard), firearms restrictions and access user conditions.

A summary of effects on access is provided in Table 5.7-8 below.

Table 5.7-8: Access Effects Assessment Summary

Potential Socio-Economic Environmental Effect	Mitigation Measures	Residual Socio-Economic Environmental Effect	Evaluation of Residual Effect
The proposed Project will create access to areas used for traditional resource use.	• No private recreational vehicles will be allowed at the camps. • EnvPP. • *Preliminary* AMP.	Access will exist but be managed and monitored under the Preliminary Access Management Plan.	Adverse, moderate magnitude, continuous, short term, KCN Community Study Area.

5.8 HERITAGE RESOURCES EFFECTS AND MITIGATION

In several years of study, no heritage resources have been identified within the access road and borrow areas for the proposed Project. Results from the ongoing field investigations of the start-up camp and main camp (phase one) will be provided in a supplementary filing. All heritage resources sites currently registered with the Province of Manitoba Archaeological Site Inventory occur outside the areas proposed for infrastructure. However, there is potential for heritage resources to be present, since the route selected may have been used as a travel corridor by early Aboriginal people.

The construction phase of the proposed Project has the greatest potential to affect unknown heritage resource sites and marked and unmarked burials, particularly during clearing, grubbing and grading phases. Excavating structural foundations along with heavy equipment operations and storage can also affect heritage resources. Potential effects can be summarized as follows:

- ROW clearing operations can inadvertently disturb heritage resource sites and burial sites. Features and artifacts are often located below the ground surface and can be easily missed, especially in wooded areas.
- The development of structural foundations is site specific and may affect heritage resources if the area is scraped and levelled, and where sewer and water pipes or foundations are excavated.
- Operations and storage of heavy equipment may cause destruction of heritage resource and burial sites. Areas which have been cleared for the ROW and which do not appear to contain any archaeological material may contain heritage resources below the ground surface. Continued disturbance of the soil surface may dislodge artifacts and scatter them. The weight of heavy equipment in storage areas can crush or dislodge subsurface artifacts and features.

The range of mitigative options for heritage resource sites includes site avoidance, preservation and excavation. While site avoidance is the preferred mitigative option, having a clear, enforceable protocol in place should any resources be uncovered during construction is an effective mitigation measure.

Heritage resources protection measures have been developed and incorporated into the EnvPP , which will advise construction crews about the established protocols to be followed should heritage resources or burial sites be encountered. All heritage resource sites are protected by *The Heritage Resources Act* and Manitoba's *Policy Respecting the Reporting, Exhumation and Reburial of Found Human Remains (1987).*

A summary of effects on heritage resources is provided in Table 5.8-1 below.

Table 5.8-1: Heritage Resources Effects Assessment Summary

Potential Environmental Effect	Mitigation Measures	Residual Environmental Effect	Evaluation of Residual Effect
The Project may inadvertently disturb heritage resources and burial sites.	• Heritage protection. • EnvPP.	Disturbance of heritage and burial sites is still possible if they are present in the Project Footprint, but the likelihood of adverse effects is substantially reduced due to implementation of heritage resource protection provisions.	Adverse, unlikely, low magnitude due to on-site monitoring, long term, Project Footprint and irreversible.

6.0 MONITORING AND FOLLOW UP

Appendix C contains an overview of the environmental protection program that will be implemented for this Project. In addition to the EnvPP and AMP, the program involves the development of Project-specific environmental monitoring plans as a follow-up to effects predictions made in the EA Report. They are designed to verify predictions or identify unanticipated effects and would consist of two documents:

- Terrestrial, Aquatic and Heritage Resource Monitoring Plan
- Socio-Economic Monitoring Plan

It is not possible to finalize these plans until the Licence conditions for this project are issued, but in general, they would likely follow the methodologies described in Appendix B.

The terrestrial, aquatic and heritage resource monitoring plan would be developed primarily to study effects on the terrestrial environment as this is largely a terrestrial-based Project. However, aquatic monitoring to cover the work at Looking Back Creek and the requirements for managing a heritage resource find will be included. The monitoring plan would include both western science studies and Aboriginal Traditional Knowledge to gain a holistic understanding of changes to the environment as a result of the proposed Project. As results become available they will be analysed to determine if adaptive management is required to mitigate unforeseen effects if they occur.

The socio-economic monitoring plan would be developed to study the effects of the proposed Project on the Partner communities. It would include tracking employment statistics and the economic activity that the proposed Project is generating.

7.0 REFERENCES

7.1 LITERATURE CITED

Abraham, K.F. and J.E. Thompson. 1998. Defining the Pen Islands caribou herd of the southern Hudson Bay. Rangifer, Special Issue No. 10. pp 33-40.

Alsop, F. 2001. Short-eared Owl (*Asio flammeus*). In Birds of North America: Eastern Region. DK Publishing, Inc. New York: New York.

Andren, H. 1994. Effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat: a review. Oikos 71:355-366.

AXYS Environmental Consulting Ltd. 2001. Thresholds for addressing cumulative effects on terrestrial and avian wildlife in the Yukon. Department of Indian and Northern Affairs, Environmental Directorate and Environment Canada, Whitehorse, Yukon.

Baydack, R.K. and D.A. Hein. 1987. Tolerance of Sharp-tailed Grouse to lek disturbance. Wild. Soc. Bull. 15:535-539.

Belisle, M. 2005. Measuring landscape connectivity: the challenge of behavioral landscape ecology. Ecology 86:1988-1995.

Betcher, R., G. Grove and C. Pupp. 1995. Groundwater in Manitoba: Hydrogeology, Quality Concerns, Management. Also available at: http://www.gov.mb.ca/waterstewardship/reports/groundwater/hg_of_manitoba.pdf.

Bezener, A. and K. DeSmet. 2000. Manitoba Birds. Lone Pine Publishing.

BIOSIS Zoological Record Archive online at http://scientific.thomson.com/products/zr/, accessed on September 4, 2007.

Blancher, P. 2003. Importance of Canada's Boreal Forest to landbirds. Bird Studies Canada. May 2003. 48 pp.

Bookhout, T.A. 2009. Yellow Rail (*Coturnicops noveboracensis*) Birds of North America online. Issue No. 139 at: http://bna.cornell.edu.bna/species/139/articles.

Braun, C. E. (Ed). 2005. Techniques for wildlife investigations and management. The Wildlife Society, Bethesda. 974 pp.

British Columbia Government. 2002. Ministry of Water, Land and Air Protection. British Columbia Frogwatch Program Factsheet: http://www.gov.bc.ca/wld/frogwater/whoswho/factshts.htm.

Bull, E.L. and J.R. Duncan. 1993. Great Gray Owl (*Strix nebulosa*). *In:* The Birds of North America (http://www.birds.cornell.edu/birdsofna/), No. 41 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Canadian Amphibian And Reptile Conservation Network (CARCNET). 2009. Factors contributing to declines in amphibian populations and occurrences (http://www.eman-res.ca/partners/carcnet/issues/e_o.titus). Reptile information (http://www.eman-res.ca/partners/carcnet/reptiles/isues/reconserv.htm).

Canadian Botanical Conservation Network. 2008. Webpage as viewed on September 23, 2008, http://www.rbg.ca/cbcn/en/projects/invasives/i_list.html.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg, MB.

Canadian Environmental Assessment Agency (CEAA). 1994. A reference guide for the *Canadian Environmental Assessment Act* – determining whether a Project is likely to cause significant adverse environmental effects. November 1994.

Canadian Wildlife Service (CWS). 2005. National migratory birds monitoring and reporting online at http://www.cws-scf.ec.gc.ca/mgbc/trends/index.cfm? lang=e&go=home.page#trends, Last updated January 2005.

Carr, L.W. and L. Fahrig. 2001. Effect of road traffic on two amphibian species of differing vagility. Conservation Biology. 15(4):1071-1078.

Chapman, J.A. and G.A. Feldhamer (Eds). 1982. Wild mammals of North America: biology, management, and economics. The Johns Hopkins University Press. Baltimore and London. 1147pp.

Committee On Status Of Endangered Wildlife In Canada (COSEWIC). 2002. Database and Listing: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm.

Committee On Status Of Endangered Wildlife In Canada (COSEWIC). 2003. Database and Listing: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm.

Committee On Status Of Endangered Wildlife In Canada (COSEWIC). 2007. Database and Listing: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm.

Committee On Status Of Endangered Wildlife In Canada (COSEWIC). 2008. Species Status Reports. Online at http://www.cosewic.gc.ca/eng/sct2/index_e.cfm, accessed April 8, 2008.

Dingman, S.L. and F.R. Koutz. 1974. Relations among vegetation, permafrost, and potential isolation in central Alaska. Arctic and Alpine research 6:37-42.

Duncan, J.R., and P.A. Duncan. 1998. Northern Hawk Owl (*Surnia ulula*). In The Birds of North America, No. 356 (A. Pool and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Dunford, J.S. 2003. Woodland caribou-wildfire relationships in Northern Alberta. Master of Science Thesis. University of Alberta, Edmonton, Alberta.

Dussault, C., J., Outllet, P., Courtois, R., Huot, J., Breton, L. and H. Jolicoeur. 2005. Linking moose habitat selection to limiting factors. Ecography 28:619-628.

Dyer, S. J., O'Neill, J. P., Wasel, S. M. and S. Boutin. 2001. Avoidance of industrial development by woodland caribou. . Journal of Wildlife Management 65:531-542.

Dykstra, P. R. 2004. Thresholds in Habitat Supply: A Review of the Literature. Ministry of Sustainable Resource Management, Ministry of Water, Land and Air Protection, and Biodiversity Branch. Victoria, B.C.

Elzinga, C. L., D.W. Salzer, J.W. Willoughby and J.P. Gibbs. 2001. Monitoring plant and animal populations. Blackwell Science Inc., Malden. 360 pp.

Environment Canada. 2008a. Scientific Review for the Identification of Critical Habitat for Woodland Caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada. August 2008. Ottawa: Environment Canada. 72 pp. plus 180 pp Appendices.

Environment Canada. 2008b. Species at Risk Public Registry. Last retrieved on September 3, 2008, from: http://www.sararegistry.gc.ca/.

Environment Canada. 2009. National Climate Data and Information Archive (www) 2009.

Erskine, A.J. 1977. Birds in boreal Canada: communities, densities and adaptations. Canadian Wildlife Service Report Services Number 41.

Fisheries and Oceans Canada. 2007a. Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff. Habitat Management Program, Fisheries and Oceans Canada, Version 1.0. 25 p.

Fisheries and Oceans Canada. 2007b. Manitoba Operational Statement for Clear-span Bridges. Version 3.0. 2 p.

Fisheries and Oceans Canada. 2007c. Manitoba Operational Statement for Temporary Stream Crossings. Version 1.0. 3 p.

Fisheries and Oceans Canada. 2007d. Manitoba Operational Statement for Ice Bridges and Snow Fills. Version 3.0. 2 p.

Fisheries and Oceans Canada 2007e. Manitoba Operational Statement for Beaver Dam Removal. Fisheries and Oceans. Version 3.0. 2 p.

Fisheries and Oceans Canada and Manitoba Natural Resources. 1996. Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat. 48p+Appendices.

Flora of North America Editorial Committee 1993. Flora of North America North of Mexico. 12+ vols. New York and Oxford.

Forman, R.T. 1995. Land mosaics: the ecology of landscapes and regions. Cambridge University Press, Cambridge, England.

Forman, R. T. T., and L. E. Alexander. 1998. Roads and Their Major Ecological Effects. Annual Review of Ecology and Systematics 29:207-C202.

Franzmann, A.W. and C.C. Schwartz (Eds). 2007. Ecology and management of the North American Moose. Second Edition. University Press of Colorado, Boulder, Colorado. 733pp.

Goldade, C.M., J.A. Dechant, D.H. Johnson, A.L. Zimmerman, B.E. Samison, J.O. Church and B.R. Euliss. 2002. Effects of management practices on wetland birds: Yellow Rail, Northern Prairie Wildlife Research Center, Jamestown, ND. Accessed at: http//www.npwrc.usgs.gov/resource /literatr/wetbird/year/year.htm.

Government of Canada. 1991. The federal policy on wetland conservation. Minister of Supply and Services Canada.

Government of Canada. 2008. Species at Risk Public Registry. 2008. www.sararegistry.gc.ca/ default_e.cfm.

Government of Manitoba. 2002. Ashton Outlines Highways Program List to Assist Industry in Planning for Upcoming Construction Season. Provincial Government Press Release. Accessed online at http://www.gov.mb.ca/chc/press/top/2003=2/03/2002-03-28-02.html in July 2009.

Hirai, Tamaki. 1998. An evaluation of woodland caribou (*Rangifer tarandus caribou*) calving habitat in the Wabowden area, Manitoba. MNRM Thesis, University of Manitoba. 107 pp + Appendixes.

Holt, D.W. and S.M. Leasure. 2009. Short-eared Owl (*Asio flammeus*). *In* The Birds of North America online. Issue No. 062 at: http://bna.birds.cornell.edu/bna/species/062/articles.

Houston, C.S., D.G. Smith, and C. Rohner. 1998. Great Horned Owl (*Bubo virginianus*). In The Birds of North America, No. 372 (A. Pool and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Hull, J. 2005. Post-Secondary Education and Labour Market Outcomes Canada, 2001. Prologica Research Inc: Winnipeg, MB.

Indian and Northern Affairs Canada. 1996. Report of the Royal Commission on Aboriginal Peoples. http://www.ainc-inac.gc.ca/ch/rcap/sg/sgmm_e.htmlLast Retrieved June 30, 2009.

Jackson, B.J. and J.A. Jackson. 2009. Killdeer (*Charadrius vociferous*). *In* The Birds of North America online. Issue No. 517 at: http://bna.birds.cornell.edu/bna/species/517/articles.

Jalkotzky, M. G., Ross, P. I. and E. M. D. Nasserden. 1997. The Effects of Linear Developments on WIldlife: A Review of Selected Scientific Literature. Canadian Association of Petroluem Producers.

James, A. R. C., Boutin, S., Hebert, D. M. and A. B. Rippin. 2004. Spatial separation of caribou from moose and its relation to predation by wolves. Journal or Wildlife Management 68:799-809.

Kelsall, J.P. 1968. The Caribou. Queens's Printer and Controller of Stationary. Ottawa. Canada.
Khan B. and M. H. Colbo. 2008. The impact of physical disturbance on stream communities: lessons from road culverts. Hydrobiologia 600:229–235.

Koonz, W. 1988. The bald eagle in Manitoba. Manitoba Natural Resources, Wildlife Bulletin 96(3):426-430.

Koonz, W. 1992. Amphibians in Manitoba. In: Declines in Canadian amphibian populations: designing a national monitoring strategy. Bishop. C. and K. Pettit (eds.), Canadian Wildlife Service, Burlington, Ontario. Occasional Paper Number 76.

Manitoba Conservation. 1991. Stand Stock Volume Table for the Nelson River Forest Section. Forest Inventory and Resource Analysis, Forestry Branch. Winnipeg. MB.

Manitoba Conservation, 2008. Species at Risk. Online at: http://www.gov.mb.ca/conservation/wildlife/managing/species_at_risk.html. Accessed on April 7, 2008.

Manitoba Conservation. N.D. 2008. Manitoba Conservation Wildlife and Ecosystem Protection Branch. Species at Risk. Last retrieved on September 3, 2008, from: http://www.gov.mb.ca/conservation/wildlife/managing/sar_facts.html.

Manitoba Conservation. 2009. Guidelines for an Environment Act Proposal Report. Accessed online at http://www.gov.mb.ca/conservation/eal/publs/info_eap.pdf in July 2009.

Manitoba Endangered Species Act (MESA). 2007. Manitoba Conservation. Updated June 2007. http://web2.gov.mb.ca/laws/statutes/ccsm/elle.php.

Manitoba Hydro. 1993a. Nelson River Studies Gull Generating Station 1990 Summer and 1990/91 Winter Subsurface Investigation. Volume 1 of 3. Report Number: GPD 93-4.

Manitoba Hydro. 1993b. Nelson River Studies Gull Generating Station 1991 Summer Subsurface Investigation Report. Volume 1 of 3. Report Number: PSPD 95-3.

Manitoba Infrastructure and Transportation. 2007. Traffic on Manitoba Highways – 2007. Government report published June 2008.

Manitoba Infrastructure and Transportation. 2008. Standard Construction Specifications. Accessed online at http://www.manitoba.ca/mit/contracts/manual.html in July 2009.

Manitoba Natural Resources. 1996. Manitoba Natural Resources Consolidated Buffer Guidelines. 5p.

Manitoba Naturalists Society. 2003. The Birds of Manitoba. Manitoba Avian Research Committee, Winnipeg, Manitoba.

Manitoba Science, Technology, Energy, Mines. 2009. GIS Map Gallery. http://www.gov.mb.ca/stem/mrd/geo/gis/minesmaps.htmlLast retrieved June 29, 2009.

Manitoba Transportation and Government Services (now Manitoba Infrastructure and Transportation). 1998. Geometric Design Criteria for Secondary Arterial Roadways.

Marks, J.S., D.L. Evans, and D.W. Holt. 1994. Long-eared Owl (*Asio otus*). In The Birds of North America, No. 133 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

Milko, R. 1998. Wetlands environmental assessment guideline. Environment Canada, Canadian Wildlife Service, Ottawa.

National Wetlands Working Group. 1997. Canadian system of wetland classification.

Northern Economic Development Commission. 1992. Northern Manitoba A Benchmark Report, Thompson, Manitoba.

Novak, M., J.A. Baker, M.E. Obbard and B. Malloch (Eds.). 1999. Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources, Queens Printer.

Poston, B., D. Ealey, P. Taylor and G. McKeating. 1990. Priority Migratory Bird Habitats of Canada's Prairie Provinces. Canadian Wildlife Service. Edmonton, Alberta.

Poulin, R.G., S.D. Grindal and R.M. Brigham. 2009. Common Nighthawks (*Chordelles minor*). Birds of North America online. Issue No. 213 at: http://bna.cornell.edu/bna/species/213/articles.

Preston, W. 1982. The amphibians and reptiles of Manitoba. Manitoba Museum of Man and Nature, Winnipeg, MB.

Rettie, W.J. and F. Messier. 2000. Hierarchical habitat selection by woodland caribou: its relationship to limiting factors. Ecography 23:466-478.

Robinson, S.D and T. R. Moore. 1999. Carbon and Peat Accumulation over the Past 1200 years in a Landscape with Discontinuous Permafrost, Northwestern Canada. Global Biogeochem. Cycles 13(2):591-601.

Rusch, D.H., S. Destefano, M.C. Reynolds and D. Lauten. 2009. Ruffed Grouse (*Bonasa umbellus*). Birds of North America online. Issue No. 515 at: http://bna.cornell.edu/bna/species/515/articles.

Schaefer, J.A. and W.O. Pruitt, Jr. 1991. Fire and woodland caribou in southeastern Manitoba. Wildl. Monogr. 116: 39 pp

Schemnitz, S.D (Ed). 1980. Wildlife management techniques manual. The Wildlife Society, Bethesda. 686 pp.

Seburn, C.N.L, and D.C. Seburn. 1998. COSEWIC status report on the northern leopard frog *Rana pipiens* (Southern Mountain and Prairie populations) in Canada, in COSEWIC assessment and status report on the northern leopard frog *Rana pipiens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-40 pp.

Shoesmith, M.W. and D.R. Storey. 1977. Movements and associated behaviour of woodland caribou in central Manitoba. Manitoba Department of Renewable Resources and Transportation Services, Research MS Rep. No. 77-15. 24 pp.

ShuHua, L., HePing, L., Yu, H., ChengYi, Z., FuMing, L., and W. JianHua. Numerical simulations of land surface physical processes and land-atmosphere interactions over oasis-desert/Gobi region. Science in China Series D: Earth Sciences Vol 50, No 2 February 2007.

Smith, R.E., H. Veldhuis, G. Mills, R. Eilers, W. Fraser and G. Lelyk. 1998. Terrestrial ecozones, ecoregions and ecodistricts of Manitoba. An Ecological Stratification of Manitoba's Natural Landscape. Land Resource Unit, Brandon Research Centre, Research Brandh, Agriculture and Agri-food Canada.

Split Lake Cree Nation and Manitoba Conservation.1994. Moose Conservation Plan. Split Lake Resource Management Board. 50 p.

Statistics Canada. 2001. Census Dictionary for 2001.

Statistics Canada. 2002. Census of Canada for 2001.

Statistics Canada. 2007. Census of Canada for 2006.

Storch, I. 2000. Grouse Action Plan 2000-2004. Downloaded from: www.gct.org.uk/gsg/grousesp/willow.htm.

Tibbitts, T.L. and W. Moskoff. 2009. Lesser Yellowlegs (*Tringa flavipes*). The Birds of North America online. Issue No. 427 at: http://bna.cornell.edu/bna/species/427/articles

Thomas, D.C., and D.R. Gray. 2002. Update COSEWIC Status Report On The Woodland Caribou *Rangifer tarandus caribou* in Canada. COSEWIC.

Thompson, J.E., and Abraham, K.F. 1994. Range, seasonal distribution and population dynamics of the Pen Islands caribou herd of Southern Hudson Bay: final report. Ontario Ministry of Natural Resources.

Vardy, S. R., Warner, B. G., Turunen, J. and R. Aravena. 2000. Carbon accumulation in permafrost peatlands in the Northwest Territories and Nunavut, Canada. *The Holocene* 10:273–280.

Williamson, D.A. 2002. Manitoba water quality standards, objectives, and guidelines. Manitoba Conservation Report 2002-11. Final Draft: November 22, 2002. 76 pp.

Workers Compensation Board of Manitoba. 2008. *WCB Provides Support to Promote the Health and Safety of Aboriginal Workers and Workers with Literacy Challenges*. News Release. Last Retrieved October, 29, 2008 from: http://www.wcb.mb.ca/app/wcbpublicweb/news_releases/current/Aboriginal_workers_literacy_challenges.html

Wrono, F.S., Prowse, T.D., Reist, J.D., Hobbie, J.E., Levesque, L.M.J. and W.F. Vincent. 2006. Climate change effects on aquatic biota, ecosystem structure and function. Ambio. Vol 35, No.7, p.359-369.

Wuskwatim and Keeyask Training Consortium Inc. 2008. Website. Last Retrieved May 30, 2009 from: http://www.wktc.ca/.

Yahner, R. and D. Scott. 1988. Effects of Forest Fragmentation on Depredation of Artificial Nests. Journal of Wildlife Management 52(1):158-161.

7.2 PERSONAL COMMUNICATIONS

Cash, Ben. Associate Professor of Biology and Chair of the Division of Natural Sciences. Maryville College, Maryville Tennessee, Winnipeg, MB, July 31, 2006.

Cash, Ben. 2006. Associate Professor of Biology and Chair of the Division of Natural Sciences. Maryville College, Maryville Tennessee, Winnipeg, MB, July 31, 2006.

Hedman, Daryll. 2008. Regional Wildlife Manager. Manitoba Conservation, Thompson Manitoba., Winnipeg, MB. October 10, 2008.

Holmes, Bruce. 2008. Regional Forester, Manitoba Conservation Northeast Region, Thompson, MB. February 20, 2008.

Rebizant, Ken. 2008. Big Game Manager. Manitoba Conservation, Winnipeg Manitoba., Winnipeg, MB. October 10, 2008.

8.0 GLOSSARY

AADT: The average annual daily traffic is defined by MIT as the number of vehicles passing a count station on an average day of the year.

Adaptive management: The implementation of new or modified mitigation measures over the construction and operation phases of a project to address unanticipated environmental effects. The need for the implementation of adaptive management measures may be determined through an effective follow-up program.

Alluvium: Sediment deposited by flowing water, as in a riverbed, flood plain or delta.

Alternative means of carrying out a project: The various technically and economically feasible ways, other than the proposed way, for a project to be implemented or carried out. Examples include other project locations, different routes and methods of development, and alternative methods of project implementation or mitigation.

Alternatives to a project: The functionally different ways, other than a proposed project, to meet the project need and achieve the intended purpose. For example, if a need for greater power generation has been identified, a proposed project might be to build a new power generation facility. An alternative to that project might be to increase the generation capacity of an existing facility.

Aquatic peatland: A peatland bordering on a water body or waterway. The peat adjacent to the water's edge is usually floating.

Aquifer: An underground bed or layer of earth, gravel or porous stone that yields water.

Baseline environment: A description of the environmental conditions at and surrounding a proposed action.

Bedrock: The solid rock that lies beneath the soil and other loose material on the Earth's surface.

Berm: A length of raised earth, snow, or debris which may act as a barrier towards movement.

Biological diversity (Canada): Means the variability among living organisms from all sources, including, without limiting the generality of the foregoing, terrestrial and marine and other aquatic ecosystems and the ecological complexes of which they form a part and includes the diversity within and between species and of ecosystems (*Canadian Environmental Protection Act, 1999*).

Biological diversity (Manitoba): Means the variability among all living organisms and the ecological complexes of which they are part, including diversity within and among species and among ecosystems.

Blanket bog: A bog with an organic layer that is between 1 and 2 m thick.

Bog: A peatland where vegetation receives nutrient inputs from precipitation and dryfall only. Peat mosses (Sphagnum species) are the dominant peat forming vegetation in bogs.

Borrow area zone: An area representing the originally anticipated extent of potential borrow area use at the time the quantitative habitat effects assessment was completed. Subsequent engineering analysis has reduced the anticipated borrow area extent (shown by the refined borrow areas).

Boulder lag: An accumulation of boulders remaining on a surface after finer materials and smaller rocks have been removed by wind or water.

Brunisols: Poorly developed mineral soils that have a B horizon that is at least 5 cm thick and lacks the diagnostic properties specified for other soil orders.

Canadian Shield: A broad region of Precambrian rock that encircles Hudson Bay. In total it covers 8 million km^2 and is made up of some of the Planets oldest rock, largely granite and gneiss.

Cataclastic: The structure produced in a rock by the actions of severe mechanical stresses that occur during metamorphic rock formation.

CDC: See **Conservation Data Centre.**

CI: See **Confidence Interval.**

Clear-Span Bridge: Small-scale bridge structure that completely spans a watercourse without altering the stream bed or bank, and that are a maximum of two lanes wide. The bridge structure (including bridge approaches, abutments, footings, and armouring) is built entirely above the ordinary high water mark.

CNP: See **Cree Nation Partners.**

Community knowledge: Information held by community members, such as farmers, hunters, fishers and naturalists, who are familiar with the environment in a specific geographic area. Community knowledge may be used in the environmental assessment of a proposed project. For example, fishermen in a specific area may know where the best "fishing spots" are, and therefore may contribute to identifying potential fish habitat.

Compliance monitoring: A broad term for a type of monitoring conducted to verify whether a practice or procedure meets the applicable requirements prescribed by legislation, internal policies, accepted industry standards or specified terms and conditions (e.g., in an agreement, lease, permit, license or authorization).

Conservation Data Centre (CDC) ranking: A Manitoba Conservation status rank assigned to a species by the Conservation Data Centre on the basis of the species' province-wide status. Species are assigned a numeric rank ranging from 1 (very rare) to 5 (demonstrably secure).

Construction: Includes activities anticipated to occur during Project development.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): Committee established by the *Species at Risk Act* as the authority for assessing the conservation status of species that may be at risk of extinction in Canada.

Confidence Interval (CI): This quantifies the uncertainty in measurement and is usually reported as the 95% CI which is the range of values within which it can be 95% certain that the true value for the whole population lies.

Country foods: Traditional foods from the land, such as wild animals, birds, fish, plants and berries.

Cree Nation Partners (CNP): A partnership formed in 2001 amongst Tataskewayk Cree Nation and War Lake First Nation.

Critical habitat: An area of habitat or the place in which an organism lives that is essential in providing the requirements needed for a specific species to live.

Cryoboreal: Refers to species characteristic of the colder parts of the Boreal Zone.

Cryosols: Soils that are characterized by either the presence of permafrost within 1 m of the surface or permafrost within 2m of the surface and evidence of cryoturbation.

Decommissioning: Planned shut-down, dismantling and removal of a building, equipment, plant and/or other facilities from operation or usage and may include site cleanup and restoration.

Development: Any project, industry, operation or activity, or any alteration or expansion of any project, industry, operation or activity which causes or is likely to cause: a) the emission or discharge of any pollutant to the environment, or b) an effect on any unique, rare or endangered feature of the environment, or c) the creation of by-products, residual or waste products not regulated by *The Dangerous Goods Handling and Transportation Act*, or d) A substantial utilization or alteration of any natural resource in such a way as to pre-empt or interfere with the use or potential use of that resource for any other purpose, or e) A substantial utilization or alteration of any natural resource in such a way as to have an adverse effect on another resource, or f) The utilization of a technology that is concerned with resource utilization and that may induce environmental damage, or g) A significant effect on the environment or will likely lead to a further development which is likely to have a significant effect on the environment, or h) A significant effect on the social, economic, environmental health and cultural conditions that influence the lives of people or a community insofar as they area caused by environmental effects (*The Environment Act*).

Direct effect: An environmental effect that is a change that a project may cause in the environment; or change that the environment may cause to a project. A direct effect is a consequence of a cause-effect relationship between a project and a specific environmental component.

Directly Negotiated Contract (DNC): A type of contract that is non-tendered and directly negotiated between parties of interest.

Diverse habitat type: Habitat type that typically includes a relatively high number of plant species and/ or a relatively high degree of structural diversity.

DNC: See **Directly Negotiated Contract.**
Drumlin: A smooth hill formed by deposits of glacial till; the long axis parallels the direction of former glacial flow.

EA: See **Environmental Assessment.**

Ecodistrict: A cartographical delineation of distinct ecological areas, identified by their geology, topography, soils, vegetation, climate conditions, living species, and water resources. An ecodistrict provides a useful approximation of ecosystem potentials.

Ecoregion: A subdivision of the ecozone, characterized by distinctive large order landforms or assemblages of regional landforms, small order macro-or mesoclimates, vegetation, soils, water, and regional human activity pattern/use.

Ecosystem: A functional unit including the living and the non-living things in an area, as well as the relationships between those living and non-living things. For example, a decaying log comprises the ecosystem for a microbe because the log provides everything that the microbe needs to survive and reproduce.

Ecosystem diversity: A form of **biological diversity**. Measured in this report as the number of habitat types and distribution of area amongst them.

Ecozone: A large geographical region having a distinct biodiversity of flora and fauna; boundaries also defined by major physiological land features.

EIS: See **Environmental Impact Statement.**

Endangered: A species facing imminent extirpation or extinction (COSEWIC).

Environment: The components of the Earth and includes: a) land, water and air, including all layers of the atmosphere, b) all organic and inorganic matter and living organisms, and c) the interacting natural systems that include components referred to in paragraphs a) and b) (*Canadian Environmental Assessment Act*).

Environmental assessment (EA): Process for identifying project and environment interactions, predicting environmental effects, identifying mitigation measures, evaluating significance, reporting and following-up to verify accuracy and effectiveness leading to the production of an Environmental Assessment report. EA is used as a planning tool to help guide decision making, as well as project design and implementation.

Environmental component: Fundamental element of the physical, biological or socio-economic environment, including the air, water, soil, terrain, vegetation, wildlife, fish, birds and land use that

may be affected by a proposed project, and may be individually assessed in the environmental assessment.

Environmental effect: In respect of a project, a) any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*, b) any effect of any change referred to in paragraph a) on i) health and socio-economic conditions, ii) physical and cultural heritage, iii) the current use of lands and resources for traditional purposes by Aboriginal persons, or iv. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, or any change to the project that may be caused by the environment; whether any such change or effect occurs within or outside Canada (*Canadian Environmental Assessment Act*).

Environmental Impact Statement (EIS): A document that presents the findings of an environmental assessment in response to specific guidelines or terms or reference. The term EIS is often used in the context of an assessment by a review panel and in the environmental assessment regimes of other jurisdictions.

Environmental monitoring: Periodic or continuous surveillance or testing, according to a pre-determined schedule, of one or more environmental components. Monitoring is usually conducted to determine the level of compliance with stated requirements, or to observe the status and trends of a particular environmental component over time.

Environmental Protection Program (EPP): Provides a framework for delivery, management and monitoring of environmental protection activities in keeping with issues identified in the environmental assessment, regulatory requirements and public expectation.

Environmental Protection Plan (EnvPP): Within the framework of an Environmental Protection Program, an Environmental Protection Plan prescribes measures and practices to avoid and minimize potential environmental effects of a proposed project.

EnvPP: See **Environmental Protection Plan.**

EPP: See **Environmental Protection Program.**

Erosion: Natural process by which the Earth's surface is worn away by the actions of water and wind.

Esker: A long winding ridge of stratified sand and gravel that is formed from drift deposited in tunnels running through a glacier.

Eutric: Referring to a soil with a relatively high degree of base saturation, and lack of well-developed surface horizon.

Fen: A type of peatland in which the vegetation is influenced by mineral enriched surface and/or groundwater. Water chemistry is neutral to alkaline. Sedges, brown mosses and/or Sphagnum mosses are usually the dominant peat forming vegetation.

Fibrisols: Organic soils consisting predominantly of relatively undecomposed plant material, such as Sphagnum mosses, with clearly visible plant fragments.

First-order stream: A stream that has no permanent tributaries. Feeds larger streams.

Fish habitat: Spawning, nursery, rearing, food supply and migration areas upon which fish depend (*Fisheries Act*).

Follow-up program: A program for: a) verifying the accuracy of the environmental assessment of a project, and b) determining the effectiveness of any measures taken to mitigate the adverse environmental effects of the project (*Canadian Environmental Assessment Act*).

Fragmentation: The breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss and/or sensory disturbance. Eventually, remaining blocks may be too small to provide usable or effective habitat for a species. The features breaking up habitat blocks may reduce the ease by which animals, plant propagules and other ecological flows move from one area to another area.

Game Hunting Area (GHA): Designated areas in Manitoba in which game hunting is regulated by species, quota, means, etc. (Manitoba Conservation).

Generating Station (GS): An industrial facility for the generation of electric power (also referred to as power station, power plant or powerhouse).

Geological overburden: Material overlying a useful mineral deposit or desired bedrock anchor.

GHA: See **Game Hunting Area.**

GHG: See **Greenhouse Gas.**

Glaciolacustrine: Pertains to lakes fed by glacial meltwater or sediments deposited into lakes that have come from glaciers.

Greywacke gneisses: Gneiss (c.v.) consisting of any of various dark gray sandstones that contain shale.
Granite gneisses: Gneiss composed of a high degree of granite.

Granite: A common, coarse-grained, light-coloured, hard igneous rock consisting chiefly of quartz, orthoclase or microcline and mica.

Granular: Composed of granules or grains of sand or gravel.

Greenhouse Gas (GHG): Gases e.g., methane, carbon dioxide, chlorofluorocarbons emitted from a variety of sources and processes that contribute to global warming by trapping heat between the Earth and the upper atmosphere.

GS: See **Generating Station.**

Habitat: The place where an organism lives. Since all natural areas are habitat for something, "habitat" refers to all habitats. Habitat for a particular species is identified with a species prefix (e.g., fish habitat, jack pine habitat, moose habitat).

Habitat Mapping Area: The central 1,502 km^2 of the Regional Study Area, within which detailed habitat mapping has been developed.

High quality wetland: A type of wetland that has high primary productivity, has high species richness, is critical habitat for a rare species, and/or is high quality habitat for a wildlife species. Relative to many other habitat types, wetlands make disproportionately high contributions to ecosystem functions such as cleaning water, storing water and storing carbon.

High Water Mark (Ordinary) (HWM): The visible high water mark of any lake, stream, or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river stream, or other body of water a character distinct from that of the banks, both in vegetation and in the nature of the soil itself. Typical features may include, a natural line or "mark" impressed on the bank or shore, indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics (Operational Statement for Clear-Span Bridges, Version 3 (Fisheries and Oceans 2007b).

Horizons: A specific layer in the soil which parallels the land surface and possesses physical or chemical characteristics which differ from the layers above and beneath.

Horizontal peatland: A flat, featureless peatland where the water table is close to the surface.

HP Piles: A steel support structure.

Hydrostratigraphic: Refers to the layers of aquifers and water-bearing deposits occurring within a given area. The hydrostratigraphy can be mapped and is predictable based on ground-water models.

HWM: See **High Water Mark (Ordinary).**

Igneous intrusive: An injection into pre-existing rocks of new rocks or minerals formed by the cooling and hardening of magma or molten lava. Basalt and granite are examples of igneous rocks which may intrude into older existing rock formations.

Impermeable: Relating to a material through which substances, such as liquids or gases, cannot pass.

Indicators: Anything that is used to measure the condition of something of interest. Indicators are often used as variables in the modeling of changes in complex environmental systems. In an environmental assessment, indicators are used to predict changes in the environment and to evaluate their significance.

Indirect effect: A secondary environmental effect that occurs as a result of a change that a project may cause in the environment. An indirect effect is at least one step removed from a project activity in terms of cause-effect linkages. For instance, a river diversion for the construction of a hydro power plant could directly result in the destruction of fish habitat causing a decline in fish population. A decline in fish population could result in closure of an outfitting operation causing loss of jobs. Thus, the river diversion could indirectly cause the loss of jobs.

Intertill: Layers of soil or granular deposits which lay between layers of till (c.v.).

Joint Keeyask Development Agreement: An agreement between Tataskweyak Cree Nation and War Lake First Nation operating as Cree Nation Partners, and, York Factory First Nation, and Fox Lake Cree Nation, and, The Manitoba Hydro-Electric Board regarding the partnership, ownership, development and operation of the Keeyask Project.

KCN: See **Keeask Cree Nations**.

KCN Community Study Area: This area includes the four First Nation communities in the vicinity of the proposed Project: Tataskweyak Cree Nation (TCN) at Split Lake; York Factory First Nation (YFFN) at York Landing; War Lake First Nation (WLFN) at Ilford; and Fox Lake Cree Nation (FLCN) at Bird and Gillam.

Keeyask Cree Nations: Tataskweyak Cree Nation (TCN) at Split Lake; York Factory First Nation (YFFN) at York Landing; War Lake First Nation (WLFN) at Ilford; and Fox Lake Cree Nation (FLCR) at Bird and Gillam.

Linear feature: A geographic feature, such as a trail or road, which can be represented by a line.

Local Study Area (LSA): A 7,870-ha (78.7-km^2) Local Study Area was established to include the spatial area immediately adjacent to the proposed Keeyask Infrastructure Project where some direct and indirect environmental effects may occur. The Local Study Area includes the project footprints as well as a 1.15-km buffer around these areas. Potential local effects on landscape level issues such as landscape diversity, fragmentation and wetland function are captured by the Local Study Area.

LSA: See **Local Study Area.**
Luvisols: Mineral soils where clay particles from the upper layer have been transported to the layer below to the extent that a Bt horizon has developed.

MESA: See ***The Endangered Species Act*** **(Manitoba).**

Mesisols: Organic soils which are more highly decomposed and contain less fibrous material than Fibrisols (c.v.).

Metamorphic: Rocks that have been transformed by extreme heat and pressure

Metasedimentary: Sedimentary rocks which have been deposited, and the undergone subsequent metamorphosis, and thus can be classified as neither fully sedimentary nor metamorphic

Mitigation: In respect of a project, the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means (*Canadian Environmental Assessment Act*).

Mitigation monitoring: A type of monitoring program that may be used to verify that mitigation measures were properly implemented and that such measures effectively mitigate the predicted adverse environmental effects.

Monitoring: Continuing assessment of conditions at and surrounding an activity. This determines if effects occur as predicted or if operations remain within acceptable limits and if mitigation measures are as effective as predicted.

Moraine: Soil and rock material that has been transported by a glacier and then deposited.

Neotropical migrant: A bird species that breeds in North America during the spring and early summer and migrates south to Mexico, the Caribbean and Central and South America for the winter.

Net merchantable: The commercially useable volume of wood fibre within an area. It includes all trees with a diameter at breast height of 9.1 cm and greater and includes the application of the regions specific cull factors as determined by Manitoba Conservation.

Northern Manitoba Study Area: This is the broadest spatial scope used for the socio-economic assessment. This area is defined as Statistics Canada Census Divisions 22 and 23.

Organic: Containing plant and animal residues at various stages of decomposition (i.e., organic soil contains decomposing plant fibres).

Passerine: Perching birds mostly small and living near the ground with feet having 4 toes arranged to allow for gripping the perch; most are songbirds.

Peat plateau bog: A generally flat-topped **peatland**, elevated above the surrounding area by ground ice that may or may not extend downward into the underlying mineral soil.

Peatland: A peatland is a **wetland** where organic material has accumulated because dead plant material production exceeds decomposition..

Peatland disintegration: Net reduction in peatland area and/or volume. Peatland disintegration can result from a variety of influences such as climate warming, fires or flooding.

Permafrost: A condition where soil temperature remains below 0°C for at least two consecutive years.

Permeability: The degree to which fluids or gases can pass through a barrier or material.

Physiography: Physical geography, i.e. the study of physical features of the surface of the Earth.

Potentially salvageable timber: Timber that is of sufficient size (stem diameter and length) to be useable for commercial or non-commercial purposes, exclusive of economic and logistical considerations.

Precambrian bedrock: Extremely stable bedrock composed of ancient crystalline rocks whose complex structure attests to a long history of uplift and depression, mountain building and erosion.

Pre-construction: Includes all project activities (surveying, staking, mapping) that lead up to but do not include project construction, including all field studies (aquatic, plant, wildlife) and related public liaison activities.

Priority habitat type: Generally refers to a habitat type that is rare, uncommon, highly diverse, highly sensitive to disturbance, plays a key functional role, is critical habitat for a particular plant or animal species, and/or is highly valued by people. Priority habitat types in the terrestrial habitat and ecosystem assessment are habitat types that are regionally rare and/or highly diverse (i.e., habitat type that typically includes a relatively high number of plant species and/or a relatively high degree of structural diversity). Habitat types that are highly sensitive, play a key functional role and/or are critical habitat for a particular plant species are also captured in the wetland function topic area. Priority habitat for a particular animal species is considered in the animal sections and referred to relative to the species (e.g., priority moose habitat).

Priority mammals: Generally refers to mammal species that is important to local people, has regulatory requirements, plays an important role in ecosystem function, whether it can be used as an indicator, is rare or uncommon, and whether there is the potential for measurable effects from the project.

Priority plant species: Plant species that are rare, near a range limit, invasive or non-native. Several degrees of rarity were recognized. The Manitoba Conservation Data Centre (CDC) assigns conservation status ranks to species as an indication of their degree of provincial conservation concern. Species with ranks ranging from "S1" to "S3?" indicate that these species are provincially very rare to uncommon and of potential conservation concern. Of these plant species, the ones of highest concern are those that are listed by the Manitoba Endangered Species Act (MESA), the Species At Risk Act (SARA) or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Invasive and non-native plants are included as priority plants because they can crowd out other plant species and, in extreme cases, change vegetation composition.

Project activity: Elements of a project component that may result in environmental effects or changes. Example project activities include clearing, grubbing, excavating, stockpiling, reclaiming, etc.

Project component: A component of the project that may have an effect on the environment. Example project components include access road, construction camp, wastewater treatment facility, etc.

Project Footprint: This includes the physical works and associated activities where direct environmental effects are expected to occur as well as incidental physical disturbance in adjacent areas and indirect effects on habitat. This 2,597-ha (26-km^2) area for the proposed Keeyask Infrastructure Project includes the proposed road, borrow areas, camp areas and associated infrastructure footprints as well as a 150-m buffer surrounding these areas. Potential localized effects on priority habitat types, priority plant species and stand-level ecosystem diversity are captured by the Project Footprint.

Proponent: A person who is undertaking, or proposes to undertake a development or who has been designated by a person or group of persons to undertake a development in Manitoba on behalf of that person or group of persons (*The Environment Act*).

Qualitative analysis: Analysis that is subjective. Also refers to analysis that does not involve precise numerical analysis, often addressing differences as direction of change or orders of magnitude.

Quantitative analysis: Analysis that uses environmental variables represented by precise numbers or ranges and is often accompanied by numerical modeling or statistical analysis.

Regional Study Area (RSA): The ecologically appropriate area that is used to assess the effects of the project on habitat composition is one that is large enough to capture a natural, fire-driven shifting habitat mosaic. An analysis of fire history data indicated that an area of approximately 14,000 km^2 would be needed to assess the effects of the proposed Keeyask Infrastructure Project.

Rehabilitation: To restore a disturbed structure, site or land area to good condition, useful operation or productive capacity.

Residual environmental effect: An environmental effect that remains, or is predicted to remain, even after mitigation measures have been applied.

Risk: A state of uncertainty where some of the possibilities involve a loss, catastrophe or other undesirable outcome. Quantitatively, risk is proportional to both the expected losses which may be caused by an event and to the probability of this event. The greater loss and greater event likelihood result in a greater overall risk.

Resource Management Area (RMA): An area to be jointly managed by a Resource Management Board established by agreement between Manitoba and a First Nation or a local Aboriginal community.

Right-of-Way (ROW): Area of land controlled or maintained for the development of a road, pipeline or transmission line.

Riparian: Along the banks of rivers and streams.

Riprap: Rock or other material used to armor shorelines streambeds, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion.

RMA: See **Resource Management Area.**

RSA: See **Regional Study Area.**

ROW: See **Right-of-Way.**

SARA: See ***Species at Risk Act.***

Scoping: An activity that focuses the environmental assessment of a proposal on relevant issues and concerns, types of effects, alternatives for consideration, timeframe, methodology, and establishes the boundaries of the assessment.

SD: See **Sustainable Development.**

Second-order Stream: A stream formed by the confluence of two first-order streams, or of a first-order stream and a second-order stream. Generally forms on steep slopes and flows quickly.

Septage: Partially treated waste stored in a septic tank.

Special concern: A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events (COSEWIC).

Species at risk: Means an extirpated, endangered or threatened species or a species of special concern (*Species at Risk Act*).

Species at Risk Act **(SARA):** The federal Act which provides for the legal protection for wildlife species listed under 'Schedule 1' of that Act.

Significance: A conclusion about whether adverse environmental effects are likely to be significant, taking into account the implementation of appropriate mitigation measures. Significance is determined by a combination of scientific data, regulated thresholds, standards, social values and professional judgment.

SLRMA: See **Split Lake Resource Management Area.**

Split Lake Resource Management Area (SLRMA): Formed by a Comprehensive Implementation Agreement between Tataskweyak Cree Nation and Manitoba in 1992 the area covers about 4,150 ha in northern Manitoba,

Start-up Camp: A temporary 125-person camp to be established at the onset of the proposed Keeyask Infrastructure Project and to be decommissioned at the conclusion of the proposed Project.

Stratigraphy: Scientific study of rock strata, especially the distribution, deposition, correlation, and age of sedimentary rocks.

Surface permafrost: Permafrost that occurs within the top 2 m of the surface materials.

Sustainability: Capacity of a thing, action, activity or process to be maintained indefinitely in a manner consistent with the spirit of Manitoba's Principles and Guidelines of Sustainable Development.

Sustainable development (SD) (Canada): Development that meets the needs of the present, without compromising the ability of future generations to meet their own needs (*Canadian Environmental Assessment Act*).

Sustainable development (SD) (Manitoba): Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Tectonic: Pertaining to the structure or movement of the earth's crust.

The Endangered Species Act **(Manitoba) (MESA):** Enacted: 1) to ensure the protection and survival of endangered and threatened species in the province; 2) to enable the reintroduction of extirpated species into the province; and 3) to designate species as endangered, threatened, extinct or extirpated. Additions or deletions to list of species under each designation are recommended by the Endangered Species Advisory Committee.

Third-order Stream: A stream formed by the confluence of two second-order streams, or of a second-order stream and a third-order stream.

Threatened: A species likely to become endangered if limiting factors are not reversed (COSEWIC).

Threshold: A limit or level which if exceeded likely results in a noticeable, detectable or measurable change or environmental effect that may be significant. Example thresholds include water-quality guidelines, acute toxicity levels, critical population levels and wilderness criteria.

Till: An unstratified, unconsolidated mass of boulders, pebbles, sand and mud deposited by the movement or melting of a glacier.

Timber: The wood of growing trees suitable for structural uses; the body, stem or trunk of a tree.

Trap Night: A unit of measure used to standardize small mammal trapping effort (e.g., 100 TN is equivalent to setting 100 snap traps in an area for a period of 24 hours).

Topography: The surface features of a region, such as its hills, valleys or rivers.

Uncertainty: The lack of certainty or a state of having limited knowledge where it is impossible to exactly describe existing state or future outcome, more than one possible outcome. In environmental assessment not knowing the nature and magnitude of environmental effects or the degree to which mitigation measures would prevent or reduce adverse effects.

Uncommon habitat type: Covers between 1% and 10% of regional land area.

Unconsolidated: Not compact or dense in structure or arrangement; i.e., "loose gravel."

Varved: A layer or series of layers of sediment deposited in a body of still water in one year. Varves are typically associated with glacial lake deposits and consist of two layers: a lower, light-coloured layer that consists primarily of sand and silt, and a darker upper layer that consists primarily of clay and organic matter.

Veneer bogs: A type of bog with thin peat (i.e., less then 1.5 thick). In the Keeyask area, veneer bogs generally occur on gentle slopes and contain discontinuous permafrost.

Very uncommon habitat type: Covers 1% or less of regional land area.

Watershed: The region draining into a river, river system or other body of water.

Wetland: A land ecosystem where periodic or prolonged water saturation at or near the soil surface is the dominant factor shaping soil attributes and vegetation composition and distribution. Peatlands are wetlands where organic material has accumulated because dead plant material production exceeds decomposition.