REPORT

Tazi Twé
Hydroelectric Project

February 2014

TAZI TWÉ HYDROELECTRIC PROJECT

Environmental Impact Statement

Submitted to:
Saskatchewan Ministry of Environment

Canadian Environmental Assessment Agency

Report Number: 10-1365-0004/DCN-171

List of Acronyms

Term	Definition
AANDC	Aboriginal Affairs and Northern Development Canada
Agency	Canadian Environmental Assessment Agency
AHA	Athabasca Health Region
ANFO	ammonium nitrate/fuel oil
ARD	acid rock drainage
BCR	Band Council Resolution
BP	Before Present
BLFN	Black Lake First Nation
BMP	Best Management Practices
CEAA	*Canadian Environmental Assessment Act*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPAWS	Canadian Parks and Wilderness Society, Saskatchewan
CWS	Canadian Wildlife Service
D&R	Decommissioning and Reclamation
DFO	Fisheries and Oceans Canada
EFHLP	Elizabeth Falls Hydro Limited Partnership
EIS	Environmental Impact Statement
EnvPP	Environmental Protection Plan
ERP	Emergency Response Plan
FNMNA	First Nation Métis and Northern Affairs
FWB	Fish and Wildlife Branch
HADD	Harmful alteration, disruption, or destruction
HBC	Hudson's Bay Company
HC	Health Canada
INAC	Indian and Northern Affairs Canada
LSA	local study area
ML	metal leaching
MOE	Saskatchewan Ministry of Environment
NLMC	Northern Labour Market Committee
NRCan	Natural Resources Canada
OIC	Order in Council
PIP	Public Involvement Program
Project	Tazi Twé Hydroelectric Project

Term	Definition
PSL	permissible sound limit
RSA	regional study area
SARA	*Species at Risk Act*
SaskPower	Saskatchewan Power Corporation
SEAA	*Saskatchewan Environmental Assessment Act*
SES	Saskatchewan Environmental Society
TC	Transport Canada
TIV	turbine inlet valves
TOR	Terms of Reference
VC	valued component
VOIP	voice over internet protocol based system
WSA	Water Security Agency
WMZ	wildlife management zone

LIST OF UNITS

Term	Definition
%	percent
°C	degrees Celsius
Cm/h	centimetres per hour
ha	hectare
km	kilometre
km^2	square kilometres
kV	kilovolt
L	litres
L/s	litres per second
mm	millimetre
m	metre
m^3	cubic metre
m^3/d	cubic metres per day
m^3/s	cubic metres per second
m/s	metres per second
MW	megawatt
MWh	megawatt hours
PPM	parts per million

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

TABLES

Table of Contents (continued)

FIGURES

Executive Summary

1.0 INTRODUCTION

This Executive Summary highlights findings and conclusions from the Environmental Impact Statement (EIS) for the Tazi Twé Hydroelectric Project (the Project). The Project is located 7 kilometres (km) from the community of Black Lake, within the Chicken Indian Reserve No. 224 (Figure 1-1). The Chicken Indian Reserve No. 224 was created under the Order in Council (OIC) 1978-1647; that is the land is set aside for the exclusive use and benefit of the members of the Black Lake First Nation (BLFN). The area surrounding the Chicken Indian Reserve No. 224 is provincial crown land and accessible to all aboriginal people for the pursuit of traditional and cultural activities. The Northern Hamlet of Stony Rapids is located about 25 km northwest of the Project.

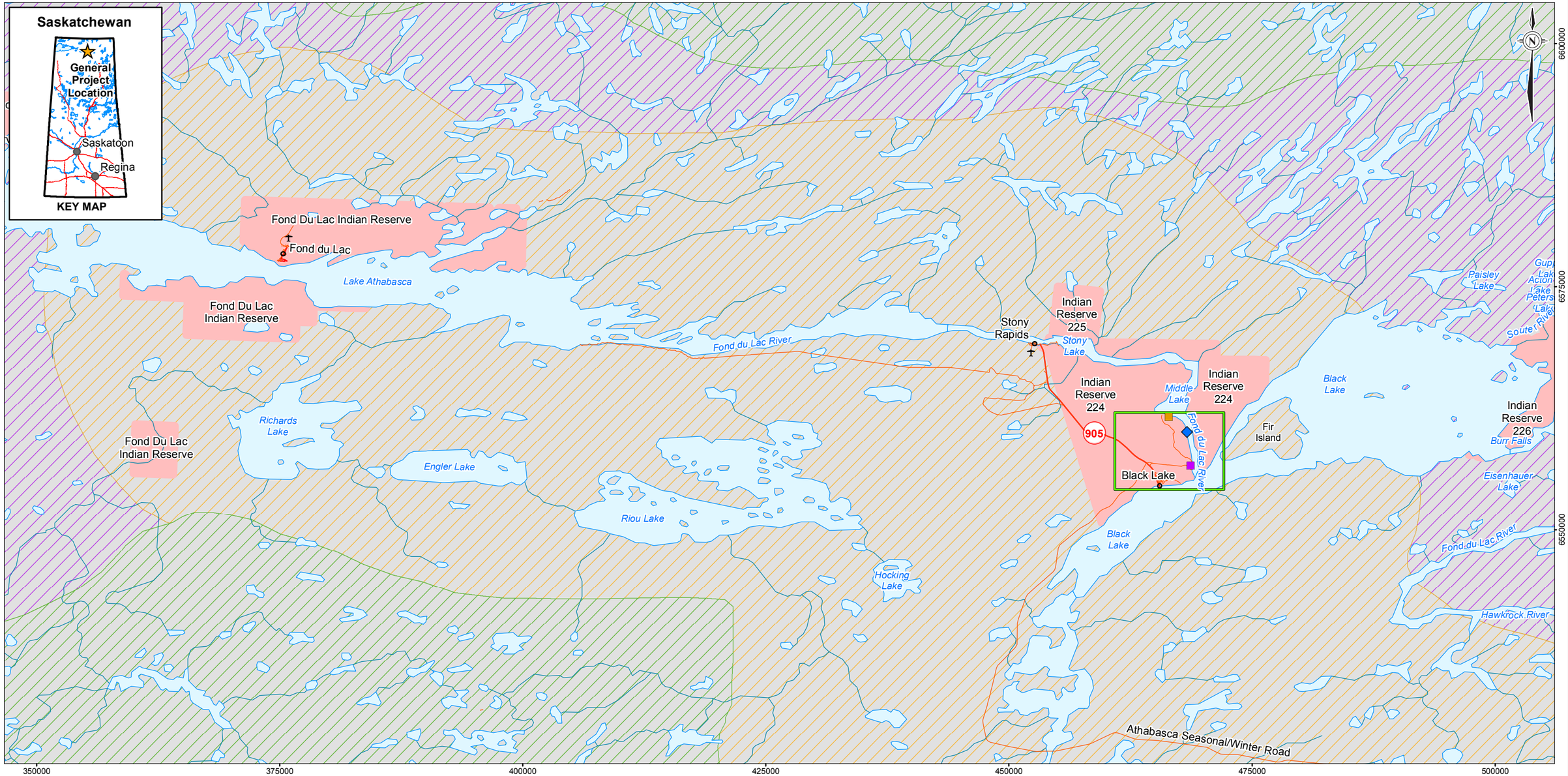
The energy produced by the Project will be integrated into the Saskatchewan Power Corporation (SaskPower) northern electrical grid to assist with accommodating the growing energy requirements of northern Saskatchewan communities and to support continued northern economic development. The Project's estimated gross average annual power supply will be approximately 400,000 megawatt hour (MWh) per year.

1.1 Project Overview

The proposed Project will be a 50 megawatt (MW) water diversion-type electrical generating station. The Project is located adjacent to the Fond du Lac River between Black Lake and Middle Lake. Water from Black Lake will be diverted through a water intake structure and power tunnel to the powerhouse before being released through a tailrace channel into the Fond du Lac River, which ultimately discharges into Middle Lake.

The principal components of the Project consist of the following:

- gravel, all-season access roads to the Project site from the all-season road between the communities of Black Lake and Stony Rapids;
- bridge over the Fond du Lac River;
- powerhouse and associated infrastructure;
- water intake and power tunnel to convey flow from Black Lake to the powerhouse;
- tailrace channel from the powerhouse to the Fond du Lac River just upstream of Middle Lake;
- submerged weir located in the Fond du Lac River at the outlet of Black Lake near Grayling Island;
- settling ponds;
- waste rock disposal areas;
- construction camp;
- transmission lines and switching stations to connect to the northern Saskatchewan electrical grid; and
- all related physical works and physical activities required to carry out these works, including the associated cofferdams, access roads, laydown areas, borrow areas, concrete batch plant, fuel storage facility and fueling areas, explosives storage, and sewage treatment and potable water facilities (Figure 1-2).



LEGEND

- HAMLET OR COMMUNITY
- RUNWAY
- RIVER
- HIGHWAY
- ROAD
- INDIAN RESERVE
- WATERBODY
- ELIZABETH FALLS
- CAMP GRAYLING
- PERMANENT RESIDENT'S CABIN
- GENERAL PROJECT LOCATION
- NORTHERN ADMINISTRATION DISTRICT
- ATHABASCA LAND USE PLAN - STAGE 1
- ATHABASCA LAND USE PLAN - STAGE 2
- ATHABASCA LAND USE PLAN - STAGE 3

REFERENCE

DMTI HIGHWAYS AND ROADS
NTS MAPSHEET 74I, 74J, 74O, 74P
NAD 83 UTM ZONE 13

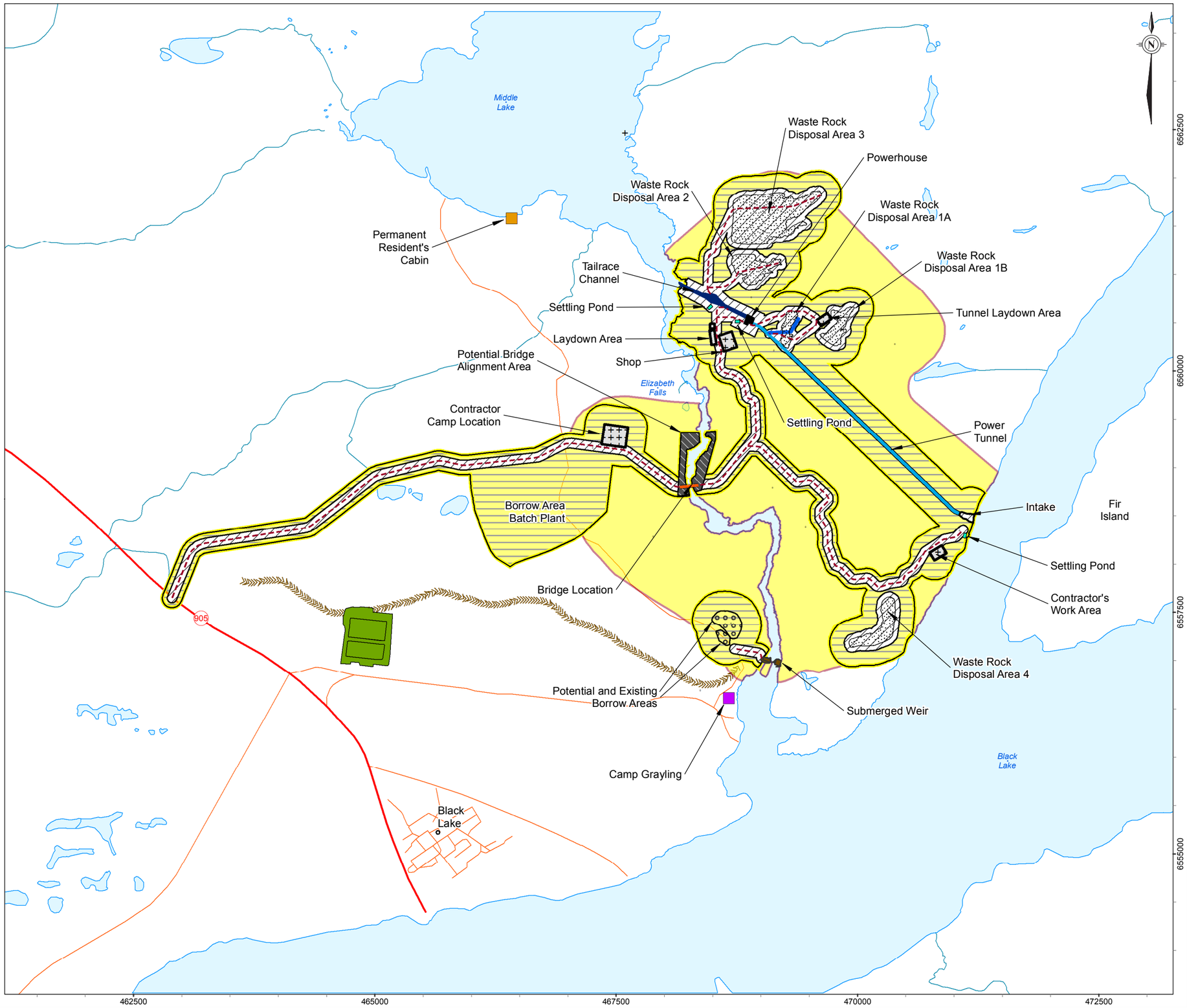
10 0 10
SCALE 1:400,000 KILOMETRES

PROJECT
TAZI TWÉ HYDROELECTRIC PROJECT

TITLE
LOCATION OF THE TAZI TWÉ HYDROELECTRIC PROJECT

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 1
GIS	SM	04/11/13	**FIGURE: 1-1**	
CHECK	MT	04/11/13		
REVIEW	MM	04/11/13		



LEGEND

- HAMLET OR COMMUNITY
- HIGHWAY
- ROAD
- ESKER
- RIVER
- WATERBODY
- CAMP GRAYLING
- PERMANENT RESIDENT'S CABIN
- POTENTIAL BRIDGE ALIGNMENT
- PERMANENT ROAD
- OPERATIONS FOOTPRINT
- PREDICTED PROJECT FOOTPRINT
- DISTURBANCE ASSESSMENT AREA
- CONTRACTOR CAMP / LAYDOWN AREA
- BORROW AREA
- SETTLING POND
- SPOIL DISPOSAL AREA
- POTENTIAL BRIDGE ALIGNMENT AREA
- INTAKE
- POWER HOUSE
- TAILRACE CHANNEL
- POWER TUNNEL
- SURGE FACILITY
- SUBMERGED WEIR
- BLACK LAKE SEWAGE LAGOON

REFERENCE

NAD83 UTM ZONE 13
NTS MAPSHEETS: 73P/3,4,5,6

1 0 1
SCALE 1:40,000 KILOMETRES

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

TAZI TWÉ HYDROELECTRIC PROJECT SITE PLAN

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 5
GIS	SM	04/11/13		
CHECK	BC	04/11/13		
REVIEW	MM	04/11/13		

FIGURE: 1-2

1.2 Project Need

The demand for power in northern Saskatchewan is expected to double over the next 10 years and the existing Far North electrical facilities will not be able to serve this demand. The objective of this Project is to develop additional power supply in northern Saskatchewan to assist with accommodating the growing energy requirements of northern Saskatchewan communities and to support continued northern economic development. As a result, SaskPower is working with BLFN to develop the Project to enable service of the Far North load into the future.

1.3 Project Benefits

The proposed Project is expected to cost approximately $500 million to develop and build. The Project will generate employment, business and investment income benefits for residents of BLFN and the Athabasca region during the construction and operational phases. The main benefits of the Project include:

- short and long term employment opportunities for residents of BLFN and other residents in the Athabasca region;
- investment in the Project by BLFN that will provide a secure, long-term source of income to improve the quality of life for members of BLFN;
- improvement of job skills by local residents engaged in the construction and operations of the Project that may be used for future employment opportunities;
- enhancement of business opportunities by local and regional companies in the provision of goods and services to the Project; and
- a long-term source of renewable power with low environmental impact that will serve the electrical energy needs of communities and industry located in the Athabasca region.

The construction phase of the Project is expected to take four years. Approximately 250 to 300 jobs will be created during the construction phase of the Project. In 2013, BLFN and SaskPower initiated formal training programs to improve the employment skills of BLFN members in order to maximize job opportunities by local residents in the construction of the Project. Additional on-the-job training programs for local residents will be facilitated by the Proponent and General Contractor selected to construct the Project. The magnitude and extent of the employment benefits derived by local residents will depend on their ability to satisfy the specific skill requirements for jobs related to the Project.

During the operational phase of the Project (90+ years) the Project will provide employment opportunities for six to eight people. BLFN and SaskPower intend to prioritize the hiring of local residents for these positions and will implement a training program to achieve that objective.

BLFN and SaskPower intend to maximize the use of local and regional based companies in the construction and operation of the Project which will result in new business and employment opportunities benefiting residents in the Athabasca region. Local and regional businesses are well positioned to provide goods and services to the Project as they have developed considerable capacity serving the construction and operational needs of the mining industry located in the Athabasca region.

The Project is a major investment opportunity for BLFN that is expected to generate a long-term source of income which will be used to address community needs and improve the quality of life of BLFN members. Other benefits to the local residents include new infrastructure, such as roads and bridge over the Fond du Lac River.

The Project will create a new source of electrical power to serve the growing demand by communities and industry located in the Athabasca region. The energy produced by the Project is sustainable, renewable and will help SaskPower to maintain a diverse supply of electricity without producing any greenhouse emissions. The Project will also enhance the reliability of the supply of electrical energy in northern Saskatchewan.

2.0 REGULATORY FRAMEWORK

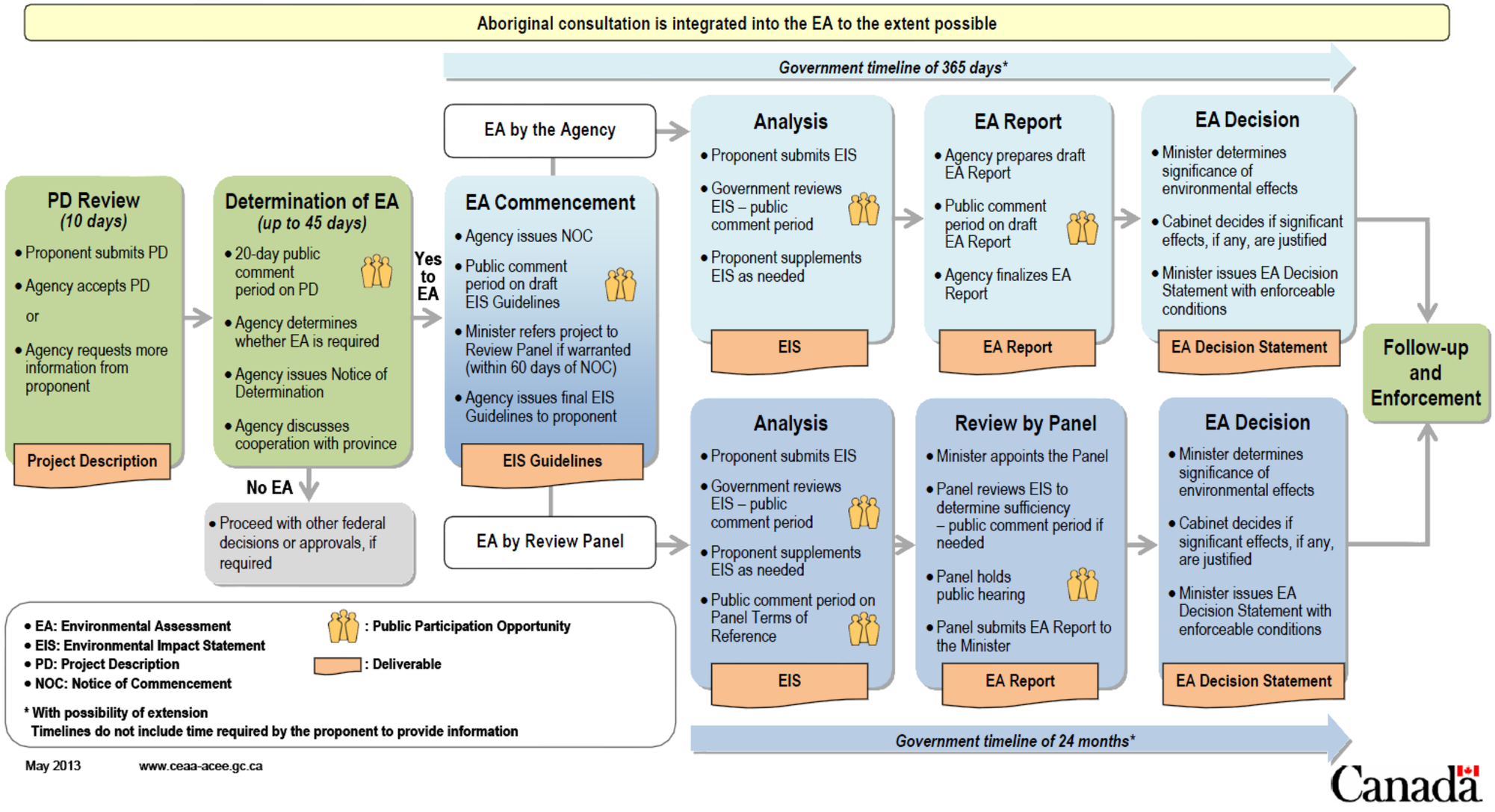
The Project is subject to an environmental assessment under the *Canadian Environmental Assessment Act* (*CEAA*) and the *Saskatchewan Environmental Assessment Act* (*SEAA*) and must meet both federal and provincial requirements before it can be constructed.

2.1 Federal

In January 2013, a Project Description was provided to the Canadian Environmental Assessment Agency (the Agency) for review. In February 2013, the Agency determined that a federal environmental assessment would be required for the Project pursuant to the *CEAA 2012 designated project list* as the proposed Project would involve the diversion of 10,000,000 cubic metres per year (m^3/year) or more of water from a natural waterbody (i.e., Black Lake) into another natural water body (i.e., Fond du Lac River). This involves completion of an environmental assessment and submission of an Environmental Impact Statement (EIS). This decision marked the start of the Agency's 365-day review period (i.e., the environmental assessment commencement phase). The Agency's environmental assessment process and timeline is outlined on Figure 2-1.

Canadian Environmental Assessment Agency | Agence canadienne d'évaluation environnementale

ENVIRONMENTAL ASSESSMENT PROCESS MANAGED BY THE AGENCY



REFERENCE
CANADIAN ENVIRONMENTAL ASSESSMENT AGENCY, 2013

PROJECT
TAZI TWÉ HYDROELECTRIC PROJECT

TITLE
CANADIAN ENVIRONMENTAL ASSESSMENT ACT REVIEW PROCESS

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	SM	31/07/13		
CHECK	BC	31/07/13		
REVIEW	MM	31/07/13		

FIGURE: 2-1

As part of the environmental assessment commencement phase, the Agency drafted EIS Guidelines to identify the information requirements for the preparation of an EIS for the Project, to be assessed pursuant to the *CEAA 2012*. These draft EIS Guidelines were available for public review and comment on the Agency's Registry internet site. Public comments, including comments from Aboriginal groups, as well as input from federal departments were incorporated into the final EIS Guidelines. After reviewing the comments, the Agency issued the final EIS Guidelines in April 2013.

2.2 Provincial

In January 2013, a Technical Proposal was submitted to the Saskatchewan Ministry of Environment (MOE). The MOE determined that the Project is a "development" as defined by Section 2(d) of the *SEAA* in February 2013. As such, an environmental assessment is required and an EIS must be submitted for the Project that satisfies the provincial environmental assessment process. A simplified flow chart of the provincial environmental assessment process is presented in Figure 2-2.

Draft Terms of Reference (TOR) were submitted to MOE in May 2013 providing a detailed description of the information required to address the potential concerns and issues associated with the development. These TOR take into account and compliment the EIS Guidelines provided by the Agency in April 2013. Following reviews, comments, and revisions, the TOR for the proposed Project were accepted as final by MOE in August 2013.

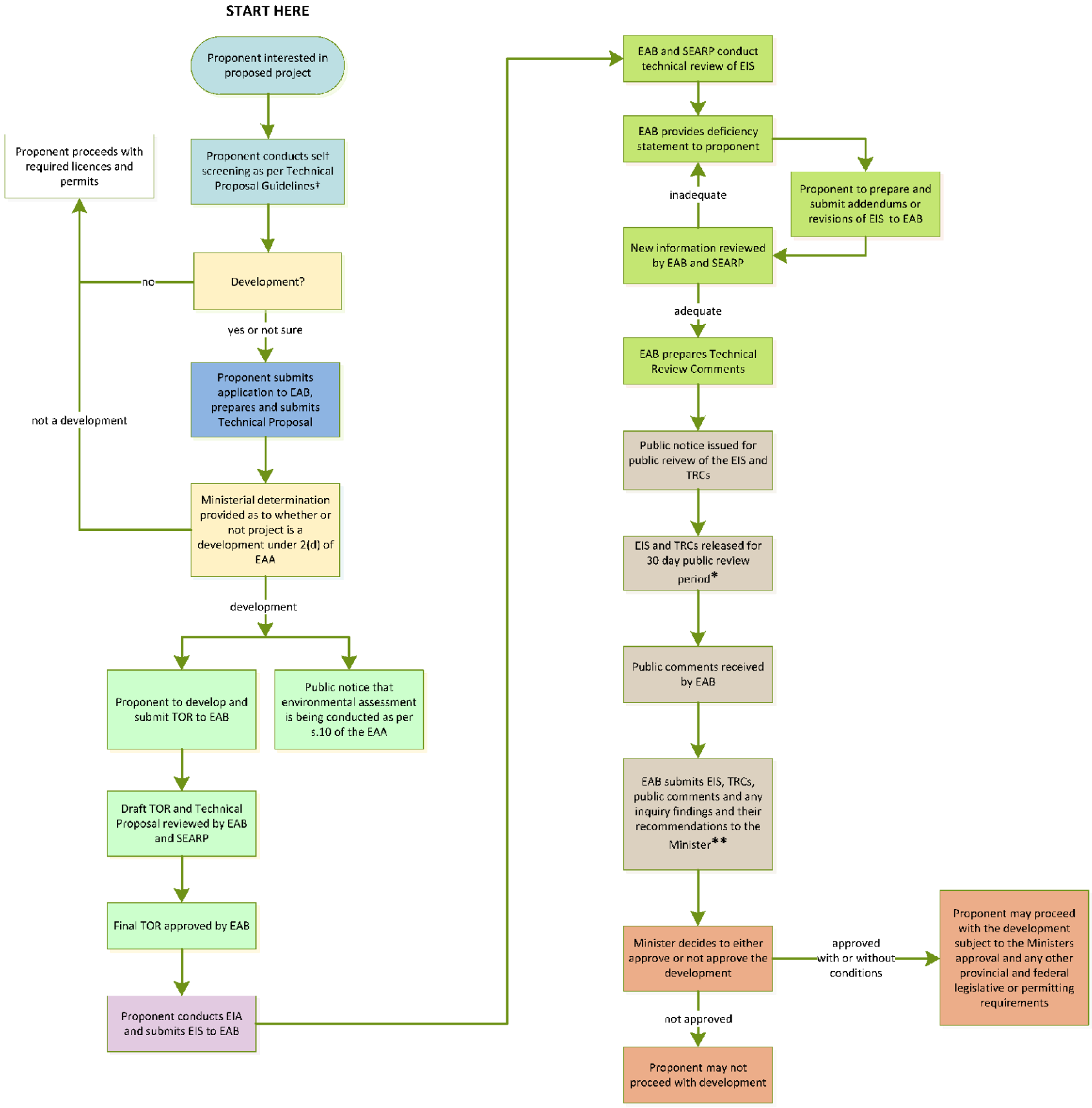
2.3 Participants in the Environmental Assessment

The agencies, departments, organizations, and other participants likely to be involved in the environmental assessment process are listed below.

The Agency is the federal responsible authority for the Project; however, other federal regulators identified as having a key role or interest in the Project include:

- Fisheries and Oceans Canada (DFO);
- Aboriginal Affairs and Northern Development Canada (AANDC);
- Transport Canada (TC);
- Health Canada (HC);
- Environment Canada;
- Natural Resources Canada (NRCan); and
- Canadian Wildlife Service (CWS).

The Saskatchewan Environmental Assessment Process



Proposal Development
Application
Screening
Scoping
Impact Assessment
Review
Public Comment
Decision by Minister

†Changes to a development with prior Ministerial Approval require review by EA Branch

Key

TPG – Technical Proposal Guidelines
EAB – Environmental Assessment Branch
EAA – The Environmental Assessment Act
TOR – Terms of Reference
SEARP – Saskatchewan Environmental Assessment Review Panel
EIA – Environmental Impact Assessment
EIS – Environmental Impact Statement
TRCs- Technical Review Comments

* Any person may: make a written submission to the minister within 30 days from the date when the minister first gives notice or if the minister considers it appropriate, within an additional period of 30 days.
**Minister may require public meetings or public inquiry into all or any aspect of the development at any time prior to making a decision about the development

REFERENCE
MINISTRY OF ENVIRONMENT, GOVERNMENT OF SASKATCHEWAN, 2013

TAZI TWÉ HYDROELECTRIC PROJECT

SASKATCHEWAN ENVIRONMENTAL ASSESSMENT ACT REVIEW PROCESS

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	SM	31/07/13	FIGURE: 2-2	
CHECK	BC	31/07/13		
REVIEW	MM	31/07/13		

Provincial regulators identified as having a key role or interest in the Project include the following:

- MOE – EAB (Ministry of Environment – Environmental Assessment Branch);
- MOE – Fish and Wildlife Branch;
- Ministry of Government Relations - First Nations, Métis and Northern Affairs (FNMNA);
- Ministry of Highways and Infrastructure;
- Ministry of Economy (previously known as Ministry of Industry and Resources); and
- Water Security Agency (WSA previously known as Saskatchewan Watershed Authority).

Communities for which the Proponent has sought engagement regarding potential or established Aboriginal rights and Treaty rights and related interests that could be affected by the Project include:

- Black Lake Denésuline First Nation;
- Hatchet Lake Denésuline First Nation;
- Fond du Lac Denésuline First Nation;
- Métis Nation – Saskatchewan Northern Region 1, Stony Rapids Local 80;
- Métis Nation – Saskatchewan Northern Region 1, Uranium City Local 50; and
- Métis Nation – Saskatchewan Northern Region 1, Camsell Portage Local 79.

Other agencies, organizations, and groups identified as stakeholders potentially having a potential interest in the Project, and for which engagement has been offered, include:

- Camp Grayling;
- Mayor and Council Northern Hamlet of Stony Rapids;
- Prince Albert Grand Council – Athabasca Region;
- Athabasca Health Authority;
- New North;
- Northern Labour Market Committee (NLMC);
- Athabasca Basin Development - Board of Directors;
- Athabasca Keepers of the Water;
- Canadian Parks and Wilderness Society, Saskatchewan (CPAWS);

- Saskatchewan Environmental Society (SES);
- regional suppliers;
- local outfitters and resource users;
- uranium industry; and
- regional educations and training institutes.

2.4 Regulatory Permitting

Regulatory permitting (i.e., licensing) occurs after environmental assessment approval and includes the submission of specific applications, and supporting design and project management documentation seeking specific construction and operating approvals. Federal and provincial permits, licences, approvals, and authorizations that could be required for the Project are listed in Table 2-1.

A Band Council Resolution (BCR) is required from the BLFN Chief and Council to manage activities such as resource management within the BLFN. The proponent is not aware of any other permits, approvals, or authorizations required at the municipal level at this time.

2.4.1 Treaty or Self-government Agreements

In 2009, an Order in Council (OIC; P.C.2009-305) was approved by the Governor General in Council, pursuant to paragraph 39(1)(c), and Section 40 of the *Indian Act* (Government of Canada 1985), designating portions of the Chicken Indian Reserve No. 224, 225, and 226 for exploration and development of minerals, development of a hydroelectric facility, and commercial leasing purposes.

The Project is located within the Chicken Indian Reserve No. 224, which was created under the OIC 1978-1647; that is the land is set aside for the exclusive use and benefit of the members of the BLFN. The area surrounding the Chicken Indian Reserve No. 224 is provincial crown land and accessible to all aboriginal people for the pursuit of traditional and cultural activities. Traditional resource use by the people of this area is a defining feature of their cultures and identities. In addition to hunting and trapping of various wildlife species, traditional land use includes fishing and gathering of plants and berries for domestic use.

The BLFN played a key role in determining what they would like to see applied with respect to resource management policies. The proponent and BLFN are working together on developing agreements and policies intended to benefit BLFN. Implementation of the Project's environmental design features and mitigation to decrease potential Project-environment interactions with aquatic and terrestrial components would reduce potential effects on traditional and non-traditional land and resource use activities. For example, to reduce potential effects on local fish and wildlife populations, policies will be in place during construction to prohibit hunting, trapping, harvesting and fishing by non-Band members during construction.

Table 2-1: Federal and Provincial Acts and Regulations that could be Required for the Project

Jurisdiction	Related Regulations	Permits Required
Federal Acts		
Canadian Emission Reduction Incentives Agency Act, S.C., 2005, c. 30	■ n/a	■ n/a
Canadian Environmental Assessment Act, 2012, S.C., 2012, c.19, s.52	■ Regulations Designating Physical Activities, SOR/2012-147 ■ Prescribed Information for the Description of a Designated Project Regulations, SOR/2012-148 ■ Cost Recovery Regulations, SOR/2012-146	■ Environmental Assessment Approval
Canadian Environmental Protection Act, 1999, C-15.1	■ Environmental Emergency Regulations, SOR/2003-307 ■ Federal Above Ground Storage Tank Technical Guidelines, P.C. 1996-1233 ■ Federal Halocarbon Regulations, 2003 SOR/2003-289 ■ Federal Underground Storage Tank Guidelines ■ Inter-provincial Movement and Hazardous Waste Regulations, SOR/2002-301 ■ National Pollutant Release Inventory and Municipal Wastewater Services May 2003 ■ Ozone-depleting Substances Regulations, 1998 SOR/99-7	■ n/a
Canadian Water Act, R.S.C., 1985, c. C-11	■ Guidelines for Canadian Drinking Water Quality	■ n/a
Canadian Wildlife Act, R.S.C., 1985, c. W-9	■ Wildlife Area Regulation, C.R.C., c. 1609	■ n/a
The Fisheries Act, R.S.C., 1985, c. F-14 (amended 2012)	■ n/a	■ Authorization For Harmful Alteration or Disruption, or the Destruction of fish habitat (Section 35) ■ As well as requirements under other sections of the act (can include Sections 20, 30, 32, and 36 as the final 2012 changes come into force)

Table 2.1: Federal and Provincial Acts and Regulations that could be Required for the Project (continued)

Jurisdiction	Related Regulations	Permits Required
Indian Act R.S.C. 1985, c.I-5	■ Indian Reserve Waste Disposal Regulations, C.R.C., c.960 ■ Indian Timber Regulations C.R.C., c.961 ■ Sand and Gravel Regulations	■ Permit to use land in a reserve for the disposal or storage of waste, or to burn waste on any land in a reserve ■ Licence to cut timber on surrendered lands or on reserve land ■ Lease of Land (Section 53) ■ Access Permit (Section 20)
Migratory Birds Convention Act, S.C., 1994, c. 22	■ *Migratory Bird Regulations, 2010 C.R.C., c. 1035*	■ n/a
*Navigable Waters Protection Act, R.S., 1985, C. N-22**	■ n/a	■ Work Approval
Species at Risk Act, S.C. 2002, c. 29	■ n/a	■ n/a
Transportation of Dangerous Goods Act, 1992, C.34	■ Transportation of Dangerous Goods Regulations, SOR/2001-286	■ n/a
Provincial Acts		
The Clean Air Act, S.S. 1986-87-88, C-12.1	■ The Clean Air Regulations, R.R.S c. C-12.1 Reg 1	■ Permit to Construct ■ Permit to Operate
The Environmental Assessment Act, S.S. 1979-80, E-10.1	■ n/a	■ Environmental Assessment Approval
Environmental Management and Protection Act, R.R.S. 2010, c. E-10.22	■ The Environmental Spill Control Regulations, R.R.S c.D-14 Reg 1 ■ The Hazardous Substances and Waste Dangerous Goods Regulations, R.R.S., c. E-10.2, Reg 3 ■ The Water Regulations, 2002, R.R.S. c. E-10.21 Reg 1 ■ Halocarbon Control Regulations, c. E-10.21 Reg 2 ■ Used Oil Collection Regulations, R.R.S., c. E-10.2 Reg 8	■ Hazardous Substances and Waste Dangerous Goods Permit to Construct (Section 10) ■ Hazardous Substances and Wastes Dangerous Goods Permit to Operate (Approval to Store - Section 9) ■ Approval to Construct - Water Works ■ Approval to Operate – Water Works ■ Permit to Construct - Aquatics Habitat Protection Permit

Table 2-1: Federal and Provincial Acts and Regulations that could be Required for the Project (continued)

Jurisdiction	Related Regulations	Permits Required
Forest Resources Management Act, 1996, F-19.1	■ The Forest Resources Management Regulations, 1999, F-19.1 Reg 1	■ Forest Product Permit
Fire Prevention Act, S.S. 1992, F-15.001	■ The Saskatchewan Fire Code Regulations, F-15.001 Reg 1 ■ The Fire Insurance Fees and Reporting Regulations, F-15.001 Reg 2	■ n/a
Fisheries Act (Saskatchewan), S.S. 1994, F-16.1	■ The Fisheries Regulations, 1994, F-16.1	■ n/a
The Heritage Property Act, S.S. 1979-80, H-2.2	■ The Heritage Property Regulations, Sask. Reg 279-80	■ n/a
Highways and Transportation Act, S.S. 1987, H-3.01	■ The Controlled Access Highways Regulations, H-3 Reg 7 ■ The Highways and Transportation Regulations, H-3.01 Reg 1 ■ The Erection of Signs Adjacent to Provincial Highways Regulations, 1986	■ Approach Permit ■ Oversize / Overweight permits ■ Roadside Permit ■ Off-premise Sign Application ■ On-premise Sign Application
The Northern Municipalities Act, 2012, N-5.2	■ The Northern Municipalities Regulations, 2011, N-5.2 Reg 1	■ Road Maintenance Agreement
Occupational Health and Safety Act, S.S. 1993, O-1.1	■ Occupational Health and Safety Regulations, 1996, R.R.S., c. O-1 Reg 1	■ n/a
Provincial Lands Act, S.S. 1978, P-31	■ Saskatchewan Wetland Conservation Corporation Land Regulations, 1993, P-31, Reg 14 ■ Crown Resource Land Regulations, P-31, Reg 17 ■ Provincial Lands Regulations, SR145/68	■ n/a
The Water Security Agency Act, S.S. 2006, W-8.1th	■ Saskatchewan Watershed Authority Regulations, R.R.S., c. S-35.03 Reg1	■ Water Rights Licence
Weed Control Act, 2010, S.S. W-11.1	■ Weed Control Regulations, W-11.1, Reg 1	■ n/a

Table 2-1: Federal and Provincial Acts and Regulations that could be Required for the Project (continued)

Jurisdiction	Related Regulations	Permits Required
Wildlife Act, S.S. 1998, c. W-13.12	■ Wildlife Regulations, W-13.1, Reg 1 ■ Wildlife Management Zones and Special Areas Boundaries Regulations, 1990, W-13.1 Reg 45 ■ Wildlife-Landowner Assistance Regulations, 1981, W-13.1, Reg 48 ■ Wild Species at Risk Regulations, W-13.1 Reg 1	■ n/a
Municipal		
Black Lake First Nation	■ n/a	■ Band Council Resolution

*Act is currently being revised. Changes to the Act had not come into force at the time this table was generated. Changes to the Act will have to be reviewed in context of the Project once additional information is available.
n/a = not applicable

3.0 ENVIRONMENTAL SETTING

The Project is located approximately 7 km northeast of the community of Black Lake, within the Chicken Indian Reserve No. 224 (Latitude: 59° 10' 48" N, Longitude: 105° 32' 12" W). Each discipline section in the EIS provides a high-level summary of the Project's existing environment information.

3.1 Climate

The Black Lake area has a subarctic continental climate with short, cool summers and long, very cold winters. Winter persists for about six months and there are few winter thaws. Summers are cool with frequent convective storms driven by evaporation from lakes and forests.

In the summer, mean maximum daily air temperatures reach a July high of 22.7 degrees Celsius (°C), while in January mean minimum temperatures are as low as -30°C. The mean annual temperature is -3.4°C. Mean annual precipitation at Stony Rapids is 424 millimetre (mm) with 66% of the precipitation occurring as rainfall during the spring, summer, and fall (Environment Canada 2013). Annually and seasonally, most winds come from either the southwest or northwest with some variability in their strength among the seasons.

3.2 Geology

The bedrock in the area consists of Precambrian age crystalline gneiss complex and the Athabasca Formation (i.e., conglomerates and sandstones) to the east and west of the Fond du Lac River, respectively. The bedrock east of the Fond du Lac River includes Precambrian age metamorphic rocks. This includes blocks of ancient continental crust, each bounded by faults, and younger metamorphosed volcanic and sedimentary rock. Mid-Proterozoic sedimentary rocks of the Athabasca Group of the Athabasca Basin underlie most of the area west of the Fond du Lac River. These consist of sandstone, conglomerate, and siltstone deposited about 1.7 billion years ago in an inland sea overlying older Precambrian basement rocks (Acton et al. 1998).

The topography surrounding Elizabeth Falls is primarily bedrock controlled with low to moderate relief. The area forms part of the Lake Athabasca drainage basin. Most of the prominent landforms in the area result from glacial action. To the east of the Fond du Lac River, ancient Precambrian rocks, rising more than 100 metres (m)

above the surrounding terrain, create a rugged, almost mountainous landscape. Upland elevations are dominated by bedrock exposures with discontinuous veneers of sandy till and the lowlands are covered by a thin layer of level to gently undulating till deposits. To the west of the Fond du Lac River, landscapes formed on flat-lying sandstone bedrock and sandy glaciofluvial deposits; there are fewer lakes and wetlands to the east of the Project. Prominent features include flutings and drumlins, which mark the northeast-southwest direction of ice movement during the last glaciation, as well as eskers.

3.3 Hydrogeology

Precambrian bedrock formations in Saskatchewan do not readily permit groundwater flow, except as fracture flow from high elevation areas towards Black Lake, Fond du Lac River, and Middle Lake. The Tazin Lake Upland Ecoregion has discontinuous sandy and boulder glacial deposits, so groundwater flow generally is confined to localized shallow fracture systems and flow directions are similar to the topographic grade. The supply of groundwater is limited by the widespread distribution of permafrost. The sandstone bedrock and the overlying glacial deposits in the Athabasca Plain Ecoregion are highly permeable so groundwater flows easily.

3.4 Hydrology

The river systems in the forested zone of Saskatchewan tend to consist of networks of lakes connected by fast-flowing, short stretches of stream (Pomeroy et al. 2005). The Project is located on the Fond du Lac River in the Athabasca River basin of Northern Saskatchewan, between Black Lake and Middle Lake.

Black Lake is at the upstream end of the Project with outflows discharging from the lake down the Fond du Lac River and eventually into Lake Athabasca, approximately 50 km downstream of the Project. Black Lake has three notable inflows: the Fond du Lac River, the Cree River, the Chipman River; and one outflow: the Fond du Lac River. The Chipman River flows from the north and enters Black Lake at its most northern point. The Cree River enters Black Lake from the south; the Fond du Lac River, carrying the largest inflow, enters Black Lake from the east with headwaters upstream of Wollaston Lake.

Black Lake has two main sections, one to the southwest of the outflow and a larger section to the northeast. The southwest section is approximately 25 km long and has a maximum width of less than 5 km, while the northeast section is approximately 40 km long and has a maximum width of less than 20 km. Black Lake has a total surface area of 418 square kilometres (km^2) and has a maximum depth of about 58 m. Middle Lake is a widening of the Fond du Lac River before the river continues toward Lake Athabasca. Middle Lake has a total surface area of 7.5 km^2 and a maximum depth of about 14 m. At the outlet of Black Lake, the Fond du Lac River has an upstream drainage area of 50,800 km^2 and receives minimal additional runoff from an area of 10.6 km^2 to the inflow of Middle Lake. The Fond du Lac River between Black Lake and Middle Lake has a total length of 6.1 km and a total change in elevation of approximately 36 m. From 1963 to 2011, the Fond du Lac River had an average flow rate of 304 cubic metres per second (m^3/s), a maximum flow rate of 860 m^3/s, and a minimum flow rate of 115 m^3/s.

3.5 Fish and Fish Habitat

Lake trout (*Salvelinus namaycush)*, arctic grayling (*Thymallus arcticus)*, lake whitefish (*Coregonus clupeaformis)*, walleye (*Sander vitreus),* and northern pike (*Esox lucius)* are found in the cold waters of the Tazin Lake Upland ecoregion. In the Athabasca Plain ecoregion cold-water species such as lake trout, arctic grayling, and lake whitefish, in addition to northern pike and walleye, are common. Overall, there is a low level of fish

species richness in the Tazin Lake Upland Ecoregion and a moderately low level in the Athabasca Plain Ecoregion.

Fish and fish habitat surveys were completed in Black Lake, Fond du Lac River (between Black Lake and Middle Lake), and Middle Lake between June 2010 and July 2012. During the fish habitat mapping and assessments 16 fish species were captured in Black Lake (Table 3-1), 12 fish species were captured in the Fond du Lac River between Black Lake and Middle Lake (Table 3-2), and 9 fish species were captured in Middle Lake (Table 3-3). A full discussion of the results of these surveys is presented in Section 12 of the EIS.

Table 3-1: Fish Species Captured in Black Lake from May 2010 to February 2011

Common Name	Scientific Name	Total Number Captured
Arctic grayling	*Thymallus arcticus*	46
burbot	*Lota lota*	112
lake cisco	*Coregonus artedi*	9
lake chub	*Couesius plumbeus*	130
lake trout	*Salvelinus namaycush*	505
lake whitefish	*Coregonus clupeaformis*	272
longnose sucker	*Catostomus catostomus*	267
ninespine stickleback	*Pungitius pungitius*	13
northern pike	*Esox lucius*	45
round whitefish	*Prosopium cylindraceum*	16
slimy sculpin	*Cottus cognatus*	86
spottail shiner	*Notropis hudsonius*	6
trout-perch	*Percopsis omiscomaycus*	7
walleye	*Sander vitreus*	24
white sucker	*Catostomus commersonii*	372
yellow perch	*Perca flavescens*	6

Table 3-2: Fish Species Captured in the Fond du Lac River from May to October 2010 and in July 2012

Common Name	Scientific Name	Total Captured		
		Upstream (Black Lake Outflow)	Downstream (Middle Lake Inflow)	Middle Section (Fond du Lac River)
Arctic grayling	*Thymallus arcticus*	1,161	695	5
burbot	*Lota lota*	1	15	0
longnose sucker	*Catostomus catostomus*	1	282	1
white sucker	*Catostomus commersonii*	45	168	1
lake whitefish	*Coregonus clupeaformis*	0	18	1
round whitefish	*Prosopium cylindraceum*	0	0	5
lake cisco	*Coregonus artedi*	0	24	0
northern pike	*Esox lucius*	0	9	0
walleye	*Sander vitreus*	1	3	2
slimy sculpin	*Cottus cognatus*	1	573	0
spottail shiner	*Notropis hudsonius*	0	12	0
trout-perch	*Percopsis omiscomaycus*	0	1	0

Table 3-3: Fish Species Captured in Middle Lake from May 2010 to February 2011

Common Name	Scientific Name	Total Number Captured
Arctic grayling	*Thymallus arcticus*	7
burbot	*Lota lota*	25
lake chub	*Couesius plumbeus*	4
lake whitefish	*Coregonus clupeaformis*	34
longnose sucker	*Catostomus catostomus*	23
ninespine stickleback	*Pungitius pungitius*	28
northern pike	*Esox lucius*	49
slimy sculpin	*Cottus cognatus*	31
white sucker	*Catostomus commersonii*	50

Deep, fast-flowing runs, rapids, deep pools, and waterfalls are the most common type of habitat section in the Fond du Lac River between the Black Lake outflow and the Middle Lake inflow. Flat-water habitat is most abundant in the Middle Lake outflow area. Barriers or potential barriers to upstream fish migration include Elizabeth Falls and two additional waterfall-type habitats.

The dominant substrate types in the main basin of Black Lake are cobble and boulder, with some gravel and sand components. Submergent and emergent aquatic vegetation occurs adjacent to the shore. Substrate in Middle Lake consists of sand and silt, with areas of cobble and boulder. Aquatic vegetation is present throughout much of the lake and is very dense along both sides of the main channel of the Fond du Lac River.

3.6 Soils and Terrain

The Project is situated on a transitional area between the boundaries of two Ecoregions that are separated by the Fond du Lac River. The Athabasca Plain Ecoregion is on the west side of the Fond du Lac River and the Tazin Lake Upland Ecoregion is on the east side of the river (Acton et al. 1998). The Athabasca Plain Ecoregion is characterized by glaciofluvial deposits, varying from homogeneous deposits of fine sand to heterogeneous deposits of sand and cobble. Brunisolic soils (i.e., forest soils with brownish-coloured B horizons) typically form on these glaciofluvial deposits. Gleyed Brunisolic soils, Gleysolic soils (i.e., water saturated mineral soils), and Organic soils occur in low-lying and poorly drained areas.

Steep bedrock outcrops characterize the Tazin Lake Upland ecoregion. Mineral and organic soils occur on nearly level bedrock surfaces and in mid to lower slopes of gently inclined bedrock faces. Organic soils exist on boulder glacial till and bedrock. Brunisolic soils are found on thin deposits of sand and boulder glacial till that is underlain by bedrock. Gleysolic soils and organic soils occur in low lying and poorly drained areas.

3.7 Vegetation

The east side of the Fond du Lac River is characterized by forests of black spruce (*Picea mariana*), but because fire is a frequent occurrence in the area, forests of jack pine (*Pinus banksiana*) are common (Acton et al. 1998). White spruce (*Picea glauca*) tends to grow along the margins of fens and marshes and stands of trembling aspen (*Populus tremuloides*) typically occupy low, sheltered areas. The characteristic vegetation on the west side of the Fond du Lac River is open jack pine forest that develops the sandy glaciofluvial sediments of the area (Acton et al. 1998). Stands of mixedwood with black spruce, jack pine, and white birch (*Betula papyrifera*) are common. Riparian areas typically contain black spruce, jack pine, and white birch, alders (*Alnus* species), and willow (*Salix* species). Wetlands typically are dominated with black spruce. Tamarack (*Larix laricina*) and dwarf birch (*Betula pumila*) frequently intermix with the black spruce in these areas.

3.7.1 Listed Plant Species

Sixteen provincially listed vascular plant species have been historically or recently documented within the area surrounding the Project site (Saskatchewan Conservation Data Centre [SKCDC] 2012). Two historical and seven current listed plant observation locations occur in the immediate vicinity of the Project. Lake Huron tansy (*Tanacetum bipinnatum* ssp. *huronense* [syn. *Tanacetum huronense* var. *floccosum*]), a historical observation near the Project, is listed as Special Concern under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (2012) and as Special Concern under Schedule 1 of the *Species at Risk Act* (*SARA)* (2012). This species is not identified as a provincial wild species at risk under the *Wildlife Act* (1998) and was not observed during the 2010 and 2012 field programs. Forty-four provincially listed lichen species were documented in the area; however, these were widely distributed throughout the area (SKCDC 2102).

Six provincially listed forbs and one listed graminoid were documented during the 2010 and 2012 field programs. These species included ground-fir (*Diphasiastrum sitchense* [syn. *Lycopodium sitchense*]), limestone oak fern (*Gymnocarpium jessoense* ssp. *parvulum*), alternate-flowered water milfoil (*Myriophyllum alterniflorum*), Labrador lousewort (*Pedicularis labradorica*), hairy butterwort (*Pinguicula villosa*), mountain woodsia (*Woodsia scopulina*), and Russet sedge (*Carex saxatilis* [syn. *Carex saxatilis* var. *rhomalea*]). No COSEWIC, *SARA, or Wildlife Act* listed species were observed during the 2010 and 2012 field surveys.

3.7.2 Traditional Use Plants

There are many traditional uses of forest plant species. Most traditional use plants are harvested for food, medicine, and tools. Gathered goods such as berries, herbs, mushrooms, and medicinal plants are used for local trade, sale, or gifts (Athabasca Land Use Planning Interim Advisory Panel 2003). Currently, gathering for domestic use is mainly for berries, particularly blueberries (*Vaccinium* spp.), bog cranberries (*Vaccinium vitis-idaea*), moss berries (*Vaccinium* spp.), and strawberries (*Fragaria virginiana*), as well as other edible vegetation, such as mushrooms, when available (Black Lake and Stony Rapids KPI Program 2012).

Many traditional use plants such as black spruce, willow, crowberry (*Empetrum nigrum*), bog cranberry, Labrador tea (*Rhododendron groenlandicum* [syn. *Ledum groenlandicum*]), and prickly rose (*Rosa acicularis*) are commonly found in many different plant communities. However, there are a few traditional use species, such as acerbic bulrush (*Schoenoplectus acutus*) and tamarack, which are more limited in their distribution and tend to be associated with few plant community types, but these species typically are abundant within those plant communities.

3.8 Wildlife

Wildlife species represent an integral part of the terrestrial environment and many species have important cultural, social, or economic value. Wildlife populations and diversity are low in the Athabasca Plain Ecoregion as compared to elsewhere on the Canadian Shield. Localized populations of moose (*Alces alces*), black bear (*Ursus americanus*), and grey wolf (*Canis lupus*) are most prominent. Barren-ground caribou (*Rangifer tarandus groenlandicus*) and arctic fox (*Vulpes lagopus*) occasionally overwinter in the area. Other wildlife in the area include woodland caribou (*Rangifer tarandus caribou*), lynx (*Lynx canadensis*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), snowshoe hare (*Lepus americanus*), waterfowl (including ducks, geese, pelicans [*Pelecanus* spp.], and sandhill cranes [*Grus canadensis*]), grouse, and other birds (Acton et al. 1998).

Black bear, wolverine (*Gulo gulo*), moose, and grey wolf inhabit the Tazin Lake Upland Ecoregion and migratory barren-ground caribou and arctic fox sometimes enter the region during winter. Birds of this region include red-throated loon (*Gavia stellata*), greater yellowlegs (*Tringa melanoleuca*), white-crowned sparrow (*Zonotrichia leucophrys*), and golden eagle (*Aquila chrysaetos*), with willow ptarmigan (*Lagopus lagopus*) appearing during winter (Acton et al. 1998).

Baseline wildlife surveys were completed in 2012 to determine available habitat types and the abundance and diversity of wildlife species present in the area (Table 3-4).

Table 3-4: Wildlife Species Observed During 2012 Surveys

Common Name	Scientific Name	Common Name	Scientific Name
Mammals			
American marten	*Martes americana*	Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*	Red fox	*Vulpes vulpes*
Black bear	*Ursus americanus*	Red squirrel	*Tamiasciurus hudsonicus*
Canada lynx	*Lynx canadensis*	River otter	*Lontra canadensis*
Fisher	*Martes pennanti*	Snowshoe hare	*Lepus americanus*
Grey wolf	*Canis lupus*	Vole species	*Microtus spp.*
Mink	*Neovison vison*	Weasel species	*Mustela spp.*
Moose	*Alces alces*	Wolverine	*Gulo gulo*
Mouse species	*Peromyscus spp.*		
Upland Breeding Birds			
Alder flycatcher	*Empidonax alnorum*	Northern flicker	*Colaptes auritus*
American crow	*Corvus brachyrhynchos*	Northern waterthrush	*Seiurus noveboracensis*
American redstart	*Setophaga ruticilla*	Olive-sided flycatcher	*Contopus cooperi*
American robin	*Turdus migratorius*	Orange-crowned warbler	*Vermivora celata*
Bay-breasted warbler	*Dendroica castanea*	Palm warbler	*Dendroica palmarum*
Black-backed woodpecker	*Picoides arcticus*	Pine siskin	*Carduelis pinus*
Black-capped chickadee	*Poecile atricapilla*	Ptarmigan species	*Lagopus muta or L. lagopus*
Blackpoll warbler	*Dendroica striata*	Red crossbill	*Loxia curvirostra*
Blue-headed vireo	*Vireo solitarius*	Red-eyed vireo	*Vireo olivaceus*
Boreal chickadee	*Poecile hudsonica*	Ruby-crowned kinglet	*Regulus calendula*
Cape May warbler	*Dendroica tigrina*	Savannah sparrow	*Passerculus sandwichensis*
Cedar waxwing	*Bombycilla cedorum*	Song sparrow	*Melospiza melodia*
Chipping sparrow	*Spizella passerina*	Swainson's thrush	*Catharus ustulatus*

Table 3-4: Wildlife Species Observed During 2012 Surveys (continued)

Common Name	Scientific Name	Common Name	Scientific Name
Common redpoll	*Carduelis flammea*	Swamp sparrow	*Melospiza georgiana*
Dark-eyed junco	*Junco hyemalis*	Tennessee warbler	*Vermivora peregrina*
Fox sparrow	*Passerella iliaca*	Tree swallow	*Tachycineta bicolor*
Gray jay	*Perisoreus canadensis*	Vesper sparrow	*Pooecetes gramineus*
Grouse species	*Bonasa umbellus, Tympanuchus phaisianellus, or Falcipennis canadensis*	White-throated sparrow	*Zonotrichia albicollis*
Hairy woodpecker	*Picoides villosus*	Wilson's warbler	*Wilsonia pusilla*
Hermit thrush	*Catharus guttatus*	Winter wren	*Troglodytes troglodytes*
Least flycatcher	*Empidonax minimus*	Yellow warbler	*Dendroica petechia*
Lincoln's sparrow	*Melospiza lincolnii*	Yellow-bellied sapsucker	*Sphyrapicus varius*
Magnolia warbler	*Dendroica magnolia*	Yellow-rumped warbler	*Dendroica coronata*
Nashville warbler	*Vermivora ruficapilla*		
Waterbird Species			
American widgeon	*Anas americana*	Mallard	*Anas platyrhynchos*
Belted kingfisher	*Megaceryle alcyon*	Merganser species	*Mergus merganser* or *M. serrator*
Blue-winged teal	*Anas discors*	Northern pintail	*Anas acuta*
Bonaparte's gull	*Larus philadelphia*	Northern shoveler	*Anas clypeata*
Bufflehead	*Bucephala albeola*	Sandhill crane	*Grus canadensis*
Canada goose	*Branta canadensis*	Surf scoter	*Melanitta perspicillata*
Common goldeneye	*Bucephala clangula*	Swan species	*Cygnus buccinator or C columbianus*
Common tern	*Sterna hirundo*	White-winged scoter	*Melanitta fusca*
Gull species	*Larus canus*, *L. delawarensis*, *L. californicus*, or *L. argentatus*		
Raptors			
Bald eagle	*Haliaeetus leucocephalus*	Osprey	*Pandion haliaetus*
Merlin	*Falco columbarius*	Red-tailed hawk	*Buteo jamaicensis*
Northern harrier	*Circus cyaneus*	Sharp-shinned hawk	*Accipiter striatus*
Amphibians			
Boreal chorus frog	*Pseudacris maculata*	Wood frog	*Lithobates sylvatica*

3.8.1 Listed Wildlife Species

Twenty-eight provincial and federal listed species have the potential to occur in the area. Three provincially tracked species, two COSEWIC-recommended species, and one *SARA*-listed species were observed during wildlife baseline surveys in 2012. The *SARA*-listed species observed was olive-sided flycatcher (*Contopus cooperi*). Horned grebe (*Podiceps auritus*) and wolverine are COSEWIC listed species that were observed. Bald eagle (*Haliaeetus leucocephalus*), sandhill crane, and an unknown swan species are provincially tracked species. Tundra swan (*Cygnus columbianus*) and trumpeter swan (*Cygnus buccinator*) are both provincially tracked species.

3.8.2 Traditional and Non-traditional Use of Wildlife Species

Traditional use of species in the area includes hunting of wolf, black bear, and moose and trapping of smaller mammals such as American marten, snowshoe hare, and red squirrel (*Tamiasciurus hudsonicus*). The Project is located within the wildlife management zone (WMZ) 76, in which non-traditional use of wildlife species are managed. There are two black bear hunting seasons in WMZ 76: April 15 to June 30, and August 25 to October 14. One bear, of either sex, can be taken by resident and non-resident hunters; only female bears with young-of-year cubs cannot be hunted. Moose can be hunted, by residents and non-residents, between September 1 and November 30; one bull moose can be taken per person.

Snow geese (*Chen caerulescens*) can be hunted between April 1 and May 31. Snow geese, Canada geese (*Branta canadensis*), and sandhill cranes can be hunted from September 1 to December 16. Ducks, American coots, and Wilson's snipes (*Gallinago delicata*) can be hunted between September 1 and December 16, and ptarmigan species can be hunted from November 1 to March 31. Sharp-tailed grouse, ruffed grouse, and spruce grouse can be hunted from September 15 to December 7.

3.9 Heritage Resources

Historical archaeological remains can be found in northern Saskatchewan. Early travelers, such as Samuel Hearne, Peter Pond, Alexander Mackenzie, David Thompson, Richard King, George Back, Charles Camsell, and Joseph Tyrell, contributed to the survey and mapping of the extreme north of Saskatchewan (Fung 1999). David Thompson is considered the first explorer to pass through the Black Lake area (Minni 1975). Sent by the Hudson Bay Company (HBC) to find a shorter route to the Athabasca country, Thompson ascended the Churchill and Reindeer Rivers to Reindeer Lake in 1796, then crossed to Wollaston Lake and up Black River to the east end of Lake Athabasca (i.e., a more direct route to the Athabasca country than previously used by HBC). Many northern communities came into existence following the establishment of the fur trade in this area (Fung 1999).

An archaeological survey completed in the area in the 1970s identified a number of heritage sites around Black Lake, Middle Lake, Stony Lake, and the Fond du Lac River. In 2012, archaeological baseline work related to the Project was carried out along the Fond du Lac River, the west shore of Black Lake and the south shore of Middle Lake. A full discussion of these survey results is presented in Section 16 of the EIS. No new Heritage Resources were identified during the assessment; however, four of the eight previously recorded heritage resources were successfully identified. These heritage resources were originally recorded by Sheila Minni as part of her 1972 and 1974 studies (Minni 1975).

Six of the known heritage resources consisted of small Precontact lithic find and scatters, two of which contained diagnostic tools. These included a distinct microblade that is typical of the Arctic Small Tool Tradition that dates

from approximately 3,500 to 2,600 Before Present (BP) and a diagnostic Early Taltheilei point dates from approximately 2,600 to 1,800 BP. The remaining two heritage resources were historic Dené sites that included a cemetery immediately northwest of Camp Grayling dating from the late nineteenth to mid-twentieth centuries, and a campsite and single grave located beside Middle Lake suggested to date from the late nineteenth century through to contemporary times.

As part of the 2012 baseline studies for this EIS, attempts were made to revisit the known heritage resources recorded along the Fond du Lac River and Middle Lake. Four of these heritage resources were successfully identified, the remaining four sites could not be positively identified. None of the known heritage resources is in conflict with the Project footprint. The cemetery is the nearest heritage resource to a Project component. It is located within 60 m of an existing road extending northward from Camp Grayling.

3.10 Traditional and Non-traditional Land Use

The Dené ("People of the Barrens") and their ancestors have lived in northern Saskatchewan, particularly in the Athabasca region, for an estimated 8,000 years (Meyer 1981). Prior to settlement in contemporary First Nation communities, the Dené had a subsistence economy based on the barren-ground caribou. Following contact with European peoples, HBC encouraged the Dené people to move into the boreal forest so they could assist with the fur trade (Gillespie 1976). Today, residents of BLFN use an expansive region, including areas of the Northwest Territories, for traditional land and resource use.

The Project is located within the Chicken Indian Reserve No. 224. The Chicken Indian Reserve No. 224 was created under the OIC 1978-1647; that is the land is set aside for the exclusive use and benefit of the members of the BLFN. The area surrounding the Chicken Indian Reserve No. 224 is provincial crown land and accessible to all aboriginal people for the pursuit of traditional and cultural activities. The BLFN have identified specific lands as their traditional territory, including Fur Blocks N-24 and N-80, as well as north beyond present-day settlements and the border of Saskatchewan and the Northwest Territories traditional territory (Black Lake and Stony Rapids KPI Program 2012).

Traditional resource use by the people of this area is a defining feature of their culture and identity. Trapping continues to be an important activity for some community members in Black Lake, particularly for elders who have spent considerably more of their lives living on the land. Residents of the region consider caribou a very important species and most hunting for caribou by residents of Black Lake takes place outside of the Project area, in the northern reaches of Saskatchewan and into the Northwest Territories. While barren-ground caribou is considered a very important species hunted by residents of the region, moose, black bear, and waterfowl, such as ducks and geese, also are hunted.

Forest fires have limited hunting and other resource use in the area. However, since the forest started to regenerate, small mammals, moose and birds have returned and some hunting, trapping, and snaring occurs in the region. In addition, burned and regenerating areas around Middle Lake and on Fir Island in Black Lake support several plant species, particularly berries. Blueberries, bog cranberries, moss berries, and strawberries are gathered by community members for domestic use, such as jam production and freezing, from mid-summer to late fall.

Fish have been a vital part of traditional life in the region and continue to be an important food source for members of the local community. The majority of fishing for domestic use takes place on Stony Lake, with some

fishing on Middle Lake and Black Lake. Black Lake also has a small commercial fishery during the summer. Lake whitefish, lake trout, northern pike, walleye, suckers, and grayling are among the preferred species.

There are many traditional uses of forest plant species. Residents collect wood for heating fuel. Some trees and plants with cultural significance are used in medicinal, ceremonial, and spiritual activities. Recent burn areas around Middle Lake and on Fir Island on Black Lake support several plant species, particularly berries (e.g., blueberries, bog cranberries, moss berries, and strawberries), which are gathered by community members for domestic use. Other edible vegetation, such as mushrooms, is available in the area around Middle Lake and south of Black Lake.

Small trails occur throughout the region, most of which are trunk trails connecting larger roads. These trails are used to access cabins and campsites and to portage through the area. In the past, the area around the proposed Project site has been used as a travel corridor for following the caribou herds and as a temporary campsite for spring fishing prior to ice break-up on Black Lake.

The only mining activity currently taking place in the Athabasca region is uranium mining. No mining activities are taking place in the area around Elizabeth Falls. However, numerous mineral deposits have been identified in the area, including uranium, gold, base metals, and other minerals.

Twenty-six outfitting lodges operate in the Athabasca region, with three lodges and outfitters offering sport fishing and hunting services within a 50 km radius of the proposed Project site around Black Lake and Stony Rapids communities.

3.11 Economy

Black Lake and Stony Rapids have community-based businesses that range from taxi services to local contractors (Keewatin Career Development Corporation 2012). Additionally, the communities actively seek to build capacity and expand their business holdings. In the community of Black Lake, a dedicated Band employee focuses on bringing training to the community and nurturing local businesses. In the Northern Hamlet of Stony Rapids, the approach to developing local business is less organized, but it is a goal of community members that more residents become employed and more local business initiatives succeed (Black Lake and Stony Rapids KPI Program 2012).

In addition to community-based contractors who work in the resource sector, other companies in the Athabasca region are not based in Black Lake or Stony Rapids, but employ residents of both communities. To employ residents, position-specific training has been offered, which builds capacity in the communities by creating a workforce that possesses position-specific skills and transferable skills that could help them acquire and retain positions in other companies (Black Lake and Stony Rapids KPI Program 2012).

The five main industries in which residents of Black Lake were employed in 2006 were:

- education services industries (23.6%);
- mining and oil and gas extraction (23.5%);
- health care and social assistance industries (17.6%);
- public administration (14.7%); and

- construction industries (8.8%).

Black Lake residents are employed in the administrative and support, waste management, and remediation services (5.9%), which includes janitorial and security services.

The average income in the Athabasca Basin communities, including the communities of Black Lake and Stony Rapids, is lower than the provincial average income. The average income in Black Lake is $21,860 per year (Statistics Canada 2007). Many of the everyday costs of living in northern Saskatchewan (e.g., food and fuel) are higher than in other areas of Saskatchewan (Northern Economic Summit 2012). The high cost of goods in the community is compounded by the high cost of utilities.

3.12 Infrastructure and Community Services

The region, located in the northern-most part of Saskatchewan, is sparsely populated compared to other areas of the province. The Athabasca region consists of seven communities, including First Nations, northern settlements, and a northern hamlet. The community of Black Lake and the Northern Hamlet of Stony Rapids have been the focus of the socio-economic characterization near the Project. The Project site is located approximately 7 km from the community of Black Lake and about 25 km southeast of Stony Rapids. Highway 905, west of the Fond du Lac River, joins these two communities (Northern Economic Summit 2012).

The communities of Black Lake and Stony Rapids each have schools. Father Porte Memorial Dené School in the community of Black Lake is a First Nation operated facility offering Pre-Kindergarten to Grade 12. There were approximately 410 children enrolled for the 2011/2012 school year (Black Lake and Stony Rapids KPI Program 2012). The school in Stony Rapids had a total enrolment of 55 students as of September 30, 2011 (NLSD ND). The school program is from Kindergarten to Grade 9. The Stony Rapids School does not offer grades 10 to 12 and students who want to complete the high school curriculum attend Father Porte Memorial Dené School in Black Lake or a school in a more southerly community. There are no post-secondary institutions in the Athabasca region, although Northlands College offers training and adult education programs throughout northern Saskatchewan (Cameco 2011).

Road access to the Athabasca region of northern Saskatchewan originates at Highway 102, which extends north from La Ronge to its terminus in Southend. Highway 905 branches north from Highway 102 near Southend to Points North Landing. Beyond Points North Landing, Hwy 905 continues as a gravel seasonal road (i.e., Athabasca Seasonal Road). Stony Rapids and Black Lake communities are served by an airport in Stony Rapids (Northern Economic Summit 2012).

Scheduled passenger flights into Stony Rapids are available from Pronto Airways and Transwest Air. During the summer months, there is limited barge service to ship goods from east to west from Stony Rapids to Fond du Lac, Uranium City, and Camsell Portage (Cousins and Coneghan 2006). The barge is privately run (Canada 2012).

3.13 Population and Health Services

The community of Black Lake had a population of 1,070 residents in 2011 and the median age is 22.5. Dené is the language spoken in about 95% of the homes in Black Lake. In comparison, Stony Rapids had a population of 243 residents in 2011 and the median age is 31.0. Dené is spoken in about 40% of the homes in Stony Rapids (Northern Economic Summit 2012).

Residents of the communities of Black Lake and Stony Rapids have access to the Athabasca Health Authority (AHA) health facility located outside of Stony Rapids on Black Lake reserve land. Patients requiring emergency services that are unavailable at the AHA health facility usually are transported to La Ronge, Prince Albert, or Saskatoon, depending on their needs (Athabasca Health Authority 2013).

4.0 PROJECT ALTERNATIVES

The EIS identifies alternatives to and alternative means of carrying out the proposed Project that are socially and environmentally acceptable, and technically and economically feasible. The alternatives were evaluated based on existing technology and practices common within the power-generation industry. This evaluation was conducted by the professionals and personnel who were familiar with the proposed Project and were experienced with the alternatives evaluated.

4.1 Alternatives to the Project

SaskPower provides electrical energy to meet industrial and residential demand on SaskPower's Far North electrical supply system. Transmission and generation facilities have been constructed over the years to meet existing demands for power; however, over the next 10 years the demand for power is expected to double in northern Saskatchewan. The existing Far North electrical facilities will be unable to serve these new demands. Alternatives to the Project that were evaluated are summarized in Table 4-1.

4.2 Alternative Means of Carrying Out the Project

The technically and economically feasible ways the Project could be carried out are described, including alternative components, activities, management systems, or mitigation considered during the Project planning. Because the design of the Project is still being finalized, preferred options have not yet been selected in some cases.

Table 4-1: Alternatives to the Project

Alternative	Description	Advantages	Disadvantages
Dam and Spillway	A 45 m high dam and spillway structure constructed across the Fond du Lac River at the downstream end of the falls, just upstream of Middle Lake	■ Easier and more precise management of downstream river flows. ■ Water intake and power tunnel not required.	■ Would flood a significant amount of land and erase the presence of the falls, including the Arctic grayling habitat that currently exists. ■ Would require a large amount of fill material from the local area, which would affect the terrestrial environment. ■ Community of Black Lake has clearly stated that it is not in favour of this type of project arrangement.
Purchased Power	Purchase capacity and energy from Manitoba Hydro through the transmission line connection to their system at the Border Station	■ Reduced disturbance to the aquatic and terrestrial environment as most of the required infrastructure is already developed.	■ Purchase of energy from Manitoba Hydro cannot be guaranteed long-term. ■ Likely a premium cost compared to the cost of the Project.
Transmission Pathway to the North	Transfer up to 75 MW of electricity generated in southern Saskatchewan through the Manitoba Hydro system to serve the load in northern Saskatchewan through the Border Station south of the Island Falls Power Station	■ Reduced disturbance to the aquatic and terrestrial environment as most of the required infrastructure is already developed.	■ Likely a premium cost compared to the cost of the Project. ■ Transmission constraints can limit the amount of power that can be transferred in the future or at certain times of the year.
Diesel Generation	Combustion of diesel fuel in a reciprocating engine coupled to a generator to produce electricity	■ Proven technology. ■ Range of unit sizes. ■ Easily located where electrical energy is needed. ■ Rapidly deployed.	■ Costly. ■ Fuel must be transported to remote locations. ■ Produces emissions.
Wind	Installation of wind turbines to generate electricity	■ Wind energy is one of the lowest-priced renewable energy technologies available today. ■ Wind energy is fueled by the wind, so it's a clean fuel source. ■ Small footprint on the landscape.	■ Insufficient wind regime in northern Saskatchewan for economic development of this type of power generation. ■ Intermittent nature of wind power would require backup generation. ■ Generally, there is some concern over the noise produced by the rotor blades, aesthetic (visual) impacts, and sometimes birds have been killed by flying into the rotors.

Table 4-1: Alternatives to the Project (continued)

Alternative	Description	Advantages	Disadvantages
Hydro	A number of locations in northern Saskatchewan could be developed as hydroelectric power sites	■ Most advanced of the available options. ■ Clean source of energy. ■ Electricity can be produced at a constant rate. ■ Provides a revenue source with employment and business opportunities for the BLFN.	■ Will not be able to provide fully the expected demand for power in the north. ■ Costly.

m = metre; MW = megawatt; BLFN = Black Lake First Nation

4.2.1 Water Intake

The water intake directs water into the power tunnel from Black Lake under controlled conditions. The primary environmental criterion considered for design of the water intake was limiting negative effects on the aquatic ecosystem, particularly fish populations. For example, two alternatives were considered for the depth of the water intake: near the surface of Black Lake (i.e., surface to 5 m depth) or at greater depths within Black Lake (i.e., greater than 2 to 5 m depth). Constructing a shallow intake near the surface of the lake was preferred because it is expected to keep water temperatures through the tunnel and tailrace similar to those found in the Fond du Lac River and reduce the entrainment of deep-water species such as lake trout (*Salvelinus namaycush*) and cisco (*Coregonus* sp.).

4.2.2 Power Tunnel and Surge Facility

Decision criteria relating to power tunnel construction alternatives focused on technical and economic feasibility. For example, an economic evaluation was undertaken based on estimating the incremental benefit-cost ratio to determine the optimum tunnel cross-sectional areas for various levels of installed generating capacity in the powerhouse. A number of tunnel alignments connecting to the powerhouse and water intake continue to be reviewed, with power tunnel lengths ranging from 2.65 to 3.3 km. Based on a technical and economic evaluation, the current preferred arrangement consists of a 2.95 km long power tunnel. The longer alignment of 3.3 km was eliminated due to the presence of a valley with 20 m or more of overburden near the downstream end of the alignment. This alignment caused a concern that there would be insufficient bedrock cover over the tunnel to maintain tunnel stability and that up to 200 m of steel lining would be required to reinforce the tunnel.

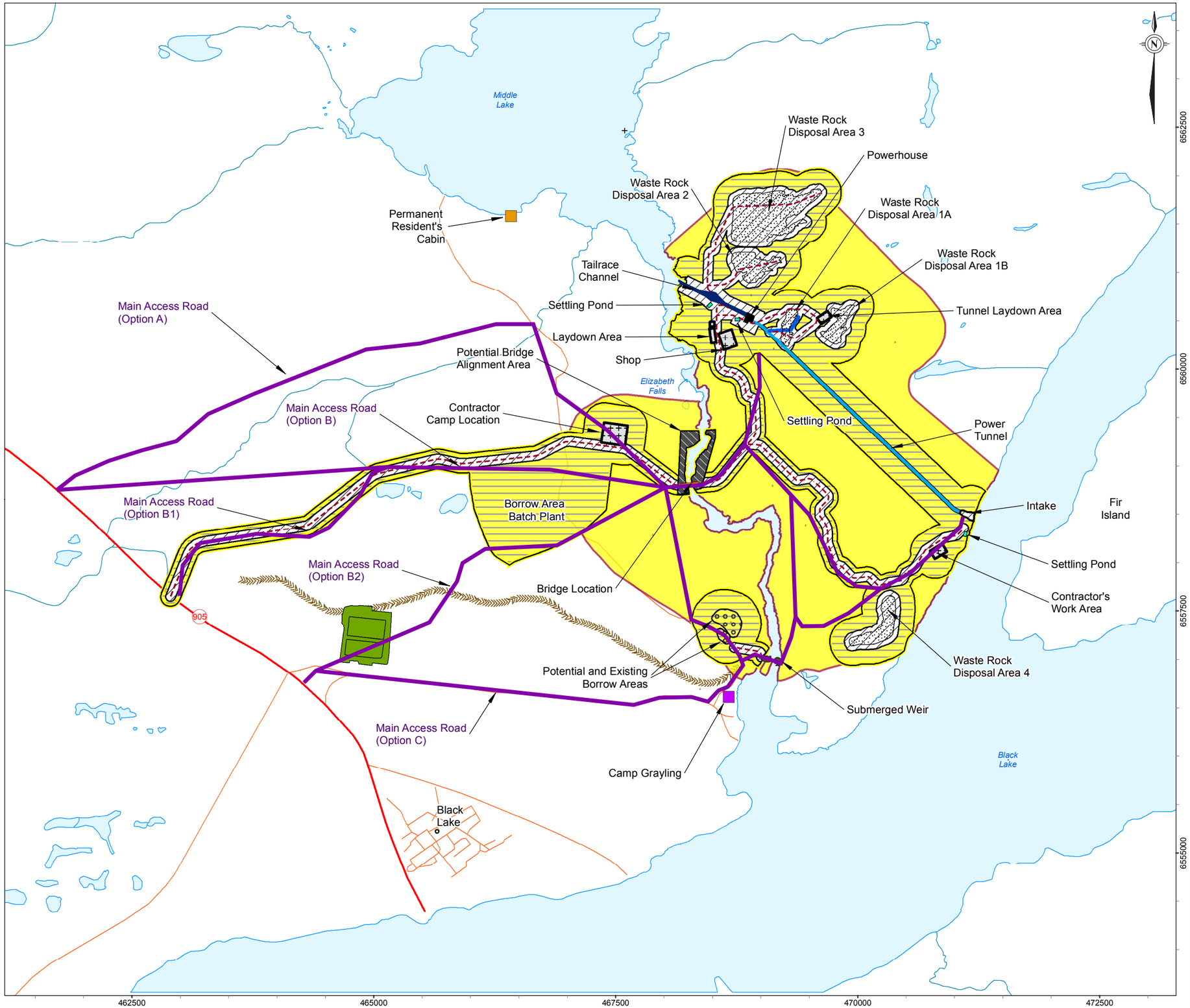
Three options were considered for the method of power tunnel construction. These included an 11 m wide by 10 m high horseshoe shaped (∩) cross-section excavated by drilling and blasting, a circular tunnel excavated by a tunnel-boring machine, and an excavated tunnel. Of these three options, the drill and blast horseshoe shaped tunnel is anticipated to be the most cost effective.

In summary, the preferred preliminary power tunnel arrangement consists of a 2.95 km long tunnel with a horseshoe shaped cross-section and a minimum rock cover of 30 m in thickness over the majority of the tunnel. It is anticipated that the tunnel will be constructed using the drill-and-blast method.

A surge facility will be incorporated into the Project water conveyance system (Figure 4-1). The surge facility is needed to control hydraulic transient pressures. The base case design for the surge facility is an inclined tunnel that branches off the power tunnel and daylights at an elevation above the level of Black Lake. This inclined adit would provide access to drive in the tunnel during construction. An alternate design option that is being considered uses a raised bore vertical shaft excavated in the rock to the surface, above the level of Black Lake. The surge facility will connect to the power conveyance a short distance upstream of the powerhouse.

4.2.3 Power Generating Capacity

Plant capacities of 42 to 50 MW were considered for the Project. The Fond du Lac River at the Black Lake outlet has a long-term average annual outflow of 304 m^3/s. To produce 42 MW of power, a flow of 160 m^3/s would typically pass through the power plant, and the remaining 144 m^3/s (on average) would pass through the natural Black Lake outlet into the Fond du Lac River. For the 50 MW power supply alternative, a flow of up to 190 m^3/s would normally pass through the power plant, with the remaining 115 m^3/s passing into the Fond du Lac River through the existing Black Lake outlet. The selected power supply of the Project will be up to 50 MW (up to 190 m^3/s discharge rate), with final output selected based on installed cost and energy production.



LEGEND

- HAMLET OR COMMUNITY
- HIGHWAY
- ROAD
- ESKER
- RIVER
- WATERBODY
- CAMP GRAYLING
- PERMANENT RESIDENT'S CABIN
- PROPOSED ROAD OPTION
- OPERATIONS FOOTPRINT
- PREDICTED PROJECT FOOTPRINT
- DISTURBANCE ASSESSMENT AREA

SPECIFIC CONSTRUCTION SITES

- POTENTIAL BRIDGE ALIGNMENT
- PERMANENT ROAD
- CONTRACTOR CAMP / LAYDOWN AREA
- BORROW AREA
- SETTLING POND
- SPOIL DISPOSAL AREA
- POTENTIAL BRIDGE ALIGNMENT AREA
- INTAKE
- POWER HOUSE
- TAILRACE CHANNEL
- POWER TUNNEL
- SURGE FACILITY
- SUBMERGED WEIR
- BLACK LAKE SEWAGE LAGOON

REFERENCE

NAD83 UTM ZONE 13
NTS MAPSHEETS: 73P/3,4,5,6

1 0 1
SCALE 1:40,000 KILOMETRES

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

ACCESS ROAD LOCATIONS

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 5
GIS	SM	05/11/13		
CHECK	BC	05/11/13		
REVIEW	MM	05/11/13		

FIGURE: 4-1

The Project is anticipated to involve two to four generating units. A multiple unit generating plant was selected because of its more flexible operation, ease of scheduling of maintenance outages as compared to a single unit power plant, and ability to maintain minimum riparian flows in the Fond du Lac River.

4.2.4 Turbine Selection

Turbine selection will be based on an evaluation of equipment performance (i.e., efficiency and output), equipment cost, and civil cost associated with the equipment to determine the lowest cost alternative. The "fish friendliness" and other environmental attributes of a turbine will also be taken into consideration.

Kaplan and Francis style turbines were considered for the Project, but Kaplan was selected. The capital and maintenance costs are generally lower for Francis-type turbines, but Kaplan turbines are more energy efficient for the plant flow regime and have the potential to reduce fish injury during plant operation. Francis turbines were not preferred due to their reduced fish friendliness and are no longer being considered in detail.

For the turbine types that were considered, the specifications emphasize the reduction or elimination, where practical or possible, of oil contained in guide bearings and in the turbine hubs (in the case of the Kaplan turbines). Turbine suppliers were asked to highlight the features of their equipment that are environmentally and fish friendly.

4.2.5 Tailrace Channel

Downstream of the powerhouse, the water from the turbine discharge enters the tailrace channel. After the water from Black Lake is used to generate power, the tailrace channel returns the water to the Fond du Lac River at a location upstream of Middle Lake. The location of the tailrace channel is shown in Figure 1-2.

The size of the tailrace channel has been designed to limit head loss, while considering the overall cost to excavate. For an installed plant capacity of 50 MW and full plant discharge of up to 190 m^3/s, the optimum tailrace channel cross-section was determined to be 25 m wide and 5.5 m deep. The length of the tailrace channel has yet to be finalized; the length in the currently preferred design is approximately 800 m, with a range of 600 to 1,100 m, with the shorter length preferred. The tailrace channel will be excavated in rock with varying depths of overburden.

For the intermediate length power tunnel (2.95 km), the tailrace location would shift to the east, while maintaining the discharge exit point at the Fond du Lac River. Tailrace excavation on this alignment would be primarily through the bedrock, within limited overburden excavation, and an overall reduction in tailrace excavation (by approximately 50%), to reduce effects on the terrestrial environment.

Several options were considered for the location and shape of the tailrace outlet and the selection was based on environmental and engineering considerations (e.g., tailrace outlet has been located upstream of important fish spawning habitat near the Fond du Lac River outflow to Middle Lake to maintain minimum required flows at this location). The tailrace channel outlet will be flared out so the water blends smoothly with the Fond du Lac River and avoids disruption to the dominant flow direction. The alignment and design will be selected to reduce any adverse effects of changed flows on the spawning channel located downstream. The selection of the final tailrace channel alignment and length will occur in conjunction with optimizing the power tunnel and powerhouse arrangement.

4.2.6 Submerged Weir at the Black Lake Outlet

The construction of the Project will create a second flow outlet for Black Lake. Without mitigation, the added flow capacity would lead to a small reduction in the long-term water levels of Black Lake. To maintain historical water levels in Black Lake following construction of the generating station, the flow through the natural outlet of Black Lake will be restricted by a submerged weir. The weir will be constructed of clean coarse rockfill and will span the Fond du Lac River at the Black Lake outlet. The location of the submerged weir is shown on Figure 1-2.

A gated concrete control structure (constructed as a combination of adjustable gates and submerged weirs) was considered as an alternative to the submerged weir. A gated control structure would have the advantage of manipulating flows in the Fond du Lac River to meet minimum riparian flow requirements, especially during spawning periods or during droughts when the natural outflows are low.

The submerged weir has the advantage of having little visual evidence as compared to the concrete control structure. The weir also has the advantage of minimizing the in water works during construction as opposed to a concrete structure that would require major cofferdam construction. The BLFN has expressed a desire that there be no concrete weir construction at the outlet of Black Lake.

4.2.7 Access Roads

Access roads and a bridge will be required for the Project. Several permanent access road alignments were presented to the BLFN and local community during public consultation meetings. A preference was indicated for an entirely new access route rather than potentially affecting any existing access routes. There was preference for a straight-line alignment that avoids any sensitive habitats. Five road alignment options were considered (Figure 4-1). The preferred route is Alignment B1, which is also preferred by the local community and was the most technically and economically feasible. Alignments A, B, B2, and C were not preferred for the following reasons:

- **Alignment A** is along an existing trail and near residential and cultural facilities would require crossing a known fish-bearing stream.
- **Alignment B** has similar disadvantages as Alignment A and would involve crossing rough terrain, which increases construction costs.
- **Alignment B2** is near the Black Lake sewage lagoon. Community members have expressed concerns that the route crosses an esker with high potential to have listed plant species and heritage resources.
- **Alignment C** is along an existing trail and cannot be upgraded because there are buried power cables beneath it and because it is near heritage resources (e.g., cemetery) that could be impacted by future road upgrades. This road provides access to Camp Grayling, which would cause disruption for camp users during construction.

After crossing the river, the main access road will turn north toward the powerhouse location (Figure 4-1). A branch road from the main access road will travel in an easterly direction providing access to the water intake facility located on the shore of Black Lake.

4.2.8 Bridge Location

Two alternate bridge locations across the Fond du Lac River were proposed, which were similar in cost and technically feasible. The preferred bridge site is located approximately 2 to 3 km downstream of Grayling Island at a point where the width of the river is relatively narrow (Figure 4-1). The location of the bridge over the Fond du Lac River avoids interfering with any possible heritage trails or historical sites near the bridge abutments on the riverbanks. A second potential location would be parallel to the axis of the proposed submerged weir at the downstream end of Grayling Island. Although technically feasible, the community expressed that this location was not preferable.

The final permanent access road and bridge locations will be selected based on engineering considerations with detailed geotechnical site reconnaissance and surveys completed in 2013, and with input from the local community and First Nations.

4.2.9 Borrow Areas

Criteria used for determining the preferred location of borrow areas for the Project will include aggregate suitability, available volume of aggregate, and haul distance. Two sites are under consideration for granular borrow sources: an existing site near Camp Grayling and one west of the preferred bridge location. There is a third potential site northeast of the proposed construction camp. The existing granular borrow source near Camp Grayling likely will be used to produce concrete aggregates for the Project. Use of the existing borrow pit reduces the amount of new surface disturbance. Additional surface and subsurface exploration would be required to establish the suitability of the optional borrow materials sites.

There might be an opportunity to crush excavated rock from the powerhouse and tailrace to process concrete aggregate. However, this will be evaluated for cost and suitability after the rock is tested.

4.2.10 Waste Rock Disposal Areas

Waste rock will be produced by excavation of the water intake, power tunnel, powerhouse, and tailrace channel. Several locations were considered as disposal areas for these materials based on proximity to the main access roads, potential ability to accommodate disposal of a large amount of excavated materials, and suitable topographical features including the ability to perform long-term monitoring.

During community engagement activities, residents of the BLFN stated several preferences for the waste rock piles including aesthetics, avoidance of resource use areas, avoiding Black Lake, Middle Lake, the Fond du Lac River, or any associated drainage (e.g., creeks and streams). While preliminary locations have been identified (Figure 1-2), waste rock disposal area locations and volumes will be refined as the Project design is finalized.

4.2.11 Construction Camp Facilities and Contractor's Work Areas

The proposed locations for the construction camp were selected based on the plans for construction and input from the community of Black Lake. The main work area (e.g., construction laydown, work areas, storage areas, stockpile areas, and construction camp) will be located on the west side of the river to accommodate the timing and construction of the bridge access to the east side. Smaller contractor's work areas will be located near the

water intake and the powerhouse. The alternative locations for the construction camp and contractor's work areas will be within the maximum area of potential disturbance shown in Figure 1-2.

4.2.12 Sewage Treatment and Potable Water Facilities

During construction, portable toilet facilities and holding tanks will be provided at various locations on the Project site and indoor plumbing will be provided at the construction camp. Waste will go to sewage holding tanks, which will be emptied regularly and hauled to the Black Lake sewage lagoon. An alternative considered consisted of treating sewage on-site using a self-contained treatment facility. This alternative was rejected because of concerns about reactions from downstream communities (i.e., Stony Rapids and Fond du Lac) that would receive the treated sewage.

During operations, a sanitary system will collect all of the sewage and grey water. A local sewage hauling service will pump out this sewage holding tank, as required, and haul the sewage off-site and for disposal at the Black Lake lagoon.

Potable water for construction and operation of the Project will come from new wells located near the camp. If the wells are not feasible, the water could be drawn from either Black Lake or the Fond du Lac River. Alternatively, potable water for the Project could be sourced from the communities of Black Lake or Stony Rapids. The water treatment facility in the Northern Hamlet of Stony Rapids is sufficient for the community, but it does not have the capacity to supply drinking water for the construction camp. The BLFN is in the process of designing an upgrade to the system and could be able to provide potable water to the construction camp in the future.

5.0 PROJECT DESCRIPTION

5.1 Introduction

The proposed Project will be a 50-MW water diversion type electrical generating station. The Project is located approximately 7 km from the community of Black Lake adjacent to the Fond du Lac River between Black Lake and Middle Lake. Water from Black Lake will be diverted through a water intake structure and power tunnel to the powerhouse before being released through a tailrace channel into the Fond du Lac River, ultimately discharging into Middle Lake.

The principal components of the Project consist of the following:

- gravel, all-season access roads to the Project site from the all-season road between the communities of Black Lake and Stony Rapids;
- bridge over the Fond du Lac River;
- powerhouse and associated infrastructure;
- water intake and power tunnel to convey flow from Black Lake to the powerhouse;
- tailrace channel from the powerhouse to the Fond du Lac River just upstream of Middle Lake;
- submerged weir located in the Fond du Lac River at the outlet of Black Lake near Grayling Island;

- settling ponds;
- waste rock disposal areas;
- construction camp;
- transmission lines and switching stations to connect to the northern Saskatchewan electrical grid; and
- all related physical works and physical activities required to carry out these works, including the associated cofferdams, access roads, laydown areas, borrow areas, concrete batch plant, fuel storage facility and fueling areas, explosives storage, and sewage treatment and potable water facilities.

An overview of the Project site plan is shown in Figure 1-2. The maximum area of disturbance is highlighted on this plan. The footprint of the Project will be as compact as possible to limit the area affected by Project activities. The maximum extent of disturbance has been estimated at 1,620 hectares (ha). It is expected that of this maximum area, 869 ha will actually be required for the Project footprint (i.e., 54% of the maximum disturbance area). Of this 869 ha, in the order of 589 ha will be reclaimed immediately following construction and about 280 ha will be required for operation. Following closure of the Project, the remaining areas will be reclaimed.

5.2 Project Schedule

The Project schedule has been defined by Project phases (Table 5-1). The main Project phases and estimated timelines are indicative of the overall Project design and planning throughout 2013. The schedule may change pursuant to finalizing Project design and because of the regulatory approval process. The Proponent will advise of changes, as appropriate.

- Construction - Q3 2014 to Q4 2017 (procurement, off-site fabrication and manufacture, delivery, and installation of the turbines and generators will continue throughout the construction phase):
  - Q3 2014 to Q2 2015 - contractor mobilization and construction camp setup to allow construction to start on main Project components;
  - Q3 2014 to Q3 2015 - access road and bridge construction is scheduled to meet delivery and installation requirements;
  - Q2 2015 to Q4 2017 - construction of the powerhouse and intake structures;
  - Q2 2015 to Q4 2017 - power tunnel, powerhouse, and tailrace channel excavations;
  - Q2 2016 to Q3 2017 – construction of water intake and installation of turbines and generators; and
  - Q3 2017 to Q4 2017 – commissioning and plant start-up; construction of weir.
- Operations – Q1 2018 to approximately Q1 2108; and
- Closure - duration of approximately two years following cessation of operations (approximately 2108 to 2110).

Table 5-1: Tazi Twé Hydroelectric Project Schedule

Project Phase	Tasks	Year																	
		2014				2015				2016				2017				2018 to 2108	2109 to 2111
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
Construction																			
	Contractor mobilization and setup of construction camp																		
	Construction of access roads and bridge																		
	Construction of powerhouse and intake structures																		
	Excavation of power tunnel, powerhouse, and tailrace channel																		
	Excavation of water intake and installation of turbines and generators																		
	Commissioning and plant start-up																		
	Construction of submerged weir																		
Operations																			
Closure																			

Note: Assuming three months after EIS approval the permit for full construction will be received; and assumes closure will be completed approximately two years following cessation of operations.

5.3 Construction

This section describes the construction activities required for the development of the Project components, including site clearing, site access roads, bridge location, development of borrow sources, construction camp, contractor work areas, powerhouse, tailrace channel, submerged weir, and settling ponds. Construction details and design information (as available to date) are provided. This section also describes environmental design features and mitigations that will be implemented to reduce or eliminate potential effects on the environment during construction.

5.3.1 Site Clearing Activities

Clearing of the site is required for construction of water intake, powerhouse, tailrace channel, access road, bridge, construction camp, and contractor laydown area, as well as for development of source sites for borrow material and for waste rock disposal. Site clearing, contouring, and excavation during construction have the potential to cause soil erosion, which could cause soil to enter nearby waterbodies.

An Erosion and Sediment Control Plan will be developed based on industry standard Best Management Practices (BMPs) and federal and provincial regulatory requirements. A detailed Weed Plant Management Plan will be designed and implemented to prevent, detect, control (remove), and monitor areas with weed species, particularly those species listed as prohibited, noxious, and nuisance under the *Weed Control Act* (2010).

5.3.2 Site Access Roads and Bridge Location

Road access to the site from southern Saskatchewan will be by Highways 102 and 905 from La Ronge to Points North (Figure 1-2). These all-season gravel-surface roads are maintained by the Saskatchewan Ministry of Highways and Infrastructure. The primary access to the Project site will be on the Athabasca Seasonal Road between Points North and Black Lake. Summer access by this route is difficult, but passable, so most of the equipment and materials required for construction will be transported between late January and late March.

All-season gravel roads and a bridge will be required to access the construction sites of the Project components. During the first year of construction, the main access road will be built extending from Highway 905 and crossing the Fond du Lac River by way of the access bridge. The locations of the bridge and main access road are shown on Figure 1-2. Access roads will also be required to link the Project work areas to the selected waste rock disposal areas. Permanent roads will be designed to meet current provincial road design standards. Site drainage, erosion, and sedimentation management during construction will be in accordance with the applicable provincial and federal regulations and guidelines.

The final permanent access road and bridge locations will be selected based on engineering considerations with detailed geotechnical site reconnaissance and surveys completed in 2013, and with input from the local community and First Nations. A discussion will be held with the local community about the ongoing use and maintenance of the roads at the time of decommissioning and reclamation of these access roads.

A new bridge will be constructed to provide access to the construction site on the east side of the Fond du Lac River. It will be located approximately 600 m upstream of Elizabeth Falls (Figure 1-2). The current bridge design anticipates a single-pier design located mid-point of the bridge span. However, two additional temporary piers could be required during bridge construction. Installation of the bridge pier will require construction of a temporary groin or work platform that will extend approximately half way across the river to provide access to the pier installation site. Bridge construction will occur during winter (i.e., under low flow conditions and outside

spawning timing windows for valued components [VCs]) and will require a DFO Authorization. Due to health and safety concerns during construction, the Project site on the east side of the Fond du Lac River will not be accessible to the public; access will be controlled at the bridge.

5.3.3 Development of Borrow Sources

Two main sites are being considered for granular borrow sources, an existing source which is located 0.6 km from Camp Grayling and a source which is located southwest of the Project bridge (Figure 1-2). A third potential site northeast of the proposed camp could provide suitable materials pending further evaluation of available quantities. The existing granular borrow source near Camp Grayling likely will be used to provide concrete aggregates for the Project.

The existing granular borrow source is approximately 600 m north from Camp Grayling on Chicken Reserve 224, with an esker separating the camp and the borrow source. This existing developed gravel pit has been the source for concrete aggregate to supply most of the concrete poured in Black Lake and Stony Rapids. The construction haul route from the borrow area would be north toward the Project site to avoid travelling past Camp Grayling.

There might be opportunity to crush excavated rock from the powerhouse and tailrace channel to process concrete aggregate. However, this will be evaluated for cost and suitability after the rock is tested. If the rock is suitable and cost effective, this option could reduce the amount of material and number of haul trips from the existing borrow source.

5.3.4 Construction Camp and Contactor Work Areas

A construction camp will be provided to house workers through construction that will accommodate 150 to 260 workers (Figure 1-2). The construction camp will include dormitories with washroom and laundry facilities, kitchen and dining facility, office space, recreational and commissary complex, water and sewage storage units, and parking spaces. The construction camp will be serviced by the SaskPower electrical distribution system and electrical generator units will initially energize the camp and provide a back-up service. First aid stations will be located on site at the construction camp. A site ambulance and first aid attendant will be provided for the Project.

The contractor's work areas will be used to store materials, maintain and assemble equipment, and administer work on the Project. One area will be located near the powerhouse and another will be located near the water intake. Additional contractor's work areas will be located near the bridge location, although the specific locations have not been finalized (Figure 1-2).

5.3.5 Powerhouse

The generating capacity of the Project is 50 MW (up to 190 m^3/s discharge rate). The Project will operate as a water diversion-type plant using approximately 36 m of gross head between Black Lake and Middle Lake. The Project's estimated, gross average annual generation will be approximately 400,000 MWh per year.

The Project will be managed so that minimum seasonal riparian flows will be maintained in the Fond du Lac River between the Black Lake outlet and the tailrace channel outlet. More specifically, the proposed minimum riparian flows would be managed to be higher (i.e., 70 m^3/s) during the spring spawning season and lower (i.e., 40 m^3/s) during the rest of the year. These values are simply minimum targets because river flows will

exceed these values for most years. The minimum seasonal riparian flows represent flow levels that are anticipated to be sufficient for the maintenance of fish and fish populations within the Fond du Lac River.

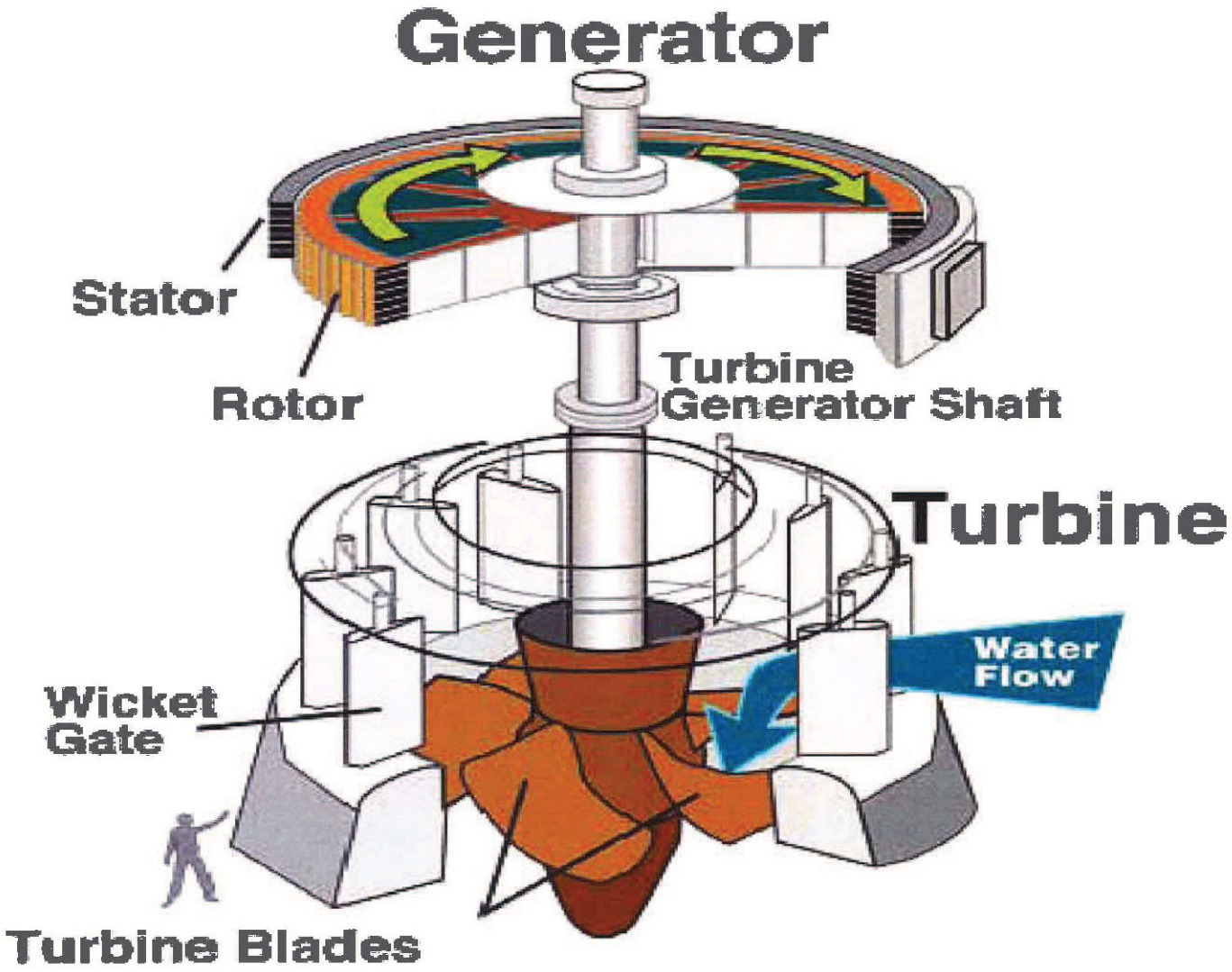
The powerhouse will include two or four turbine generator units plus two or more flow bypass conduits. A multiple unit generating plant was selected because of its flexibility of operation and its easily managed scheduling of maintenance outages when compared to a single unit power plant. The station will be equipped with flow bypass features to ensure that the change in operation does not negatively affect downstream flows or water levels during a sudden change in turbine load. An example of a typical turbine and generator installation layout is provided in Figure 5-1.

5.3.6 Water Intake

The water intake will be located adjacent to a rock outcrop within bedrock 70 to 90 m from the shore of Black Lake and will divert water from near the surface of the lake (i.e., water surface to about 5 m below the surface) into the power tunnel under controlled conditions. The streamlined water intake design will limit entrance hydraulic losses. The water intake will be designed to draw the required power plant design discharge from Black Lake over the full range of anticipated lake levels.

The construction area for the water intake and the tailrace channel outlet will be enclosed by cofferdams or a rock plug (if feasible). The height of the cofferdam for the water intake will be based on the associated water level of Black Lake. The height of the cofferdam for the tailrace channel outlet will be based on the associated tailwater level in the Fond du Lac River. In-water works will be completed in accordance with conditions outlined in an authorization from DFO.

The size and shape of the water intake will limit hydraulic losses and maintain similar intake flow water temperatures to natural outflows at the Black Lake outlet. A rock trap placed upstream of the water intake will reduce the risk of local bed material entering the generating units and trashracks will exclude timber debris. Warning buoys and signage will be installed in front of the water intake and at the tailrace channel outlet into the Fond du Lac River to restrict boaters from the hazardous areas and to identify safe ice conditions on the lake in front of the intake during winter.



REFERENCE

PROCESS DIAGRAMS PROVIDED BY SASKPOWER

PROJECT

TAZI TWÉ HYDROELECTRIC PROJECT

TITLE

TYPICAL TURBINE LAYOUT

Tazi Twé Hydroelectric Project

PROJECT	10-1365-0004		FILE No.	
DESIGN			SCALE AS SHOWN	REV. 0
GIS	SM	03/12/13	**FIGURE: 5-1**	
CHECK	MT	03/12/13		
REVIEW	BC	03/12/13		

5.3.7 Power Tunnel

The power tunnel dimensions will be optimized based on the rock quality encountered and hydraulic requirements, but is expected to be up to 11 m wide by 10 m high, with a horseshoe shaped (∩) cross-section. With the currently preferred tunnel alignment, the length of the power tunnel is 2.95 km. The power tunnel will be constructed using the drill-and-blast method. Approximately 430,000 cubic metres (m^3) of waste rock will be created by the tunnel excavation, assuming an overbreak of 0.5 m along the entire length of the tunnel.

A Blasting Plan is expected to be developed for the Project, which will describe the type of explosives used (e.g., ammonium nitrate/fuel oil [ANFO] and water-resistant explosives like Unimax® or similar) and the method of detonation (e.g., singular versus sequential blasting). At the present time, ANFO is expected to be used for the tunnel excavation. Tunnelling will be done from two active work faces, one originating at the water intake and the other from the power tunnel access adit located near the powerhouse. The underground works will be performed in accordance with requirements of the *Occupational Health and Safety Act* of the Province of Saskatchewan. General safety regulations and regulations for underground work activities will be followed at the construction site.

A surge facility/adit will be incorporated into the Project water conveyance system to control hydraulic transient pressures. The adit will limit the rise and fall of pressure when the turbine and generator units experience a load rejection by quickly reducing the water flow. The surge facility will limit the reduction in pressure when the units are started or when the load quickly increases. Due to the length of the power tunnel, the units will not maintain a constant speed while reacting to load changes if there was no surge facility. The surge facility/adit will be an inclined tunnel branching off the power tunnel and emerging at the surface at an elevation sufficient to contain the highest water pressures during operation, which will be above the surface level of Black Lake. The surge facility will provide access to the power tunnel during construction.

A rock trap will be designed to prevent entry of cobbles and boulders into the power tunnel and powerhouse, and will be designed to fulfill this function during filling of the power tunnel (i.e., when operating under partially full conditions), as well as when operating at full capacity (i.e., when the power tunnel is full and operating under pressure). The rock trap will be designed to provide safe access for personnel and for equipment used for inspection and maintenance.

Long-term access to the power tunnel will be required to carry out tunnel inspections, tunnel cleaning, and cleaning of the rock trap. Access hatches, walking and travelling surfaces, and other facilities for safe future access of personnel and light excavation equipment for inspection, maintenance, and repairs of the tunnel will be provided.

5.3.8 Tailrace Channel

After the water from Black Lake is used to generate power, the tailrace channel returns the water to the Fond du Lac River at a location upstream of Middle Lake (Figure 1-2). The tailrace channel will be about 800 m long, a width of 25 m, and a depth of 5.5 m (the final design is subject to optimization). About 58,000 m^3 of overburden and 475,000 m^3 of waste rock will be removed during the excavation of the tailrace channel.

The tailrace alignment is along a rocky ridge to the northeast along the edge of the broad flat valley and allows the majority of the excavation to occur in bedrock, reducing the amount of overburden to be excavated. At the proposed tailrace channel outlet an existing rock ridge will act as a rock plug preventing the migration of Fond du

Lac River water into the excavation during construction. At its highest point, this ridge is approximately 7 m above the water level in the Fond du Lac River. To reduce effects on fish and fish habitat, the tailrace channel outlet discharges upstream of important fish spawning habitat near the Fond du Lac River outflow to Middle Lake to maintain minimum required flows at this location.

The size of the tailrace channel has been designed to limit head loss, while considering the overall cost to excavate. The tailrace channel outlet has a designed water depth of 5.5 m and is expected to have an approximate flow velocity of 1.4 metres per second (m/s) based on a discharge rate of up to 190 m^3/s. The channel will be blasted into the bedrock or excavated in overburden and will have a relatively smooth, regular bottom with steeply sloping sides and exclude instream velocity refugia (e.g., slack water areas behind boulders or baffles).

5.3.9 Submerged Weir at the Black Lake Outlet

A submerged weir spanning the width of the Fond du Lac River will be constructed at the natural outflow of Black Lake at Grayling Island (Figure 1-2) to maintain historical water levels in Black Lake during Project operation. The Fond du Lac River is approximately 210 m wide at the location of the proposed weir.

The submerged weir will be completely underwater during the open water period and will be designed with a triangular cross section. The weir will be constructed entirely of coarse rock fill, having an average diameter of 500 mm. As the weir is not required to act as a water retention structure, a central impervious core will not be required. This configuration of the submerged weir is designed to facilitate safe downstream passage for all fish species at the Black Lake outflow to the Fond du Lac River and at all lake levels and discharges.

The submerged weir will be constructed at the end of the Project schedule once the powerhouse is operational. Construction will consist of advancement of clean rockfill material from the shore of the Fond du Lac River towards Grayling Island. At this stage, spoil material will be readily available for use in weir construction. The rock material used to construct the weir will be inspected and confirmed to have no potential or low potential for acid generation or radioactive materials. All in-water works will be completed in accordance with conditions outlined in a DFO authorization. An Erosion and Sediment Control Plan and a Turbidity Monitoring Program will be developed and implemented for the Project.

5.3.10 Settling Ponds

Three settling ponds have been included in the construction plan for the Project for the management, and possible treatment, of the Project's wastewater other than site runoff and sewage and grey water (Figure 1-2). At this preliminary design stage, each settling pond is anticipated to be approximately 43 m long by 11 m wide. Design discharge capacity into each pond will be refined as construction proceeds, but at this time, the upper bound capacity for each has been assumed to be 3,300 cubic metres per day (m^3/d). Water in the settling ponds will be pumped to the Fond du Lac River at one or both of two potential discharge locations after the water has been tested and confirmed to meet appropriate discharge criteria. Construction and monitoring of settling ponds or water treatment areas will be included in the Site Water Management Plan.

5.4 Operations

The following provides Project description information relating to the operations phase of the Project including power plant operations, site infrastructure, and supporting infrastructure during operations. This section

describes industry standards, environmental design features, and mitigations that will be implemented during operations to reduce or eliminate potential effects on the environment.

5.4.1 Power Plant Operations

5.4.1.1 Normal Operating Conditions

The basis of the proposed design ensures that the plant will be operated such that total daily flows and water levels on Black Lake and Middle Lake during operation will remain very similar to the natural conditions observed prior to development. River and lake flows and levels will continue to fluctuate up and down throughout the year (just as they do now) based on the inflows into Black Lake.

To produce 50 MW of power, a flow of up to 190 m^3/s would be required to pass through the power plant with the remaining 115 m^3/s (on average) passing through the natural Black Lake outlet into the Fond du Lac River. Powerhouse flows will be released into the Fond du Lac River upstream of Middle Lake, restoring the long-term annual outflow of 304 m^3/s entering Middle Lake and areas downstream of the tailrace channel outlet.

The Project will be managed to maintain natural (pre-development) flows and levels, as well as to meet minimum target seasonal riparian flows in the Fond du Lac River (between the Black Lake outlet and the tailrace channel outlet) of the following:

- 70 m^3/s for spring spawning season (i.e., May 1 to June 30); and
- 40 m^3/s for the over-wintering, summer, and fall seasons (i.e., January 1 to April 30 and July 1 to December 31 for a given year).

These are the minimum target flows that will be released down the short section of the Fond du Lac River between Black Lake and the tailrace channel outlet during these periods. Most years the flows will exceed these values, particularly during the spring spawning period.

A surge facility (adit) will be incorporated into the Project water conveyance system to control hydraulic transient pressures. Due to the length of the power tunnel, the generating units would not be able to maintain a constant speed while reacting to load changes if there was no surge facility. The adit will tie into the power tunnel a short distance upstream of the powerhouse.

An energy model was developed to simulate daily operation of the plant over the available historical flow record from 1963 to 2011. The headpond for the Project, Black Lake, will vary in elevation depending on overall inflow from its upstream watershed. The weir at the lake outlet will be designed to maintain the historical water levels on Black Lake (1963 to 2011) and levels will vary as they did naturally prior to development of the project. The energy model assumed two or four generating units. Hydraulic losses included losses at the water inlet, water intake structure, trashrack, power tunnel, transition/penstock bifurcation, butterfly valves, and tailrace channel. Several potential minimum riparian flow scenarios were modelled to determine the average annual net energy potential given various flow levels. The Project's estimated, gross average annual generation will be approximately 400,000 MWh per year.

The tailrace channel is expected to remain open over its entire length during winter. An analysis was completed to determine the effect on winter water temperature due to the velocity of the flows as well as due to the

temperatures of the discharge from the proposed Project on the Fond du Lac River at the outlet of the tailrace channel.

5.4.1.2 Upset Conditions

When the generating station is in operation, there will be occasions (e.g., scheduled maintenance) when the plant must be shut down and the flow through the powerhouse must be diverted, units in the powerhouse must be reduced or even stopped, and flows in the tailrace channel would be reduced. Annual inspections would be scheduled to avoid spawning periods and are expected to last for periods of up to two weeks. Only one unit would be shutdown at a time to reduce the effect on water levels on Black Lake and Middle Lake and to maintain energy production. Maintenance shutdowns likely will be conducted during the winter or during other periods when there is less flow available to pass through the plant.

It is anticipated that each unit could be taken out of service once per month (on average), to perform minor adjustments, inspections, and maintenance. To accommodate the power tunnel inspections, the entire plant would be shut down for approximately 1.5 to 2 weeks every five years. The turbine generator units would receive major overhaul work every 30 years. It is expected that one unit at a time would be overhauled, with each overhaul lasting two to three months.

The power plant will be shut down without advance notice if there is a load rejection in the transmission system due to transmission line failure. These unplanned shutdowns are expected to be relatively brief, typically from a few minutes to four or five hours. On occasions during the spring fish spawning and rearing period (May 15 to July 15), when the unplanned shutdown exceeds 15 minutes, the bypass conduit at the powerhouse will begin releasing flow to reduce drawdown effects on the Fond du Lac River below the tailrace channel outlet and upstream of Middle Lake. During these periods, flows through the natural outlet would slowly increase as water levels in Black Lake respond to reduced power tunnel outflows.

The turbine generator units for the proposed power plant will be equipped with turbine inlet valves (TIV) to handle the sudden requirement to stop the flow. The TIVs will be designed to close at a rate that will avoid undesirable increases in water pressure in the power tunnel. The sudden curtailment or start up of flow within the power tunnel will trigger a pressure surge or transient condition within the power tunnel. Although the pressure will rise in the power tunnel as the pressure wave migrates upstream toward the water intake, it will dissipate rapidly once it reaches the open water of Black Lake.

Modelling has been completed to simulate a worst-case scenario when all turbine generator units suddenly shut down for an extended period. The modelling results suggest that the sudden shutdown of the units and subsequent bypass 80 m^3/s of power generation flows would subject Middle Lake to a maximum drop in water level of approximately 0.41 m. The maximum rate of water level drop was determined to be approximately 4.35 centimetres per hour (cm/h). The plant will be equipped with measures that allow flows to be bypassed through the plant when the turbine generator units are shutdown or cannot be connected to the transmission line grid, with the size of the bypass conduit selected to be in the order of 50% of the plant capacity.

5.4.2 Powerhouse

The powerhouse complex will be located in a rock excavation to the east of Elizabeth Falls. Adjacent to the powerhouse will be the parking and vehicle manoeuvring area. A reinforced concrete powerhouse substructure will encase and support all the electrical and mechanical equipment associated with the turbine generator units

in the central area of the main powerhouse floor level. Governor equipment used to control the generating units and other mechanical equipment would be installed beside the generator enclosures. A section of floor along the downstream side of the units at the service bay slab level will accommodate electrical panels and cubicles, and an oil-water separator near the service bay.

The steel penstock leading from the power tunnel will bifurcate into two or four smaller penstocks (depending on the number of units) that will pass through the upstream wall of the powerhouse where butterfly valves will be located to be used for emergency shut off of the flow to each unit. Having passed through the turbines, the water will be discharged into the tailrace channel where it re-enters the Fond du Lac River through the tailrace channel outlet downstream of Elizabeth Falls. When flow bypass is required, a flow of 80 m^3/cm will be moved through the water conveyance system at the powerhouse, either by a discrete branchline diverting off of the penstock upstream of the powerhouse and dissipating into the tailrace through mechanical nozzles, or alternatively by passing through one or more of the turbines depending on the final design and equipment selection.

A dewatering and drainage sump will be located at the lowest elevation of the powerhouse. The dewatering system will consist of a set of pumps and associated controls that will operate to completely dewater the power tunnel, steel penstocks, turbine water passageways, and draft tubes for inspection. All drain and fill lines will be equipped with valves and connected to the service air system. Compressed air will be used to purge the drain lines of sediment prior to dewatering.

A service bay, located immediately adjacent to the west side of the powerhouse, will serve as an area for assembly and maintenance of the larger turbine and generator components. Rooms for station control equipment, service and maintenance, storage areas, and toilets will be located along the southwest side of the service bay. A large overhead door and man door will be located in the southwest wall of the service bay.

At each turbine generator unit, a turbine inlet valve will be positioned upstream of the turbine case. The valve will provide emergency closure capability to shut down the turbine if control of the generating unit is lost. The valve can be used to isolate the unit during dewatering and will be hydraulically operated and provided with a counter-weight as a backup in the event of a hydraulic system failure. Each valve will have bypass piping to allow the hydraulic head across the valve to be balanced before operation.

Primary heating of the powerhouse structure will be accomplished by circulating the heat expelled from the generator equipment to the surrounding area. Heating, cooling, and ventilation of occupied spaces (i.e., control room, mechanical and electrical shops, communication and electronic rooms, lunchroom, and toilets) will be accomplished by mechanical heating and cooling units supplemented with exhaust ventilation to provide fume, humidity, and odour control. The air supply and exhaust system for the plant will shut down automatically in the event of a fire.

Drainage from the rooftop will be collected in scuppers and drained by gravity through downspouts to the tailrace channel. Drainage within the powerhouse will be collected in a sump in the lower section of powerhouse. From there, float-operated pumps will transfer the drainage to an oil-water separator before it is released to the tailrace channel. The drainage system will be sized to handle the largest combination of drain loads, including fire protection discharges and rain, and will operate with temperatures normally between 10°C and 40°C. The oil-water separator storage area will have sufficient volume to hold the contents of the largest single oil container within the power station.

Environmental issues associated with the new powerhouse drainage systems include oil containment and potential oil discharges to the river. The pumped drainage sump, primary interceptor chamber and the oil and water separation chamber will be equipped with oil detection equipment capable of detecting trace oils on the surface of the water. In the event of oil detection, the oil detector will alarm back to the main control room. To mitigate the risk of a drainage system failure flooding the powerhouse, the drainage sump will overflow into the dewatering sump, thereby providing significant additional pumping capacity.

5.4.3 Water Intake

The water intake will consist of a reinforced concrete structure with provision for steel stoplogs and exclusion bar racks, and a streamlined water passage to direct the flow to the power tunnel. The intake channel and structure will withdraw the required plant discharge from Black Lake over the full range of anticipated lake levels. The water intake will divert water from near the surface of the lake (i.e., surface to about 5 m below the lake surface). The ceiling of the water passage will be set low enough to prevent entrainment of air into the power tunnel. The level of the water intake deck will be set so that it remains operational during periods of high water in Black Lake.

The design of the water intake will allow for a smooth and gradual acceleration of the flow that will limit the disturbance to the local fish habitat (i.e., adult large-bodied fish species likely to be present near the water intake have burst swimming speeds in excess of the proposed exclusion bar rack approach velocity). The exclusion bar rack will consist of embedded horizontal steel beams that support assembled exclusion bar rack.

Sectional stoplogs will be provided for the two openings at the water intake to isolate the power tunnel for inspection and repairs. The stoplog sections will only be installed or removed under balanced head conditions, which is when the power tunnel is full of water but not flowing, and with the butterfly valves and turbine inlet valves closed in the powerhouse. A small slide gate or embedded filling line will be provided in the water intake structure to allow for gradual filling of the power tunnel. A hatch will be provided immediately downstream of the stoplogs to gain access into the power tunnel for inspection and maintenance. Air intakes and vent pipes will be provided downstream of the stoplogs to stabilize air pressure in the power tunnel during dewatering and rewatering.

5.4.4 Switchyard

The switchyard for the Project will be located near the powerhouse. A grounding grid will be located underneath a layer of locally obtained crushed rock. The equipment within the switchyard will consist of the following items:

- two runs of 13.8 kilovolt (kV) 133% insulated XLPE TECK cable from the powerhouse entering the switchyard;
- each of the turbine generator units will connect to one generator step-up transformer located in the switchyard;
- 138 kV SF6 Circuit Breakers; and
- 138 kV Disconnect and Grounding Switches.

An access road will be built to bring equipment to the site and to facilitate future maintenance. A chain link fence with barbed wire will enclose the switchyard with gates for vehicles and pedestrian access.

5.5 General Project Activities

5.5.1 Site Water Management

Site wastewater will be of several types, including waste rock runoff, groundwater inflows during the construction of the power tunnel, general site runoff, and water collected in settling ponds. Water collected within the three settling ponds for the Project will be composed of waste rock runoff and groundwater inflows during the construction of the power tunnel. At this preliminary design stage, each settling pond is anticipated to be approximately 43 m long by 11 m wide and have a flow capacity of about 3,300 m^3/d. Water collected in disturbed areas located away from the settling ponds will be pumped to these locations.

Water within the settling ponds will be tested and treated, if necessary, before release to the Fond du Lac River, in accordance with applicable regulations and licence requirements. Retention of Project-affected water in the settling ponds will allow suspended sediments and associated parameters (e.g., some metals) to settle out. Water in the settling ponds will be pumped to the Fond du Lac River at one or both of two potential discharge locations after the water has been tested and confirmed to meet appropriate discharge criteria (if required). A Water Quality Monitoring Program will be implemented to determine the nature of potential changes to the water quality of the Fond du Lac River receiving discharge from the settling ponds. Contingency plans for off-site disposal of dewatered settling pond sludge will be included in an Environmental Protection Plan (EnvPP).

5.5.2 Waste Rock Management

While preliminary locations have been identified (Figure 1-2), waste rock disposal area locations and volumes will be defined as the Project design is finalized. The total potential disposal volume of waste rock and overburden after excavation will be approximately 1,192,000 m^3. This represents a volume for disposal consisting of approximately 118,000 m^3 of overburden and 1,074,000 m^3 of rock.

Waste rock removed from excavations can be used in construction where these materials meet the applicable Project requirements and in concrete production. The remaining excavated (rock and overburden) will be deposited in waste rock disposal areas. A Waste Rock Management Plan will be developed for the Project to assess and manage various waste rock types (including rock with acid rock drainage [ARD] potential, elevated concentrations of various metals, or containing uranium mineralization) and to mitigate potential negative effects on the surrounding environment.

Waste rock excavated from the power tunnel will be checked for susceptibility to generate ARD and metals leaching (ML) prior to placing in a permanent waste rock disposal area. Monitoring of excavated rock during construction is a practical means for assessing potential geochemical changes to materials caused by weathering and identifying ARD/ML concerns associated with sulphide mineralization of bedrock. Previous geological testing has confirmed that radioactive waste rock is not likely to be encountered (Hatch 2012).

5.5.3 Domestic and Industrial Waste Management

Non-hazardous waste at the Project consists of domestic waste (e.g., kitchen waste and office waste) and construction material waste (e.g., plastics, wood, metal, and other inert materials). Domestic waste produced during the construction and operation phase of the Project, including food refuse and similar material, will be managed with bear-proof storage containers and will be hauled off-site to an existing permitted waste disposal facility. During construction, about 4 m^3/d of solid waste will be produced, varying in volume at different times of the year. If solid waste is hauled to Black Lake for disposal, it will be subject to the Indian Reserve Waste

Disposal Regulations contained in the *Indian Act* (1985). Some recycling will take place at the construction camp with the recyclable materials hauled to southern facilities.

5.5.4 Hazardous Substances

Hazardous substances used at the Project during construction will include fuels and other petroleum hydrocarbons (e.g., diesel fuel, light or medium oils, hydraulic fluid, and lubricants), pressurized gases (i.e., oxygen, acetylene, propane, and compressed air) and chemical additives. Fuel will be stored in a dedicated, secured staging area adjacent to the maintenance facility on the east side of the river near the powerhouse, complete with appropriate spill-proof equipment (including secondary containment) and documentation. The management of hazardous wastes will include collecting the wastes in suitable containers and storing them for shipment off-site via a licensed contractor to recycling or disposal facilities. All storage and handling of hazardous materials and hazardous waste will meet the requirements of the *Hazardous Substances and Waste Dangerous Goods Act and Regulations* and *Transportation of Dangerous Goods Act and Regulations*.

5.6 Supporting Infrastructure and Services

Diesel-powered generators and 25 kV power from the SaskPower electrical grid are the only options available for initial Project construction power. Diesel generators will be used as a temporary means of providing construction power and as backup power if the SaskPower grid is out of service. It is anticipated that construction power from the SaskPower electrical grid will be available within a few months after the start of construction.

A transmission line will be required to connect the Project to the existing northern Saskatchewan electrical grid through the existing Stony Rapids Switching Station (approximately 3 km south of the Northern Hamlet of Stony Rapids) or, potentially, a new switching station in the area. The station service system will provide power for all station services and equipment heating, lighting, motors, and generation equipment. This power will be provided by two transformers, one connected to the generator switchgear lineup and one connected to SaskPower's 25 kV distribution network. Backup power for the station service will be provided by a diesel-powered generator sets. The transmission line will be a separate project and SaskPower will be the proponent of any environmental assessment required for providing the new power line to the Project.

SaskPower will coordinate with SaskTel for the installation of communication infrastructure to support the construction requirements. The construction site will have a satellite phone connection for a backup system. Permanent communications for the Project will be provided by fibre optic connection, which will provide the communications link for IT and corporate LAN (including a voice over internet protocol based system [VOIP]) and security systems. Other communication infrastructure will include a satellite phone connection to the plant.

The withdrawal of water for domestic and industrial purposes will be required during Project construction and operation. Water requirements for the construction phase can reach up to 4,700,000 litres (L) per year (i.e., approximately 13 m^3/d) for industrial water and potable water use is expected to be between and 30,000 and 45,000 litres/day). Potable water for the construction camp is anticipated to be sourced from one or more new wells located near the camp, although this water could be drawn from either Black Lake or the Fond du Lac River. Pump intakes would be screened to prevent entrainment of fish in accordance with the "Freshwater Intake End-of-Pipe Fish Screen Guideline" (DFO 1995).

During operations, approximately 365,000 L/year (i.e., 1 m^3/d) of water will be required for the Project. Potable water will be drawn from the penstock and treated for use. A water treatment facility will be constructed on-site to meet daily water consumption requirements. The water treatment facility will meet provincial drinking water quality and safety standards and will be licensed under *The Water Regulations* (2002). Industrial water (i.e., used for fire suppression, preparing concrete, and controlling road dust) will be taken from Black Lake (i.e., intake location) and the Fond du Lac River (i.e., bridge location). Pump intakes would be screened to prevent entrainment of fish in accordance with the "Freshwater Intake End-of-Pipe Fish Screen Guideline" (DFO 1995).

A supply of industrial water will be required for dust suppression and fire-protection during Project operation. The fire protection water system will be comprised of two electric motor driven pumps, each powered by separate electrical sources, and a by-pass to allow flow to pass in the event that both pumps fail. Each pump will be sized to meet the full demand of the largest component of the system with the addition of 31.5 litres per second (L/s) for hose demand. There is no treatment required for industrial water.

Sewage and grey water from the Project will be transported to the Black Lake Lagoon for treatment. During the peak construction period, it is expected that the workers will produce about 30,000 L/day of sewage and grey water (e.g., the equivalent of two truckloads a day). During the operations phase, it is estimated that the Project will produce approximately 1,400 L of wastewater per day during operations. Sewage and grey water from plumbing fixtures will be directed to the sanitary system and pumped to an outdoor buried fiberglass sewage-holding tank. The sewage-holding tank will be pumped out as required (about once a week) and disposed of at the Black Lake lagoon.

Due to health and safety concerns, access to the Project site on the east side of the Fond du Lac River will be restricted during the construction period. Access restrictions to Project components on the west side of the river will also be enacted during the construction phase of the Project, although special considerations will be made for local residents. For health and safety reasons, access to some Project infrastructure on the east side of the Fond du Lac River will also be restricted during the operations phase of the Project. This includes the powerhouse, switching station, water intake structure, and the tailrace channel. An Access Management Plan will be developed by the Proponent to address overall access to the Project site during construction and operation, with consideration given to land-based and water and ice-based travel. This will include effective and timely communication with resource users (including members of BLFN, residents of Stony Rapids, and the owner of Camp Grayling) about Project activities and any restrictions that will be put in place for overall public safety.

5.7 Closure

A Decommissioning and Reclamation Plan (D&R) Plan will be developed with the objective of returning lands disturbed by Project activities to a condition that is physically stable, safe, and environmentally sustaining in keeping with the land use and landscape of the day. Detailed plans for decommissioning, reclamation, and abandonment will be developed in consultation with regulatory agencies during licensing.

The D&R Plan will follow a process of progressive reclamation where any disturbed area that is no longer in use after construction is complete will be reclaimed as soon as practical. Reclamation activities can occur throughout the operational life of the Project although they will be concentrated during and immediately following construction. The operational life of the Project is expected to extend to 90 years or more. The exact life

expectancy of the Project cannot be determined at this time as hydroelectric projects of this type can operate almost indefinitely with ongoing equipment maintenance and upgrades. It is anticipated that final closure of the Project will take approximately two years following cessation of power production operations.

5.8 Human Resources

It is anticipated that construction of the Project will occur under the direction of a single general contractor. Due to the specialized and diverse nature of the work associated with constructing a hydroelectric power facility, some specific activities will need to be completed by sub-contractors with expertise in areas. There is the potential for several components of the construction to be sourced locally, including using local businesses and labour. Training for these positions would occur on the job or would be scheduled leading up to the operations of the Project. At this time, the total number of jobs created by the Project has not yet been determined, although it is estimated that during the peak construction period, the Project will create approximately 250 to 300 jobs and the camp population could be up to 250 workers. It is the intent of the Proponent (BLFN and SaskPower) to train and employ people from the local community to maintain and operate the plant once it is commissioned. The BLFN facilities at Black Lake will be used for pre-employment training and the Northlands College facilities (i.e., La Ronge campus) will be used for the more advanced trades training and education upgrading.

5.9 Environment, Health, and Safety Management System

SaskPower and BLFN (as the Project proponent) through the Project Manager will make sure that all contractors comply with current provincial and federal Health and Safety regulations, as well as SaskPower's ISO 18001 safety system. The SaskPower Safety Management Policy applies to all SaskPower facilities and operations, employees, contractors, and visitors. The policy states that SaskPower is committed to maintaining a workplace in which safety is part of everything that is done and equally important as anything else done by the corporation.

An EnvPP will be developed before the start of construction. The EnvPP will include information relating to general Project activities such as site water management, waste rock management, domestic and industrial waste management, and management of hazardous substance (as indicated above in Section 5.6). Other plans developed as part of the overall EnvPP include a Weed Management Plan and an Emergency Response Plan (ERP). The ERP will outline specific spill prevention and clean-up procedures.

5.10 Accidents, Malfunctions, and Unplanned Events

Accidents, malfunctions, and unplanned events can occur on an industrial site. Execution of the SaskPower Safety Management Policy for the Project will work towards preventing and mitigating accidents and malfunctions. Accidents, malfunctions, and unplanned events identified for the Project include:

- emergency shutdowns of power generation activities;
- improper inspection of construction equipment;
- release or spills of hazardous substances;
- increased traffic and potential for collisions;
- failure of embankment dykes around the settling ponds; and

- fire.

While some of the accidents, malfunctions, and unplanned events could affect the environmental, the likelihood of them occurring or the magnitude of their effects is sufficiently reduced through mitigation strategies. Potential effects from accidents, malfunctions, and unplanned events were classified as having no linkage or as having a negligible residual effect on VCs.

5.11 Effects of the Environment on the Project

The local environmental setting can affect the construction, operation, and closure phases of the Project. This section of the EIS examines the interactions between the surrounding environment and the Project, to identify the main environmental conditions that can affect the Project. These environmental conditions are examined to determine their local severity, probability, and/or frequency. Mitigation, contingency plans, and designs for each are designed and monitored to confirm that risks to the Project are sufficiently reduced.

The environmental conditions that may affect the Project can be categorized based on the time over which they occur.

- Short-term events: these events are high intensity events that occur over a short time scale (e.g., storm events; temperature extremes). Mitigation for these events cannot generally be responsive due to the intense nature and short time period over which they occur.
- Seasonal events: These events can last weeks or months and can feature similar conditions to the short-term events (i.e., high precipitation), but will not necessarily include large extreme events. The effects would be cumulative in nature.
- Long-term events: These events can develop over a period of years. This category involves long-term variations in the environmental setting surrounding the Project.

A summary of the short-term and seasonal events that can occur near the Project, the potential environmental or Project effects and the mitigation strategies that will be employed to help reduce effects is shown in Table 5-2. While some of the short-term events could affect the Project or environmental interactions negatively, the likelihood of them occurring or the magnitude of their effects is sufficiently reduced through mitigation strategies.

Table 5-2: Summary of Potential Environmental Effects from Short-term and Seasonal on the Project and Associated Mitigation

Event	Potential Effect	Mitigation Strategies
Short-term Events		
Storms	Intense rain can cause erosion, which can compromise the integrity of site infrastructure.	Site will be graded and will include stable slopes, and will be landscaped to include armouring or vegetation where necessary according to the Erosion and Sediment Control Plan.
	Storm events can damage site infrastructure and interrupt site operations.	Site infrastructure will be designed according to NBC standards.
	High rainfall events can cause overtopping of site drainage structures and can limit access to site or ability to travel on site.	Road crossing structures will be designed to sufficient design standards for seasonal flood events, which are considerably higher than short-term rain events.
	Storm events can introduce dangerous working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	Electrical storms could cause a power outage.	Power will be generated on site and the site will be connected to the SaskPower grid; backup power for the station service will be provided by a permanent diesel-powered generator.
	Lightning strike could start a forest fire.	An emergency plan will be developed to prevent and respond to fires and equipment will be available. The fire protection water system will be comprised of two electric motor driven pumps, each powered by separate electrical sources, and a by-pass to allow flow to pass in the event that both pumps fail.
		The SaskPower Safety Rulebook explains all relevant safe work practices and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
Extreme Snowfall	Snow drifts and ice on roads surrounding and on site can affect driving safety.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	Poor visibility or deep snow can affect worker safety.	
Extreme Temperatures	Extreme temperatures can introduce unsafe working conditions.	
	Extreme temperatures can affect the performance of equipment and interrupt operations.	Procedures will be developed for maintaining the use of equipment during extreme temperature (e.g., storage and usage limits).
High Winds	High winds can introduce unsafe working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
	High winds can damage site infrastructure or equipment and interrupt operations.	Site infrastructure will be designed according to NBC standards.

Table 5-2: Summary of Potential Environmental Effects from Short-term and Seasonal on the Project and Associated Mitigation (continued)

Event	Potential Effect	Mitigation Strategies
Fires	Fires can damage site infrastructure and interrupt operations.	An emergency plan will be developed to prevent and respond to fires and equipment will be available. The fire protection water system will be comprised of two electric motor driven pumps, each powered by separate electrical sources, and a by-pass to allow flow to pass in the event that both pumps fail.
	Forest fires can introduce unsafe working conditions.	The SaskPower Safety Rulebook explains all relevant safe work practices, and complies with current provincial and federal Health and Safety regulations, and the SaskPower ISO 18001 safety system.
Seismic Events	Seismic activity can damage buildings, injure occupants, and interrupt operations.	Site infrastructure will be designed according to NBC standards.
Seasonal Events		
Low Precipitation	Dry events can increase the likelihood of fires.	Water required for fire suppression will be obtained from Black Lake or the Fond du Lac River.
	Drought conditions can affect the quantity of water available for tunnel operations.	The Water Management Plan for the Project outlines a detailed water management strategy that will allow maximum facility efficiency to be attained while maintaining minimum riparian flow in the Fond du Lac River.
	Drought conditions can affect the quantity of water available for domestic and industrial water supply.	The proponent will retrieve its water supply from local groundwater wells or directly from the Fond du Lac River or Black Lake, which all have sufficient water to supply the site even during extreme droughts (Section 9.0; Section 10.0).
High Precipitation	High seasonal precipitation or a rapid spring melt can cause flood conditions which can affect site infrastructure.	Drainage structures will be designed for flood events greater than that produced by snowmelt; culverts will be monitored and ice blockages will be removed, if required.
		Site buildings will be designed according to NBC standards and will be located well above high water levels.

Climate change can affect the Project by increasing the frequency and intensity of short-term events. While the changes to the frequency and intensity of short-term events are difficult to predict and the climate change models used in this assessment do not estimate how these events will change. The longer summers and warmer temperatures suggest more energy in the climate system and likely an increase in frequency and intensity of short-term events (i.e., storms, high temperature extremes, wind extremes, and fires). While the magnitude of these changes is currently unknown, appropriate conservatism has been incorporated into the Project design to address these potential issues. For example, cross drainage structures will be designed for infrequent flood events. Additionally, conservatism incorporated into the design criteria help to address potential long-term changes in the intensity of short-term events.

Climate change can affect the Project by increasing the frequency and/or intensity of seasonal events. While an increase in radiation, wind, and temperature can increase evaporation from waterbody surfaces, this is unlikely to offset the increase in total precipitation and can result in a net increase in runoff. An increase in water levels and flow rates is not expected to affect the Project beyond the potential effects described in Table 5-2.

6.0 ABORIGINAL, PUBLIC, AND REGULATORY ENGAGEMENT

Stakeholder engagement and Duty to Consult are separate processes that are important components of the environmental assessment process. Early engagement with stakeholders can reduce misinformation, address stakeholder concerns, and ultimately prevent potential issues and allow the Project to progress smoothly.

The engagement approach for the Project has been developed based on the nature of the Project, knowledge of the communities and stakeholders near the Project, and professional experience. The purpose of the engagement program for the Project is to include as many stakeholders as possible in a wide-reaching and inclusive program that will allow individuals and groups to receive information about the Project, ask questions or clarifications, and ultimately provide any input or concerns they have.

This process began by identifying the main categories of stakeholders so that engagement activities and initiatives would best suit each. For the Project, stakeholder categories are: First Nations and Métis, the public, and regulatory agencies. Development of the engagement process for this Project considered the following factors:

- The Project is a partnership between SaskPower and BLFN.
- The Project is located in northern Saskatchewan within the Chicken Indian Reserve No. 224, near the communities of Black Lake and Stony Rapids.
- A large portion of the local population is First Nation or Métis; however, there are non-Aboriginal community members in the area.
- The Project, in general terms, has been discussed for several decades. This means the surrounding communities already have some ideas about the Project, but there could be inaccurate information circulating about the Project.

The First Nation and Métis communities identified as stakeholders for the Project include:

- Black Lake Denésuline First Nation;
- Resident of Cabin on Middle Lake;
- Métis Nation Saskatchewan – Stony Rapids, Local # 80;
- Fond du Lac Denésuline First Nation;
- Hatchet Lake Denésuline First Nation;
- Métis Nation Saskatchewan – Camsell Portage, Local # 79; and
- Métis Nation Saskatchewan – Uranium City, Local # 50.

The methods of engagement included open house meetings, workshops, and one-on-one communication. Translation was provided as appropriate. The Public Involvement Program (PIP), developed by the proponent for the Project, maintained a strong focus on the engagement of Aboriginal people, in particular those residents in the Athabasca Region of northern Saskatchewan. It is important to note that the population of this region of northern Saskatchewan is more than 90% aboriginal, so many of the public engagement activities had a strong Aboriginal representation.

The meetings held from 2012 to early 2013 focused on engagement with the local communities. This included providing Project updates and gathering feedback. Eight community sessions have taken place to date with additional sessions expected to be held in late 2013 and early 2014. One community session held in Black Lake (April 9, 2013) was completed as a workshop, with the specific purpose of receiving feedback from local residents on various aspects of the Project (e.g., water intake structure; weir; riverscape (changes to the river); project valued components; road, bridge and camp locations; and how it works). Attendance at this workshop exceeded expectations.

Feedback and questions were encouraged throughout all of the engagement and consultation activities to date. In some cases feedback forms were handed out with the hopes that attendees would fill them out and return them. Most of the feedback was recorded by the EFHLP members who attended these meetings.

Feedback from the meetings was generally positive and showed the community's interest in the Project. The main questions and concerns that were recorded were in regards to fish mortality and habitat, power rates in northern Saskatchewan and the potential financial benefits and employment opportunities that the Project will have on the area. A full discussion of these workshops is included in Section 6 of the EIS.

6.1 Public

Extensive public involvement has been the cornerstone in the project development process to arrive at a technically feasible, economically viable, and environmentally sustainable Project. The Northern Hamlet of Stony Rapids has been identified as the main non-reserve community for inclusion in engagement activities. In addition, the following agencies, organizations, and groups were identified as stakeholders potentially having an interest in the Project:

- Camp Grayling;
- Mayor and Council Northern Hamlet of Stony Rapids;
- Prince Albert Grand Council – Athabasca Region;
- AHA;
- New North;
- NLMC;
- Athabasca Basin Development - Board of Directors;
- Athabasca Keepers of the Water;

- CPAWS;
- SES;
- regional suppliers;
- local outfitters and resource users;
- uranium industry; and
- regional educations and training institutes.

Three formal meetings were held in Stony Rapids, including one Community Information Session held in 2010. In addition, the Northern Hamlet of Stony Rapids Mayor and Council were invited to a workshop in Black Lake in April 2013. Although few people turned out for the Community Information Session, many questions were raised. Most of the questions were about the environmental assessment and the potential impacts that the Project could have on the environment. A summary of the Community Information Sessions is provided in Appendix 6.4 of the EIS.

Feedback and questions were encouraged throughout all of the engagement and consultation activities to date. Most of the feedback was recorded by the EFHLP members who attended these meetings. The feedback received was generally positive. The main questions and concerns that were recorded were in regards to the environmental impacts including aesthetics, fish, and water levels, as well as the potential financial benefits that the Project will have on the area.

6.2 Regulatory Agencies

As part of the environmental assessment approvals process, a number of federal and provincial regulatory agencies will be reviewing the EIS. Agencies were included in the Project engagement program to gain an early understanding of the concerns and comments these agencies might have about the Project. This Project is undergoing both a federal and provincial environmental assessment review process. As such, both the Agency and MOE Environmental Assessment Branch are the lead agencies for these processes and both have played a large role in the engagement process. Due to the nature of the Project, the following agencies have also been included in the engagement program:

- Aboriginal Affairs and Northern Development Canada (AANDC) (previously known as Indian and Northern Affairs Canada [INAC]);
- DFO;
- NRCan; and
- MOE – Fish and Wildlife Branch (MOE – FWB).

Other federal and provincial regulators identified as having a key role or interest in the Project include:

- TC;

- HC;
- Environment Canada;
- CWS;
- Ministry of Government Relations - FNMNA;
- Ministry of Highways and Infrastructure;
- Ministry of Economy; and
- WSA (previously known as Saskatchewan Watershed Authority)

6.3 Future Information Distribution, Engagement, and Consultation Activities

To date the engagement program has been focussed on the planning and environmental assessment phase of the Project. Future engagement activities related to this phase of the Project will include the continued dissemination of information through the web page, newsletters, and additional community sessions. A community session in the community of Fond du Lac First Nation was held in December 2013 and additional sessions with the communities of Black Lake First Nations and Stony Rapids are planned for early 2014. As the Project progresses, the engagement program will be altered to coincide with the next phases of the Project.

6.4 Duty to Consult

In Canada, consultation generally refers to the Duty to Consult. The Supreme Court of Canada has ruled that the Crown has a legal Duty to Consult with and where appropriate, accommodate First Nations and Métis on matters that can affect Aboriginal claims or rights (*CEAA 2012*, Ceballos 2010). This includes permitting, changes in tenure, and approval of developments on and off reserve lands. The purpose of Duty to Consult is to identify different values and concerns existing between Aboriginal groups and the Government of Canada, and to address questions and concerns so that they arrive at a result that meets the needs of all interested parties (Ceballos 2010).

Governments in Canada, at the federal and provincial level, have a duty to consult with aboriginal groups when making decisions that could affect lands and resources subject to aboriginal claims. The Agency acts as consultation coordinator to integrate the Government of Canada's Aboriginal consultation activities into the environmental assessment process to the greatest extent possible (*CEAA 2012*). This applies to all environmental assessments for which the Agency is the responsible authority.

The following is a complete list of all Aboriginal groups who have been identified by the federal officials for consultation related to the environmental assessment on the basis that potential or established Aboriginal or Treaty rights and interests may be affected by the Project:

- Black Lake Denésuline First Nation;
- Fond du Lac Denésuline First Nation;

- Hatchet Lake Denésuline First Nation;
- Métis Nation – Saskatchewan (MN-S) Camsell Portage Local 79;
- Métis Nation Saskatchewan Stony Rapids Local 80; and
- Métis Nation Saskatchewan Uranium City Local 50.

The Agency is responsible for completing all the requirements of the federal Duty to Consult process. Based on the Project information provided in the Project Description, the MOE Environmental Assessment Branch determined that the Project triggered the provincial Duty to Consult because the Project is considered a "development" under the *Environmental Assessment Act* (2010).

Although the legal Duty to Consult ultimately resides with the Crown, and not with the proponent, MOE has delegated certain procedural aspects to the proponent of this Project as they are in the best position to describe accurately the Project and any potential effects on the environment. The Environmental Assessment Branch identified the communities that the proponent was to provide Project-specific information to, and then describe how Treaty and Aboriginal rights and traditional uses may potentially be affected by the Project. The communities identified by the Environmental Assessment Branch include the following:

- Fond du Lac Denésuline First Nation; and
- Métis Nation Saskatchewan – Northern Region I, Local # 80.

The primary objective of the Project proponent is to assist MOE in meeting its Duty to Consult. The Proponent will work with potentially affected First Nation and Métis communities in assessing potential environmental and social-economic impacts, and developing the EIS. Meetings to fulfill MOE's Duty to Consult requirements will be carried out in accordance with requirements specific to MOE's letter of April 19, 2013 and as described in the First Nation and Métis Duty to Consult Plan for the Project – MOE.

Letters of introduction identifying the Proponent's role in the Provincial Duty to Consult obligations as well as providing information on the Project were submitted to the Fond du Lac First Nation and the Métis Local # 80 by the Proponent on September 18, 2013. In the letter, the proponent requested that a meeting be scheduled to discuss the Project and to gather information related to concerns about fish habitat in the Fond du Lac River (between Black Lake and Middle Lake). A meeting was held with the Fond du Lac First Nation on December 2, 2013. To date efforts to schedule a meeting with the Métis Local # 80 have been unsuccessful.

7.0 ENVIRONMENTAL ASSESSMENT APPROACH

The assessment first describes the existing environment and then compares it to the predicted future condition with and without the Project. After predicting potential environmental effects of the Project, the proponent identified ways to avoid or mitigate any adverse effects. A full range of topics was studied under the general categories of: the biophysical environment and the socio-economic environment. Some components were selected from these topics for more detailed analysis as VCs, based on their scientific and cultural importance and potential to be affected by the Project. A number of analyses were completed to evaluate the potential effects on VCs during the construction, operation, and closure phases of the Project.

The overall environmental assessment approach progresses through the following steps:

- description of existing conditions for environmental components so that changes from the Project can be measured;
- identification of VCs, including valued ecosystem components and valued socio-economic components, and associated assessment endpoints and measurement endpoints;
- establishment of environmental assessment boundaries (i.e., spatial and temporal boundaries);
- identification of potential project-environment interactions, environmental effects pathways, and environmental design features and mitigation practices (i.e., pathways analysis);
- residual effects analysis (i.e., project-specific effects and cumulative effects);
- consideration of uncertainty;
- determination of significance; and
- development of monitoring and follow-up programs to address the uncertainties and to verify the residual effect predictions.

Valued components represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important or of concern by the proponent, government agencies, Aboriginal peoples and the public. The value of a component not only relates to its role in the ecosystem, but also to the value placed on it by humans. The identification of key Project-environment interactions and the initial VC selection process were used to guide the design of scientifically robust programs to describe the existing environment. Baseline surveys were completed to document conditions near the Project.

Observations collected during baseline surveys represent part of the range of variation in the ecological and socio-economic systems produced by historical and current environmental selection pressures (both human and natural). As such, baseline conditions represent the cumulative effects from previous and existing land use practices and natural processes that have shaped the biophysical, cultural, and socio-economic components during the period of human settlement. Results of the baseline surveys were used to support the final VC selection. The final list of VCs for the Project are shown in Table 7-1 and rationale for the selection of these VCs is provided.

Table 7-1: Rationale for Selection of Valued Components

Valued Component	Rationale
Atmospheric Environment	■ Close link between air quality and other VCs (i.e., surface water quality, fish habitat, soils, vegetation, wildlife, and people). ■ Changes in noise levels can affect fish and wildlife. ■ Changes in air quality or noise levels can affect the quality of life of people living near the Project. ■ Local communities and residents have identified air and noise as a concern.
Groundwater	■ Changes to groundwater can affect quantity and quality of surface water, which can subsequently affect the aquatic and terrestrial environments and people that use these resources. ■ Changes to groundwater was identified as a concern by the public, First Nations and Métis, and regulatory agencies in the Project region.
Surface Hydrology	■ Availability of surface water to sustain aquatic life was identified as a concern by the public, First Nations and Métis, and regulatory agencies in the Project region. ■ Natural and human-related disturbances can alter the timing and nature of the interaction between physical and biological components of the surface water environment. ■ Changes to surface water quantity can influence components of the terrestrial environment and the availability of natural resources for traditional and non-traditional human use.
Surface Water Quality	■ Surface water quality is important to community members, First Nations and Métis, and provincial and federal government regulators. ■ Changes to surface water quality can affect other biophysical and socio-economic VCs that depend on suitable surface water quality.

Fish and Fish Habitat	■ Local Aboriginal people from the Black Lake First Nation, and the outfitter at Camp Grayling identified a number of important fish species in Black Lake, Fond du Lac River, and Middle Lake that are used for traditional and economic purposes. These selected fish VCs are as follows:
	  ▪ Black Lake fish species: Arctic grayling (*Thymallus arcticus*), cisco species (*Coregonus* spp.), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), longnose sucker (*Catostomus catostomus*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), and white sucker (*Catostomus commersonii*);
	  ▪ Fond du Lac River: Arctic grayling (three populations); and
	  ▪ Middle Lake: Arctic grayling, lake whitefish, longnose sucker, northern pike, walleye, and white sucker.
	■ Fish have been a vital part of traditional life in the region and continue to be prepared for consumption based on local cultural practices.
	■ Fish habitat is critical to the growth and development of the various life stages of fish species.
	■ Effects on fish and fish habitat and effects on aquatic species as defined in the *Species at Risk Act (SARA)* are areas of federal jurisdiction, and therefore, pursuant to Section 5 of *CEAA 2012*.

Soils	■ Close links among soils and other VCs (i.e., vegetation, wildlife, wildlife habitat, and surface water quality). ■ Natural and human-related disturbances can change the interactions between the soil and other VCs. ■ Changes in soils and other VCs can influence the opportunity for traditional and non-traditional human use of natural resources (e.g., gathering, hunting, trapping, and fishing).
Vegetation	■ Plant populations and communities provide food and habitat for wildlife. ■ Protection of listed (rare) plant species designated by federal and provincial legislation. ■ In recent interviews with the local Aboriginal people, several plant species were identified and are considered to be VCs by for traditional and economic purposes, including blueberries (*Vaccinium* spp.), bog cranberries (*Vaccinium* spp.), moss berries (*Vaccinium* spp.), and strawberries (*Fragaria virginiana*), as well as other edible vegetation, like mushrooms, when available.

Table 7-1: Rationale for Selection of Valued Components (continued)

Valued Component	Rationale
Wildlife	■ Protection of listed wildlife species is designated by federal and provincial legislation. ■ Selected wildlife species were chosen for their potential for interaction with the Project, socio-economic and cultural importance (e.g., hunting, trapping), sensitivity (i.e., listed species), knowledge of the species, life history, and ecological importance. ■ Given the large number of species that could potentially interact with the Project, it is neither possible, nor necessary to attempt to measure effects on all possible receptors. Thus, wildlife VCs are identified as surrogates to focus or structure the environmental effects assessment, with the understanding that the effects on other components of the environment would be similar. For example, assessing the effects from the Project on increases in harvest pressure on furbearer populations using American marten is expected to provide similar results for black bear, wolverine, and lynx occupying the study area(s). Selected wildlife VCs include the following: ▪ moose (*Alces alces):* large home range; important subsistence and cultural species; prey species for large carnivores. ▪ woodland caribou (*Rangifer tarandus caribou)*: important subsistence, cultural and economic species; migratory species with extensive range requirements; primary prey species for large carnivores in northern environments; considered "rare to uncommon" in Saskatchewan, and ranked as "threatened" by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and *SARA*. ▪ barren-ground caribou (*Rangifer tarandus groenlandicus)*: important subsistence, cultural and economic species; migratory species with extensive range requirements; primary prey species for large carnivores in northern environments; considered "rare to uncommon" in Saskatchewan. ▪ beaver (*Castor canadensis):* prey species for many carnivores in northern environments; tolerant of human activities but could be affected by habitat loss; could be affected by changes to water levels; commonly harvested furbearer (valued economic species). ▪ American marten (*Martes americana):* most commonly harvested furbearer (valued economic species); mid-trophic predator in boreal ecosystems. ▪ upland breeding birds: have a small territory size and high bird density so large numbers of upland birds could be affected by habitat loss; migratory birds are susceptible to population declines as a result of changing environmental conditions on breeding and overwintering habitats; some species are tracked in Saskatchewan, and listed as "special concern" and "threatened" federally. ▪ waterbirds (ducks, loons, and grebes): can be affected by loss of shoreline habitat for breeding; important staging habitat could be lost; can be sensitive to noise disturbance and human activity; some species are important for subsistence, some species can be protected migratory birds; some species are tracked in Saskatchewan, and are listed as "special concern" federally. ▪ bald eagle (*Haliaeetus leucocephalus*): breeding habitat is limited; can be sensitive to noise disturbance and human activity during nesting; Could be affected by changes to water levels as species is piscivorous; tracked species in Saskatchewan.
Heritage Resources	■ Heritage resources are important for revealing past and present land use, cultural identity, and relationships with other cultures and the social and biophysical environments. ■ Potential alteration or loss of heritage resources could have an effect on Aboriginal people. ■ Several known heritage sites exist near the Project including a historic Dené cemetery.
Land and Resource Use	■ Pursuant to Section 5 of the *CEAA 2012*, the potential to affect the ability of Aboriginal people to maintain traditional land and resource use must be evaluated. ■ Several fish, plant, and wildlife species are considered to be VCs by local Aboriginal people for hunting, trapping, fishing, and gathering for domestic and commercial use. ▪ Fish species include Arctic grayling, cisco species, lake trout, lake whitefish, longnose sucker, northern pike, walleye, and white sucker. ▪ Plant species include blueberries, bog cranberries, moss berries, and strawberries, as well as other edible vegetation, like mushrooms, when available. ▪ Wildlife species include black bear, wolf, coyote, red fox, arctic fox, lynx, wolverine, fisher, American marten, weasel species, mink, beaver, muskrat, river otter, red squirrel, upland birds (e.g., ptarmigan), and waterbirds (e.g., snow geese and Canada geese). ■ Increased access to the Project area is a topic of interest for Aboriginal groups.
Employment and Economy	■ During engagement sessions, local Aboriginal groups and community members expressed interest in economic and employment opportunities that will be generated by the Project. ■ Changes on the local, regional, and provincial economy and the potential effects of these changes on Aboriginal people must be evaluated pursuant to Section 5 of the *CEAA 2012*.
Infrastructure and Community Services	■ Increased traffic volume on local access roads is a topic of interest for Aboriginal groups. ■ Increased employment and economy can cause increased demands on community services and infrastructure, and the potential effect of these changes on Aboriginal people must be evaluated pursuant to Section 5 of the *CEAA 2012*.
Human Population and Health	■ The liveability of the environment during construction and throughout operations is a concern of residents located closest to the Project. ■ Local residents identified aesthetics as an issue that would affect the quality of life of residents near the Project. ■ Increased household incomes could influence patterns of family life.

VC = valued components; Project = Tazi Twé Hydroelectric Project; *SARA* = *Species at Risk Act*; *CEAA* = *Canadian Environmental Assessment Act*; COSEWIC; Committee on the Status of Endangered Wildlife in Canada

The definitions of the aspect or key properties of the VC that requires protection to be sustainable (i.e., assessment endpoint) and the measurable indicators of change (i.e., measurement endpoint), help to focus baseline studies, but are also important for predicting the significance of residual effects and for monitoring and managing these effects (Noble 2010). Assessment endpoints are general statements about what is being protected and represent the key properties of the VC that reflect its ecological status or societal value. Measurement endpoints (biophysical or socio-economic indicators) represent properties of the environment, population, or system that, when changed, could result in, or contribute to, an effect on an assessment endpoint. Measurement endpoints may be quantitative (e.g., concentrations of metals in surface water) or qualitative (e.g., movement and behaviour of wildlife from disturbance). Measurement endpoints also provide the primary factors for discussions concerning the uncertainty of effects on VCs, and subsequently, are the key variables for study in monitoring and follow-up programs. The significance of effects from the Project on VCs is evaluated by linking changes in measurement endpoints to effects on an assessment endpoint.

Valued components, assessment endpoints, and measurement endpoints that will be used in this EIS are presented in Table 7-2.

Table 7-2: Valued Components and Associated Assessment and Measurement Endpoints

Valued Components	Assessment Endpoint	Measurement Endpoint
Atmospheric Environment	■ No assessment endpoint. Results of the assessment are used in the effects analysis for other VCs.	■ particulate matter ($PM_{2.5}$, PM_{10}) and total suspended particulates; ■ carbon monoxide, sulphur dioxide, nitrogen oxides; ■ deposition rates; and ■ noise levels.
Groundwater	■ No assessment endpoint. Results of the assessment are used in the effects analysis for other VCs.	■ changes to groundwater levels and amount available for human use; ■ physical analytes (e.g., pH, conductivity, turbidity); ■ major ions and nutrients; and ■ total and dissolved metals.
Surface Hydrology	■ No assessment endpoint. Results of the assessment are used in the effects analysis for other VCs.	■ flow rate and the spatial and temporal distribution of water; ■ surface topography, drainage boundaries, and waterbodies (e.g., streams, lakes, and drainages); and ■ water level, waterbody volume, flow rates, and watershed area.
Surface Water Quality	■ Protection of surface water quality for aquatic and terrestrial ecosystems, and human use.	■ physical analytes (e.g., pH, conductivity, turbidity, sediment quality); ■ major ions and nutrients; and ■ total and dissolved metals.

Table 7-2: Valued Components and Associated Assessment and Measurement Endpoints (continued)

Valued Components	Assessment Endpoint	Measurement Endpoint
Fish and Fish Habitat	■ Maintenance of self-sustaining fish populations (including listed species).	■ habitat quantity; ■ habitat quality; ■ relative abundance and distribution of fish species; and ■ survival and reproduction.
Soils	■ No assessment endpoint. Results of the assessment are used in the effects analysis for other VCs.	■ terrain and slope stability; ■ soil quality, quantity, and distribution; and ■ permafrost distribution.
Vegetation	■ Maintenance of a self-sustaining plant population and community (including listed species).	■ plant community diversity; ■ plant community health; ■ relative abundance and distribution of plant species; and ■ habitat fragmentation.
Wildlife	■ Maintenance of self-sustaining wildlife populations (including listed species).	■ changes in habitat quality and quantity; ■ habitat fragmentation; ■ movement and behaviour; ■ relative abundance and distribution of wildlife species; and ■ survival and reproduction.
Heritage Resources	■ Protection and preservation of heritage resources.	■ value and quantity of archaeological and sacred sites.
Land and Resource Use	■ Continued opportunity for traditional and non-traditional activities such as hunting, fishing, trapping, and plant and berry gathering.	■ relative abundance and distribution of fish species; ■ relative abundance and distribution of plant species; ■ relative abundance and distribution of wildlife species; and ■ capacity for traditional and recreational land use.
Economy	■ Continued opportunity for employment.	■ employment and income; ■ education, training, and opportunities for youth; ■ capacity of labour pool; and ■ tourism potential.

Table 7-2: Valued Components and Associated Assessment and Measurement Endpoints (continued)

Valued Components	Assessment Endpoint	Measurement Endpoint
Infrastructure and Community Services	■ Continued access to health care, family services, education, and recreation.	■ health care services and facilities; ■ child care services and facilities; ■ education facilities; ■ traffic volume; and ■ quality and development of infrastructure and community services.
Human Population and Health	■ Protection of human health and maintenance of quality of life.	■ population demographics; ■ substance abuse; ■ crime rates; ■ health care; ■ child care; ■ education; ■ family and community cohesion; ■ livability of the environment (e.g., effects on people from Project-related changes to air and water quality, noise levels, and aesthetics of the environment); and ■ long-term social, cultural, and economic sustainability.

VC = valued components; PM_{10} = particulate matter concentrations less than 10 microns; $PM_{2.5}$ = particulate matter concentrations less than 2.5 microns

To facilitate the assessment of Project effects, it is necessary to establish relevant spatial and temporal boundaries within which potential effects are to be evaluated. Spatial and temporal boundaries of the assessment can be VC-specific, which provides ecologically relevant assessment predictions.

Interactions or linkages between Project components or activities, and the corresponding potential changes to measurement endpoints (indicators of change) of the environment are identified through a screening process. This screening step is largely a qualitative assessment, intended to focus the residual effects analysis on interactions that will require a more comprehensive assessment of effects on VCs (i.e., those interactions that may result in significant residual effects after mitigation). Pathways were determined to be primary, secondary, or as having no linkage using scientific and traditional knowledge, and experience with similar developments and environmental design features.

In the EIS, the residual effects analysis considers all primary Project interactions that will likely result in measurable environmental changes and residual effects on VCs (i.e., after implementing environmental design features and mitigation). Cumulative residual effects are also evaluated in the EIS. Cumulative effects are those that are likely from a reviewable project, combined with the effects from prior development, existing activities, and reasonably foreseeable future developments that are sufficiently certain to proceed. Cumulative effects

represent the sum of all natural and human-induced influences on the physical, biological, cultural, and economic components of the environment through time and across space.

The uncertainty section of the EIS identifies the key sources of uncertainty and discusses how uncertainty is addressed to increase the level of confidence that effects will not be worse than predicted. Where possible, a strong attempt is made to reduce uncertainty in the EIS to increase the level of confidence in effect predictions.

The classification of residual effects on the primary interactions provides the foundation for determining environmental significance from the Project and other developments on VC assessment endpoints. Residual effects were classified using criteria such as direction, magnitude, geographic extent, duration, reversibility, frequency, and likelihood. The evaluation of significance considers the entire set of pathways that influence the assessment endpoint.

In the EIS, monitoring programs are proposed to deal with the uncertainties associated with the effects predictions and environmental design features. In general, monitoring is used to test (verify) effect predictions and determine the effectiveness of environmental design features (mitigation). Monitoring is also used to identify unanticipated effects and support adaptive management, as appropriate.

8.0 ENVIRONMENTAL EFFECTS FROM THE PROJECT

A preliminary site screening process was completed to identify anticipated potential effects from the interaction of the proposed Project with the various components of the biophysical and socio-economic environment. Because the Project is a designated project, the environmental effects the Project could have on components of the environment listed in paragraph 5(1) (a) of *CEAA 2012* must be assessed. These components include fish and fish habitat, aquatic species, and migratory birds. However, the Project is located on, and therefore will have an effect on, federal lands administered by AANDC under the *Indian Act*. As a result, all potential effects resulting from a project located on federal land must be assessed subject to paragraph 5(1) (b) of the *CEAA 2012*. Section 5(1)(a) of *CEAA 2012* outlines the categories of direct and indirect environmental effects that are to be considered in an environmental assessment of a designated project, and include:

- fish and fish habitat;
- aquatic species; and
- migratory birds.

Overall, this EIS describes the optimum net benefit of the Project, while taking into account the desired endpoints, practical considerations, uncertainty, and sustainability. As such, the screening of potential effects specifically relates to the pathways through which the implementation of the Project could affect VCs. Potential pathways through which the Project could affect VCs are assessed as being primary, secondary, or having no linkage to effects on the biophysical and socio-economic environments (Table 8-1).

Primary pathways underwent further effects analysis and residual effects classification to determine the environmental significance of the Project on the assessment endpoints of receptors. Interactions with no linkage to a change or changes that are considered minor (secondary) will not be analyzed further or classified in the EIS because environmental design features will remove the interaction (no linkage) or residual effects can be determined to be negligible through a simple qualitative or quantitative evaluation. Interactions determined to have no linkage to VCs or those that are considered secondary are not predicted to result in significant effects on VCs.

Primary pathways and environmental design features and mitigation implemented to reduce residual effects on VCs are summarized in Table 8-2.

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ Infrastructure Footprints ■ Temporary infrastructure – Construction camp – overburden disposal areas – construction area and materials laydown area ■ Operational infrastructure – power generation station – water intake structure – power tunnel – tailrace channel – submerged weir – bridge – transmission line – waste rock disposal areas – water diversion structures around the Project footprint – potable water and wastewater intake and discharge structures – site access roads (including source material)	Construction	■ Loss or alteration of permafrost.						•	•	•					
	Construction	■ Direct loss or alteration of local soil and vegetation from the Project footprint.						■	■						
	Construction	■ Direct loss and fragmentation of wildlife habitat from the Project footprint.								■					
	Construction	■ Site clearing, contouring, and excavation can cause soil erosion.				•	•	•							
	Construction	■ Soil salvage, stockpiling, and transport can change physical, biological, or chemical properties of soils and increase erosion potential.						•							
	Construction	■ Destruction of migratory bird nests.								•					
	Construction	■ Ground disturbance can alter or destroy heritage resources.									•				
	Construction	■ Dewatering of the power tunnel during construction.		•	•	•	•			•					
■ General Construction, Operation, and Closure Activities	Construction, Operations, and Closure	■ Introduction of weed species.							•						

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ General Construction, Operation and Closure Activities (continued)	Construction, Operations, and Closure	■ Sensory effects (e.g., presence of buildings, lights, smells, noise, blasting activity, and vehicles).								■					
	Construction and Operations	■ Project construction and operation will increase local education and training opportunities.											♦		
	Construction and Operations	■ Project construction and operation will result in increased opportunities for employment within the LSA and RSA.											♦		
	Construction and Operations	■ Project construction and operation will result in increased opportunities for local businesses to participate on contracting opportunities.											♦		
	Construction and Operations	■ Project construction and operation will result in income opportunities, including income associated with employment in addition to equity income resulting from BLFN participation as a partner in the Project.											♦		♦
	Operations	■ During the operation phase of the Project BLFN may use revenue generated from their equity share in the Project to improve or develop new infrastructure and community services for their members.												♦	♦

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ General Construction, Operation and Closure Activities (continued)	Construction, Operations, and Closure	■ Changes to commercial fishing resulting from effects fish and fish habitat associated with the loss or alteration of habitat.										●			
	Construction, Operations, and Closure	■ Changes to water consumption arising from changes to water quality resulting from site disturbances, clearing and excavation, and management and discharge of wastewater.										●			
	Construction, Operations, and Closure	■ Changes to commercial trapping resulting from changes to vegetation and wildlife abundance and distribution.										●			
	Construction, Operations, and Closure	■ Changes to traditional and domestic resource use resulting from changes to vegetation, wildlife and wildlife habitat, fish and fish habitat, and surface water quality.										■			
	Construction, Operations, and Closure	■ Changes to outfitting and lodge activities resulting from changes to wildlife and fish habitat.										■			
	Construction and Operations	■ During the construction and operation phases of the Project reserve lands will be unavailable for other uses.										●			

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ Construction of In-water Works ■ power tunnel ■ water intake structure ■ tailrace channel ■ weir structure ■ bridge	Construction	■ Construction of the water intake, submerged weir, tailrace channel, and bridge abutments.				•	•								
	Construction Operations	■ Direct loss or alteration of fish habitat from the Project footprint or activities.					■								
	Construction	■ Fish salvage from exclusion zones may result in incidental mortality of fish.					•								
	Construction and Operations	■ Installation of the submerged weir in the Fond du Lac River may block or delay movements of migratory fish species.					•								
■ Site Infrastructure	Construction, Operations, and Closure	■ Site infrastructure (e.g., tailrace channel) could restrict wildlife movement and increase risk of mortality from predation.								•					
	Construction, Operations, and Closure	■ Physical hazards (e.g., blasting activities, tailrace channel, buildings, and waste rock disposal areas) from the Project can cause injury or mortality to wildlife and affect human activities.								•		•			
■ Site Access	Construction, Operations, and Closure	■ Increased access to the site and areas on the east side of the Fond du Lac River.					•			•					
	Construction and Operations	■ Changes to traffic related to the Project may affect road maintenance requirements and local residents.												•	
	Construction	■ During the construction phase of the Project, there will be additional use of the airport and airport facilities due to the influx of non-local workers.												•	
	Construction and Operations	■ The Project may affect the ability to access country foods during construction and operations, which could affect health and well-being.												•	
	Construction, Operations, and Closure	■ Changes to access and navigation resulting from the creation of access roads, bridges, tailrace, and the water intake on Black Lake.										•			

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ Blasting Activities	Construction	■ Use of explosives near fish-bearing water can cause injury or mortality to fish.					•								
	Construction	■ Use of explosives.		•		■	•	•	•	•					
■ Air Emissions and Noise Levels – emission of dust from blasting activities and hauling waste rock to disposal areas – emission of standard pollutants from vehicles and heavy equipment operation – noise and vibrations from construction and operations activities	Construction, Operations, and Closure	■ Emission and deposition of criteria air contaminants.	■	•		■	•	•	•	•					•
	Construction, Operations, and Closure	■ Dust deposition.	■	•		■	•	•	•	•					•
	Construction, Operations, and Closure	■ Changes in existing ambient sound levels and vibrations can affect human population and health.	■												•
■ Potable and Industrial Water Supply	Construction	■ Water withdrawal for domestic (e.g., potable water) and industrial (e.g., dust suppression) purposes.		•	•	•	•							•	
		■ Impingement or entrainment of fish in water intake pumps used for domestic and industrial purposes can result in injury or mortality, which can affect fish populations.					•								
■ Domestic and Industrial Waste Management	Construction, Operations, and Closure	■ Attraction to the Project (e.g., food waste, oil products) could increase human-wildlife interactions and mortality risk to individual animals.								•					
	Construction, Operations, and Closure	■ Attraction to the Project (e.g., food waste or oil products) could increase predator numbers and predation risk.								•					
	Construction, Operations, and Closure	■ Disposal of domestic and industrial waste in a local landfill site, can affect the capacity of community infrastructure.												•	
	Construction, Operations, and Closure	■ Disposal of sewage and grey water.				•	•							•	

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ Power Generation Activities ■ water withdrawal for power generation ■ diversion of water through the power tunnel to the powerhouse ■ discharge of tailrace channel flows	Operations	■ Water withdrawal from Black Lake for power generation could impinge or entrain fish.					■								
	Operations	■ Withdrawal, diversion, and discharge of water for power generation.			■	•	■	•	•	•					
	Operations	■ Discharge of tailrace channel flows may attract fish to the tailrace channel outlet.					•								
	Operations	■ Withdrawal and discharge of water for power generation could change the temperature.				•	•			•					
	Operations	■ Diversion of water through the power tunnel.		•	•		•	•	•	•					
	Operations	■ Maintenance shutdowns of power generation activities.		•	■		•								
	Operations	■ Changes to water and ice regime on the Fond du Lac River and near the water intake on Black Lake may affect safety during open water and ice travel among local residents and for wildlife.								•					•

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
	Construction and Operations	■ Changes to surface water quality can affect the health of resource users who collect or drink water while pursuing traditional activities on the land.													•
■ Site Water Management ■ collection and treatment of surface runoff within the Project footprint ■ withdrawal of potable and industrial water ■ discharge of wastewater ■ collection and treatment of groundwater in the power tunnel	Construction and Operations	■ The interception and collection of direct precipitation and surface runoff within the Project footprint.			•	•	•								
	Construction and Operations	■ Surface water diversions (e.g., berms, ditches, and waste rock disposal areas) around the Project footprint.			•	•	•								
	Construction Operations	■ Collection and disposal of wastewater from the site.		•	•	■	•	•	•	•					
■ Waste Rock Piles	Construction, Operations, and Closure	■ Seepage from waste rock disposal areas.		•		•	•	•	•	•					
■ Housing of Local and Non-local workers	Construction	■ Local population increase to take advantage of employment opportunities leading to increased demand on housing.												•	
■ Presence of a non-local workforce	Construction	■ The Project may affect local retail and hotel services during construction and operations due to increased demand from the non-local workforce or through Project contracts with local services.												•	

Table 8-1: Potential Interactions between the Project and the Biophysical and Socio-economic Environments (continued)

Project Component/Activity	Expected Project Phase for Project Component/Activity	Potential Effects on Environmental Components	Biophysical Environment								Socio-economic Environment				
			Atmospheric Environment	Hydrogeology	Hydrology	Surface Water Quality	Fish and Fish Habitat*	Soils	Vegetation	Wildlife*	Heritage Resources*	Land and Resource Use*	Economy	Infrastructure and Community Services	Population and Health*
■ Presence of a non-local workforce	Construction Operations Closure	■ The Project may affect local health and emergency services, which may be required to address serious accidents and injuries on the Project site; this may involve the local RCMP.												●	
	Construction	■ The presence of short-term workers at the construction camp increases the potential risk for the spread of communicable diseases.													●
	Construction	■ The presence of short-term workers and their interaction with local residents has the potential to affect local health and well-being.													●
■ Closure Activities	Closure	■ Cessation of power generation activities, including the withdrawal, diversion, and discharge of water.		●	●	●	●			●					
■ Accidents, Malfunctions, and Unplanned Events ■ emergency shutdowns of power generation activities; ■ improper inspection of construction equipment; ■ release or spills of hazardous substances; ■ increased traffic and potential for collisions; ■ physical hazards; ■ failure of embankment dykes around the settling ponds; and ■ fire.	Operations	■ Emergency shutdowns of power generation activities.			■		●		●	●		●			
	Construction, Operations, and Closure	■ Release or spills of hazardous substances (e.g., fuel or oil).		●		●	●	●	●	●		●			●
	Construction, Operations, and Closure	■ Increased traffic and degradation of transportation infrastructure can increase the potential for vehicle to vehicle and vehicle to wildlife collisions.								●		●			■
	Construction and Operations	■ Failure of the embankment dykes around the settling ponds.		●		●	●	●	●	●		●			
	Construction, Operations, and Closure	■ Fire.	●					●	●	●		●		●	●
	Construction, Operations, and Closure	■ Ground disturbance as a result of unplanned events (e.g., spills or containment failure) can affect previously unidentified heritage resources.									●				

LSA = local study area; RSA = regional study area
■ Primary Interaction
● No Linkage or Secondary Interaction
♦ Positive Interaction
Blank cell – no Interaction anticipated
*Represents a biophysical or socio-economic component identified under Section 5 of the CEAA, 2012.
-Valued components (VC) represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important or of concern by the proponent, government agencies, Aboriginal peoples and the public. The value could be determined based on cultural ideals or scientific concern.
-Surface Water Quality, and Fish and Fish Habitat: includes fish and fish habitat, as defined in the *Fisheries A*ct, and aquatic species, as defined in the SARA.
-Wildlife and Wildlife Habitat: includes migratory birds, as defined in the *Migratory Birds Convention Act*, 1994.
-Heritage Resources, Traditional and Non-traditional Land use, Quality of Life, and Economy, Employment, and Training: includes effects that could be caused on the environment that could affect aboriginal health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Air Quality and Noise	■ Air Emissions ▪ Emissions of dust from blasting activities, access road construction, and hauling waste rock to Waste Rock Disposal Areas. ▪ Emission of standard pollutants from vehicles and heavy equipment operation.	Construction, Operations, and Closure	■ Emissions of criteria air contaminants can cause changes to local and regional air quality.	■ Equipment will be regularly maintained for compliance with provincial and federal air emission standards. ■ The equipment used for hauling and mucking operations will operate using diesel fuel with an ultra-low sulphur diesel content (less than 15 parts per million [ppm]). ■ The heavy-duty stationary and mobile diesel-fuelled fleet equipment will meet or exceed EPA Tier 2/3 air quality emissions standards. ■ The gasoline-fuelled fleet equipment will meet or exceed EPA Tier 2 Bin 6 air quality emissions standards. ■ A forced air method of ventilation will be used for venting of dust, gases and fumes from inside the power tunnel following blasting and will be carried out until air quality inside the working environment returns to acceptable levels.
			■ Dust emissions can cause changes to local and regional air quality.	■ It is expected that most construction equipment and materials will be transported to the site between late January and late March by using the Athabasca Seasonal Road; fugitive dust emissions are naturally mitigated by 85-95% during winter. ■ An EnvPP will describe material handling protocols including dust management. ■ Soil salvage stockpiles or exposed soils will be seeded as appropriate for the area. ■ All unpaved roads will be watered on a regular basis to prevent wind driven fugitive dust. ■ A speed limit will be enforced on unpaved roads on site. ■ A forced air method of ventilation will be used for venting of dust, gases and fumes from inside the power tunnel following blasting and will be carried out until air quality inside the working environment returns to acceptable levels.
	General Construction, Operations, and Closure Activities.	Construction, Operations, and Closure	■ Changes in existing ambient sound levels and vibrations.	■ Confirm that all internal combustion engines of construction equipment are well maintained with muffler systems. ■ The powerhouse will be located in a deep cut in the bedrock and insulated, which will reduce noise emissions from the building. ■ A detailed Blasting Plan will be developed for the Project.
Hydrology	Power Generation Activities ■ water withdrawal for power generation ■ diversion of water through the power tunnel to the powerhouse ■ discharge of tailrace channel flows	Operations	■ Withdrawal, diversion, and discharge of water for power generation may change hydrology.	■ A submerged weir will be constructed on the Fond du Lac River at the outlet of Black Lake and will be designed to maintain the range of water levels in Black Lake and in the uppermost section of the Fond du Lac River within the historical range for all powerhouse operating flow conditions. ■ Project site runoff resulting from rainfall, snowmelt, and groundwater releases will be managed by directing runoff around work site infrastructure by using appropriately sized ditches, channels, and culverts.
	Power Generation Activities ■ water withdrawal for power generation ■ diversion of water through the power tunnel to the powerhouse ■ discharge of tailrace channel flows	Operations	■ Maintenance shutdowns of power generation activities can change surface hydrology.	■ Scheduled maintenance shutdowns will occur annually on a unit-by-unit basis and are estimated to last from a few days up to two weeks. ■ Only one unit at a time will be removed from service for maintenance. ■ Maintenance shutdowns will be timed to minimize effects, for example during winter months, during other periods when there is less flow available to pass through the powerhouse, or during summer when sufficient water is available. ■ Each unit could be taken out of service, once per month, to perform minor adjustments, inspections, and maintenance. ■ The power tunnel will be drained for inspection for one to two weeks approximately every five years. ■ Major overhaul work on the turbine and generator units will be completed approximately every 30 years. ■ During planned maintenance shutdowns, downstream flows will be maintained by bypassing water around the powerhouse turbine generator units using a bypass conduit, if required.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Hydrology (continued)	Accidents and Malfunctions ■ emergency shutdowns of power turbines	Operations	■ Emergency shutdowns of power generation activities can change hydrology.	■ During unplanned emergency shutdowns, downstream flows will be maintained by bypassing water around the powerhouse turbine generator units using a bypass conduit.
Surface Water Quality	■ Blasting Activities	Construction	■ Use of explosives near surface waterbodies can change surface water quality.	■ A detailed blasting plan will be developed for the Project and set-back distances during blasting of the intake foundation, powerhouse foundation, and tailrace channel will be included as part of this plan. ■ Best practices, as outlined in the Blasting Plan for the Project, will be applied to blasting activities to minimize any potential for enhanced nitrogen loading of groundwater inflows due to the placement and use of ANFO during construction. ■ DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998) will be used for this Project. ■ A Site Water Management Plan will be developed for the Project. ■ Construction and monitoring of settling ponds or water treatment areas to receive runoff from the waste rock disposal areas will be part of Site Water Management Plan.
	■ Air Emissions ▪ emissions of dust from blasting activities and hauling Waste Rock Disposal Areas ▪ emission of standard pollutants from vehicles and heavy equipment operation	Construction, Operations, and Closure	■ Deposition of criteria air contaminants (e.g., NO_x and SO_x) can change surface water quality.	■ Equipment will be regularly maintained for compliance with provincial and federal air emission standards. ■ The equipment used for hauling and mucking operations will operate using diesel fuel with an ultra-low sulfur diesel content less than 15 ppm. ■ The heavy-duty stationary and mobile diesel-fueled equipment fleet will meet or exceed EPA Tier 2/3 air quality emissions standards. ■ The gasoline-fueled equipment fleet will meet or exceed EPA Tier 2 Bin 6 air quality emissions standards. ■ An EnvPP will describe material handling protocols including dust management. ■ Soil salvage stockpiles or exposed soils will be seeded. ■ All unpaved roads will be watered on a regular basis to prevent wind driven fugitive dust. ■ A speed limit will be enforced on unpaved roads on site. ■ A forced air method of ventilation will be used for venting of dust, gases and fumes from inside the power tunnel following blasting. ■ A Water Quality Monitoring Program will be implemented.
		Construction, Operations, and Closure	■ Dust deposition can change surface water and sediment quality.	
	■ Air Emissions ▪ emissions of dust from blasting activities and hauling Waste Rock Disposal Areas ▪ emission of standard pollutants from vehicles and heavy equipment operation	Construction and Operations	■ Collection and disposal of wastewater from the site can cause changes to surface water and sediment quality.	■ A Site Water Management Plan will be developed for the Project. ■ Implementation of Water Quality Monitoring Program. ■ Construction and monitoring of settling ponds or water treatment areas will be part of Site Water Management Plan. ■ Groundwater originating from construction of the power tunnel will be collected, treated (if required) and monitored to confirm discharge criteria are met prior to release into the receiving environment. ■ Runoff from the waste rock disposal areas will be directed to settling ponds prior to discharge to the Fond du Lac River. ■ Wastewaters released from the settling ponds will meet applicable water quality guidelines (CCME) at the end of the mixing zone. ■ Contingency plans for off-site disposal of dewatered settling pond sludge will be included in a Construction Environmental Management Plan. ■ Indoor toilet facilities will be available at the construction camp and sewage will be collected in a holding tank. ■ Sewage and grey water will be hauled off-site and disposed of at the Black Lake Lagoon.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Surface Water Quality (continued)	■ Waste Rock Disposal Areas	Construction, Operations, and Closure	■ Seepage from waste rock disposal areas can change surface water and sediment quality.	■ A Waste Rock Management Plan will be developed for the Project. ■ Excavated material will be stored away from watercourses or lakes. ■ Excavated rock and aggregate materials will be tested to confirm that this material will not have negative effects on the surrounding environment. Specific mitigation measures will be applied if the material is identified to be acid generating, or containing elevated levels of metals or radionuclides. ■ Construction and monitoring of settling ponds or water treatment areas will be included in the Site Water Management Plan. ■ Additional site investigation and laboratory testing will be completed upon completion of the final Project design and during construction of the Project.
Fish and Fish Habitat	■ Construction of in-water works ▪ water intake structure ▪ tailrace channel outlet ▪ submerged weir structure ▪ bridge	Construction	■ Direct loss or alteration of fish habitat from the Project footprint or activities can affect fish.	■ Permanent alteration or destruction of fish habitat will be offset by restoration of shoreline and fish habitat; details will be included in a Fisheries Offsetting Plan. ■ Compact layout of the surface facilities within local watersheds will limit the area that is disturbed by construction and operation. ■ Best management practices for erosion and sedimentation (e.g., ground cover, silt fences, and curtains) will be implemented, where needed. ■ A submerged weir at the outlet of Black Lake will be used to maintain water levels in the lake and subsequently reduce effects of fluctuating water levels on fish habitat in Black Lake. ■ The water intake will be located to avoid sensitive fish habitat in Black Lake.
	■ Power Generation Activities ▪ water withdrawal for power generation ▪ diversion of water through the power tunnel to the powerhouse ▪ discharge of tailrace channel flows	Operations	■ Water withdrawal from Black Lake for power generation could impinge or entrain fish, resulting in fish injury or mortality, which can affect fish populations.	■ An “exclusion bar rack” will be used to prevent entry of debris into the power tunnel and to provide a visual deterrent for fish entrainment at the water intake. ■ Design and operation of a shallow water intake will reduce entrainment of deep-water fishes. ■ The water intake location was selected to avoid sensitive fish habitat. ■ The soffit (ceiling) of the water intake passage will be set low enough to prevent entrainment of air into the power tunnel and subsequently reduce the potential for gas bubble trauma in entrained fish. ■ A submerged weir will be constructed on the Fond du Lac River at the outlet of Black Lake and will be designed to maintain the range of water levels in Black Lake and in the uppermost section of the Fond du Lac River within the historical range, for all powerhouse operating flow conditions. ■ The tailrace channel outlet will be located upstream of important fish spawning habitat near the Fond du Lac River inflow to Middle Lake to maintain minimum required flows at this location. ■ For planned or unplanned shutdowns longer than 15 minutes duration during the spring spawning and rearing period (May 15 to July 15) and low winter flow period, downstream flows will be maintained by bypassing water around the powerhouse turbine generator units using a bypass conduit. ■ A spring spawning trigger flow of 70 m^3/s from May 1 to June 30 will be implemented to support successful spawning of Arctic grayling and other spring spawners in the Fond du Lac River. ■ Project site runoff resulting from rainfall, snowmelt, and groundwater releases will be managed by directing runoff around work site infrastructure by using appropriately sized ditches, channels, and culverts.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Soils	Infrastructure Footprints ■ Temporary infrastructure ▪ construction camp ▪ overburden disposal areas ▪ construction area and materials laydown area ■ Operational infrastructure ▪ power generation station ▪ water intake structure ▪ power tunnel ▪ tailrace channel ▪ submerged weir ▪ bridge ▪ transmission line ▪ waste rock disposal areas ▪ water diversion structures around the Project footprint ▪ potable water and wastewater intake and discharge structures ▪ site access roads (including source material)	Construction, Operations, and Closure	■ Direct loss or alteration of local soil from the Project footprint.	■ The access road will be as narrow as possible, while maintaining safe construction and operation practices. ■ Organic topsoil horizons will not be stripped in areas containing ice-rich permafrost to reduce potential for an increase in thaw depth and related thaw subsidence. ■ Soil disturbance will be limited to only those areas required for construction and operation of the Project. ■ Siting and construction of the Project will be planned to avoid environmentally sensitive areas (e.g., critical wildlife habitat, rare plants and wildlife species, and wetlands) as much as possible. ■ Location of the settling ponds will be based on topography (i.e., a low area) that is not in a sensitive feature such as a wetland or floodplain. ■ A qualified environmental monitor will be employed during clearing operations and will inspect the surrounding area for any damage following clearing. ■ Topsoil will be salvaged (i.e., seed bank) and replaced on areas to be reclaimed to enhance regeneration of vegetation. ■ An Erosion and Sediment Control Plan will be implemented prior to grubbing activities and grubbing will not be completed during wet weather periods. ■ A Reclamation Plan will be developed for the Project to be reviewed and approved by agencies. ■ Progressive reclamation is expected to occur during construction and operations. ■ Depressions created by grubbing will be filled with suitable material to the level of the surrounding ground.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Vegetation	Infrastructure Footprints ■ Temporary infrastructure ▪ construction camp ▪ overburden disposal areas ▪ construction area and materials laydown area ■ Operational infrastructure ▪ power generation station ▪ water intake structure ▪ power tunnel ▪ tailrace channel ▪ submerged weir ▪ bridge ▪ transmission line ▪ waste rock disposal areas ▪ water diversion structures around the Project footprint ▪ potable water and wastewater intake and discharge structures ▪ site access roads (including source material)	Construction, Operations, and Closure	Direct loss or alteration and fragmentation of vegetation from the Project footprint.	■ Clearing of vegetation will be limited to the extent possible and will only be removed in areas that could pose a hazard or interfere with construction activities. ■ Siting and construction of the Project will be planned to avoid environmentally sensitive areas (e.g., critical wildlife habitat, listed plants species, and wetlands) as much as possible. ■ Location of the settling ponds will be based on topography (i.e., a low area) that is not in a sensitive feature such as a wetland or floodplain. ■ If avoidance of sensitive areas is not feasible, consultation with MOE will be completed to determine the significance of the area and identify feasible mitigation strategies. ■ The Project will avoid listed plants as much as possible, however, if avoidance of listed plants is not feasible, consultation with MOE will be completed to determine the significance of the area and identify feasible mitigation strategies. ■ If a listed plant species is encountered that was not expected, appropriate mitigation will be applied prior to further construction activities. ■ Upper soil horizons will be salvaged (i.e., seed bank) and replaced on areas to be reclaimed to enhance regeneration of vegetation. ■ Matting (e.g., timber or rig mats) will be placed in sensitive areas to avoid rutting. ■ Grubbing activities will not be completed during wet weather periods. ■ A Reclamation Plan will be developed for the Project to be reviewed and approved by agencies. ■ Progressive reclamation is expected to occur following construction and during operations ■ Access roads will be removed and recontoured and engagement with local communities will be completed to determine the timing for the removal of access roads. ■ If merchantable timber is cleared, it will be made available to the local community for use.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Wildlife	Infrastructure Footprints ■ Temporary infrastructure ▪ construction camp ▪ overburden disposal areas ▪ construction area and materials laydown area ■ Operational infrastructure ▪ power generation station ▪ water intake structure ▪ power tunnel ▪ tailrace channel ▪ submerged weir ▪ bridge ▪ transmission line ▪ waste rock disposal areas ▪ water diversion structures around the Project footprint ▪ potable water and wastewater intake and discharge structures ▪ site access roads (including source material)	Construction, Operations, and Closure	Direct loss and fragmentation of habitat from the Project footprint can affect wildlife abundance.	■ Clearing of vegetation will be limited to the minimum extent possible and will only be removed in areas that could pose a hazard or interfere with construction activities. ■ Vegetation clearing will not be completed during the period of migratory breeding bird and nesting activity (approximately May 1 through July 31). If clearing is to occur during this time, a qualified environmental monitor will be on-site to identify any bird nests that could be present prior to vegetation clearing. ■ Siting and construction of the Project will be planned to avoid environmentally sensitive areas (e.g., critical wildlife habitat, listed wildlife species, and wetlands) as much as possible. ■ Location of the settling ponds will be based on topography (i.e., a low area) that is not in a sensitive feature such as a wetland or floodplain. ■ If avoidance of sensitive areas is not feasible, consultation with MOE will be completed to determine the significance of the area and identify feasible mitigation strategies. ■ If a listed wildlife species is encountered that was not expected, appropriate mitigation will be applied prior to further construction activities. ■ Upper soil horizons will be salvaged (i.e., seed bank) and replaced it on areas to be reclaimed to enhance regeneration of vegetation. ■ Matting (e.g., timber or rig mats) will be placed in sensitive areas to avoid rutting. ■ Grubbing activities will not be completed during wet weather periods. ■ A Reclamation Plan will be developed for the Project to be reviewed and approved by agencies. ■ Progressive reclamation is expected to occur following construction and during operations ■ Access roads will be removed and terrain contoured, to blend with the surrounding terrain. Engagement with local communities will be completed to determine the timing for the removal of access roads
		Construction, Operations, and Closure	Sensory effects (e.g., presence of buildings, lights, smells, noise, blasting activity, and vehicles) can affect wildlife.	■ If construction occurs during sensitive nesting, breeding, and rearing periods for wildlife species, then an appropriate pre-construction survey should be completed and provincial activity setback guidelines will be applied. ■ The powerhouse will be located in a deep cut in the bedrock and insulated, which will reduce noise emissions from the building. ■ Lighting will be covered and will face downwards to illuminate the ground, not the sky. ■ Low-glare fixtures or lighting with motion sensors will be used, where possible. ■ Lighting will be high cut-off fixtures that will limit light emissions beyond work areas. ■ A detailed Blasting Plan will be developed for the Project.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Land and Resource Use	General Construction, Operations, and Closure	Construction, Operation, and Closure	Changes to traditional and domestic resource use resulting from changes to vegetation, wildlife and wildlife habitat, fish and fish habitat, water quality, and access and navigation.	■ Placement of Project access roads and infrastructure considered inputs from public involvement activities and avoids areas of importance to the communities, including the location of cultural camps while improving long-term access to the sites. ■ Pressures to wildlife and fish associated with the presence of a non-local workforce will be minimized through several resource management strategies, including the prohibition of firearms, hunting, trapping, harvesting, and fishing for all employees. All-terrain vehicle use will be prohibited at the construction site. ■ An access management plan will be developed by the Proponent to address overall access to the SSA during construction and operation of the Project, with consideration given to both land based and water/ice based travel. ■ The Proponent is committed to timely and effective communication with local resource users about construction and operation activities, including providing information about any restrictions that may be put in place to limit risks to public safety. ■ Compensation for demonstrated losses will be considered on a case-by-case basis. ■ See mitigation policies and procedures to reduce sensory disturbances including noise and vibrations in Section 8 of this EIS. ■ See mitigation policies and procedures to reduce effects on fish habitat and fish in Section 12 of this EIS. ■ See mitigation policies and procedures to reduce effects on vegetation and habitat in Section 14 of this EIS. ■ See mitigation policies and procedures to reduce effects on wildlife in Section 15 of this EIS.
			Changes to outfitting and lodge activities resulting from changes to fish and fish habitat, and access and navigation.	■ An Access Management Plan will be developed by the Proponent to address overall access to the Project area during construction and operation of the Project, with consideration given to land based as well as water and ice based travel. ■ The Proponent is committed to working with the owner of Camp Grayling to discuss any potential Project impacts and the mitigation or compensation that may be appropriate in the circumstances. ■ See mitigation policies and plans to reduce sensory disturbances including noise and vibrations in Section 8 of this EIS. ■ See mitigation policies and plans to reduce effects on fish habitat and fish in Section 12 of this EIS.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase When the Component or Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Economy	■ General Construction, Operations, and Closure	Construction	Project construction and operation will increase local education and training opportunities.	■ A pre-employment training program will be deployed that is designed to prepare individuals for employment during construction through a combination of academic upgrading, industry safety training, and job readiness skills. ■ During the construction phase, contractors will provide on the job training including small tool training, PPE training, fall protection, rigging and crane signaling, lockout tagout training, confined space training, and cultural awareness orientation. ■ Contractors will be required to support apprenticeship-training programs and implement a craft-mentoring program that pairs trainees and apprentices with experienced craftsmen and foremen.
		Operation		■ Train individuals from Black Lake to maintain and operate the plant once it is commissioned. Individuals demonstrating aptitude will be recruited during the construction phase, and will be sent to other hydroelectric facilities in Saskatchewan for on-the-job training.

		Construction	Project construction and operation will result in increased opportunities for employment within the LSA and RSA.	■ Requirements of the General Contractor to optimize the participation of workers from the BLFN.
				■ Preferential hiring priority will be as follows:
				  ▪ First preferences to BLFN members;
				  ▪ Second preference to residents of the rest of the Athabasca region; and
				  ▪ Third preference to residents of the rest of Saskatchewan.
				■ The Proponent will work with the general contractor on recruitment and retention strategies. This will include on-the-job training targeted at residents of the LSA and RSA.
				■ The general contractor will hire an employment counselor for the course of construction, ideally of Aboriginal ancestry, whose role would be to recruit of local employees and to provide on-site counseling services.

		Operation		■ Employ people from the local community to maintain and operate the Project once it is commissioned.
		Construction and Operation	Project construction and operation will result in increased opportunities for local businesses to participate on contracting opportunities	■ Requirements of the General Contractor to optimize the participation of businesses/contractors owned or partially owned by BLFN. ■ Commitment to establish a fair and transparent subcontracting strategy that gives meaningful opportunities to Athabasca region contractors, subject to being commercially reasonable, SaskPower's legally required procurement policies and to each business's capacity and ability to deliver with respect to quality, timeliness, and cost competitiveness.
	■ BLFN Project Income	Construction and Operation	Project construction and operation will result in income opportunities, including income associated with employment in addition to equity income resulting from BLFN's participation as a partner in the Project.	■ BLFN is consulting members to determine appropriate use of the new income for the community.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase when the Component/Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Infrastructure and Community Services	■ BLFN Project Income	Operations	During the operation phase of the Project BLFN may use revenue generated from their equity share in the Project to improve or develop new infrastructure and community services for their members.	■ BLFN leadership consultation with members to determine the most appropriate use of the new income for the community.
Human Population and Health	■ Presence of a construction workforce	Construction	The presence of short-term workers at the construction camp increases the potential risk for the spread of communicable diseases.	■ During the construction phase, non-local workers will be flown into and out of Stony Rapids, with shuttle service provided from the airport to the construction camp and Project site. ■ Non-local workers will return to their home communities for their days off rather than remaining on-site or in the communities of Black Lake or Stony Rapids. ■ The non-local construction workers will be provided with accommodation at the construction camp during their work rotation, while local construction workers will be given the option to reside at home or at the construction camp. ■ The construction camp will be designated as a dry construction camp (i.e., no alcohol or illegal drugs will be permitted on-site) following regulations currently enforced on BLFN reserve land. ■ For overall safety, and in order to dissuade the potential for drugs to infiltrate the construction camp, the proponent will have a drug-testing program in place to screen workers prior to being employed as well as test workers if there is reason to believe they are under the influence of a banned substance. In addition, drug testing may occur if a safety incident has occurred. ■ The construction camp will provide recreational facilities for workers, including a canteen and cable and internet services. ■ The construction camp will be fenced and access will be controlled by a security gate staffed 24 hours a day. ■ Casual visitors to the construction camp will not be permitted. ■ Access to camp vehicles will be strictly limited. ■ Sanitary practices will be implemented in the camp to prevent the spread of communicable disease, including the installation of hand wash stations and workplace sanitary practices signage. ■ In the community of Black Lake, awareness programs will be developed to identify the risks associated with the presence of a construction camp and non-local workers, focusing on sensitive populations such as women and children. ■ The Partnership will coordinate with local service providers, such as the RCMP, health, and social services, to understand the potential strains that an influx of non-local workers could place on the communities. This will include the identification of appropriate local supports and counselling should an incident occur. ■ Mechanisms for monitoring potential impacts, including monitoring for an increase in the prevalence of communicable diseases, will also be developed, so that if negative situations arise, the effects can be quickly identified, tracked and adaptive management can be used to address the situation.

Table 8-2: Primary Pathways and Proposed Environmental Design Features and Mitigation (continued)

Valued Component	Project Component or Activity	Project Phase when the Component/Activity Occurs	Potential Interactions on Environment Components	Environmental Design Features and Mitigation
Human Population and Health	■ Accidents, Malfunctions, and Unplanned Events	Construction Operation Closure	Increased traffic and degradation of transportation infrastructure can increase the potential for vehicle-to-vehicle collisions, which can cause injury or mortality to people.	■ Speed limits and reduced speed limits for trucks will be clearly posted and enforced to mitigate against potential accidents during construction. ■ Unpaved roads will be regularly graded and maintained to avoid wash boarding and rutting. Additional road maintenance could include dust control measures and stream crossing improvements. ■ Vegetation along the roadside will be mowed and cut to increase visibility of wildlife passing through or using the roadsides and ditches. ■ Safety policies will be developed by SaskPower and the general contractor will address safe driving practices for all construction personnel on public roads. SaskPower and the contractor will monitor all reported incidents of speed violations and provide appropriate disciplinary measures, where necessary. ■ Shuttle vehicles will be used by the contractor to transport workers between the construction site and the Stony Rapids airport to reduce the use of personal vehicles. ■ All workers and operations employees who will be driving as part of Project activities will be required to adhere to all driving rules and regulations, with particular attention to Saskatchewan distracted driver legislation. ■ Employees will be directed to respond appropriately to changing road and weather conditions and to identify and avoid potential driving hazards. ■ The contractor and Proponent will coordinate with local RCMP, health, and emergency services providers regarding traffic increases and possible issues affecting public health and safety.

LSA = local study area; RSA = regional study area; BLFN = Black Lake First Nation; MOE = Ministry of Environment; CCME = Canadian Council of Minister of the Environment; Project = Tazi Twé Hydroelectric Project; DFO = Fisheries and Oceans Canada; EnvPP = Environmental Protection Plan; RCMP = Royal Canadian Mounted Police; ANFO = ammonium nitrate/fuel oil; EIS = Environment Impact Statement; PPE = personal protective equipment; % = percent; ppm = parts per million; m^3/s = cubic metres per second

8.1 Summary of *Canadian Environmental Assessment Act* Section 5 Requirements

Section 5 of the *CEAA 2012* outlines the environmental effects that should be considered for a designated project. The following provides a summary of the changes to components of the environment that are listed under Section 5.

8.1.1 Fish and Fish Habitat and Aquatic Species

The fish and fish habitat assessment was completed to identify and evaluate potential effects from the Project on fish and fish habitat and to provide recommendations on best practices and mitigation. The assessment endpoint for fish and fish habitat is focused on the maintenance of fish populations that have been identified as important to BLFN or the outfitter at Camp Grayling; fish species that have been identified as potentially sensitive are included.

Water withdrawal from Black Lake for power generation is expected to cause some injury and mortality to fish because of impingement or entrainment at the water intake. Fish injuries and mortalities that are expected to occur because of impingement or entrainment of fish in the water intake during Project operations are predicted to have residual effects that are measureable, but within the anticipated resilience limits of the fish population.

Some fish currently drift downstream out of Black Lake into the Fond du Lac River through the Black Lake outflow. During Project operation, fish are expected to drift downstream through the natural river outflow and the water intake. However, the total number of fish leaving the Black Lake fish community is not expected to change from the current level of out-migration because overall Black Lake outflow rates and volumes will not change with the development of the Project. Out-migration of fish from Black Lake once the Project is operating is expected to be similar to current levels and therefore within the resilience limits of Black Lake fish populations. Selection of a shallow-water (i.e., 5 m deep) water intake design is thought to be protective of deep-water species, such as lake trout, lake whitefish, and cisco, during specific periods of the annual cycle. Black Lake cisco have some features characteristic of lake cisco and shortjaw cisco (Coregonus artedi); shortjaw cisco (Coregonus zenithicus) are listed as a potentially threatened species under Schedule 2 of *SARA*, and are identified as a threatened species by the COSEWIC.

Although the number of fish moving downstream out of Black Lake is not expected to change because of Project development, a higher rate of injury and mortality is expected for fish that are impinged at or entrained by the water intake structure versus fish that pass downstream through the natural Black Lake outflow. Fish that drift into the Fond du Lac River through the natural Black Lake outflow could become integrated into downstream populations of the same species, assuming they are not harmed or killed during passage down the turbulent river, and could therefore have the opportunity to spawn and pass on their genetic material. Fish that are entrained with water flows into the power tunnel could be more likely to be killed or injured; injured fish could become easier prey for birds and piscivorous fish downstream of the tailrace channel outlet. Therefore, fish that pass through the power tunnel and powerhouse turbines could be less likely to survive and reproduce. The frequency of residual effects for injury and mortality of impinged or entrained Black Lake fish is expected to be continuous and permanent; however, the potential for future effects will cease immediately following the cessation of power generation.

Loss and alteration of fish habitat is expected due to the Project footprint. Although appropriate and applicable mitigation practices will be used and sensitive habitats will be avoided to the greatest extent possible,

construction, and operation of the Project is expected to result in some harmful alteration, disruption, or destruction (HADD) of fish habitat. However, with successful design and implementation of the Fish Habitat Offsetting Plan, it is not expected that there will be a net loss of fish habitat resulting from the Project footprint or construction of Project components. Following closure, Project infrastructure will be decommissioned and reclaimed. Design and implementation of the Fish Habitat Offsetting Plan early in the Project development will compensate for habitat losses, therefore, the effects are considered reversible in the short-term.

The loss and alteration of fish habitat that is expected because of changes to hydrology in the Fond du Lac River between Black Lake and Middle Lake during Project operations is predicted to have both positive and negative residual effects. The quantity of suitable overwintering habitat available to Arctic grayling in the bypassed section of the Fond du Lac River during Project operation is expected to be greater than that available under historically normal flow conditions (i.e., without the Project in place). Under average to below-average spring flow conditions, Project operation is expected to result in a net decrease in the quantity of suitable spawning habitat available to Arctic grayling. Foraging habitat is expected to improve under reduced riparian flows proposed for the Project. It is anticipated that hydrological changes in the Fond du Lac River will alter the relative abundance of prey items available to Arctic grayling and other fish species. Overall, positive and negative residual effects from the Project are predicted to be measureable, but within the anticipated resilience limit of the fish populations in the Fond du Lac River. The frequency of residual effects for loss and alteration of fish habitat in the Fond du Lac River because of Project operation and changes to hydrology is expected to be continuous. Effects will cease within a few years following the cessation of power generation and therefore are considered reversible over the long-term.

The residual effects from the Project are not predicted to be large enough to alter the state of fish health, abundance, distribution, or habitat, and therefore influence the maintenance of self-sustaining fish populations. The scale of residual effects from the Project interactions, independently or combined, should not be large enough to cause irreversible changes at the population level and decrease the resilience of fish communities within the local or regional study areas. Overall, the residual effects from the Project as a whole on maintenance of self-sustaining fish populations are not significant.

8.1.2 Migratory Birds

Upland breeding birds, waterbirds, and the bald eagle have been identified as valued components species to represent the broader category of migratory birds.

8.1.2.1 Habitat Loss and Fragmentation

Development of the Project is expected to change the abundance, distribution, and spatial arrangement of habitat in the regional study area (RSA). Habitat loss includes the direct removal or alteration of habitat due to the Project and other developments. Changes to habitat were assessed to the maximum predicted point of development of the Project footprint (disturbance assessment area), which should have the largest geographic extent of residual effects on wildlife. Thus, the analysis overestimates the changes to habitat loss and fragmentation from the Project and the predicted effects on the abundance and distribution of migratory birds.

Decreases in habitat area can directly influence migratory bird populations by reducing the carrying capacity of the environment. A species with very specific habitat requirements and low dispersal ability (or ability to move) is more likely to be negatively affected by habitat fragmentation than a generalist or highly mobile species.

Upland breeding bird populations are anticipated to adapt to the changes in habitat loss and fragmentation from the Project. Most upland breeding bird species have high reproductive capability (BNA 2013) and have long effective dispersal distances (i.e., are highly mobile). Fragmentation effects have less influence than habitat loss when there is a large proportion of natural habitat on the landscape (Fahrig 1997, 2003; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010), which is the predicted state and condition of habitat in the RSA with the Project. Changes to the loss and fragmentation of habitat from the Project are anticipated to have a negligible influence on the abundance, distribution, and connectivity of upland breeding bird populations.

The RSA is located in the Western Boreal Forest of North America, which is considered an important breeding area for waterfowl (Slattery 2013). However, there was a low abundance of waterbirds recorded during baseline surveys and no important breeding or staging areas are present in the RSA (Poston et al. 1990; SKCDC 2013). The small and local changes in habitat loss and fragmentation from the Project are expected to be within the resilience limits of waterbirds and result in a negligible influence on the abundance, distribution, and connectivity of populations.

Bald eagles generally nest in forested areas adjacent to large, fish-bearing bodies of water (Blood and Anweiler 1994; Buehler 2000). Fourteen bald eagle individuals and two bald eagle nests were observed during baseline surveys. Bald eagles are anticipated to adapt to the minor and local changes in habitat loss and fragmentation from the Project. Bald eagles have high reproductive capability (Buehler 2000) and it is likely that food supply, not habitat quantity, is the limiting factor for bald eagles currently breeding in the RSA. Changes to habitat loss and fragmentation from the Project in the RSA are anticipated to have a negligible influence on the abundance, distribution, and connectivity of the bald eagle population.

8.1.2.2 Habitat Quality

Project development could generate sensory disturbances including increased noise levels and visual disturbances from moving vehicles and humans during construction and operations. Factors that seem to influence the magnitude of effects include the type of disturbance, the frequency and intensity of the disturbance, and the level of habituation to disturbance (Fortin and Andruskiw 2003; Bayne et al. 2008; Fahrig and Rytwinksi 2009). Few studies have focused on the effects of noise and disturbance to upland bird behaviour and movement. Behaviours most likely to be affected are nest site selection, territory selection, mate attraction, and foraging. Noise could inhibit predator detection and interfere with mate/chick communication (Habib et al. 2007). Similar to habitat loss and fragmentation, changes to habitat quality were assessed for the maximum predicted point of development of the Project footprint (disturbance assessment area), which should have the largest geographic extent of residual effects on migratory birds.

Indirect effects on upland breeding bird communities from sensory disturbance associated with the Project were assessed by calculating changes in density using data from baseline studies. A 1 km zone of influence was used in the upland breeding bird habitat quality analysis as scientific literature suggests that most sensory disturbance to upland breeding birds are limited to within 1 km of infrastructure.

Decrease in upland breeding bird habitat quality from the Project is predicted to be within or slightly exceed baseline values for most habitats. However, changes in habitat quality from the Project are expected to be within the resilience limits of affected bird populations. Although the analysis has assumed that indirect habitat effects result in a decrease in bird abundance, changes in habitat quality from sensory disturbance, do not necessarily result in demographic consequences to populations (Gill et al. 2001). Most of the effects from

indirect changes in habitat quality could be related to a local shift in distribution with little influence on survival and reproduction rates. Most upland breeding bird species have high reproductive capability (BNA 2013). Changes to habitat quality from sensory disturbance effects associated with the Project are anticipated to have a negligible to minor influence on the abundance and distribution of upland breeding bird populations.

Few studies have focused on the effects of noise and disturbance to waterbird behaviour and movement. However, some studies (Korschgren et al. 1985; Ward and Stein 1989; Dahlgren and Korschgren 1992) have found that noise and motion disturbances originating from man-made sources can negatively affect waterbird behaviour. Disturbance effects on waterbirds could include displacement, nest abandonment, reduced nest success, or reduced foraging efficiency (Hockin et al. 1992; Dahlgren and Korschgren 1992).

Decreases in waterbird habitat quality from the Project are predicted to be within or slightly exceed baseline values; however, waterbird species are anticipated to adapt to changes in habitat quality from the Project. Most waterbird species have high reproductive capability (BNA 2013). Construction activities could result in local changes to the movement and behaviour of individuals, but effects from sensory disturbance should disappear at the end of construction. There were low numbers of waterbirds recorded in the local study area (LSA), which is likely due to natural limited availability of quality breeding habitat near the Project. Changes to habitat quality from sensory disturbance effects associated with the Project are anticipated to have a negligible influence on the abundance and distribution of waterbird populations in the RSA.

Studies on responses of bald eagles to human disturbance are limited, so effects on bald eagle from Project-related sensory disturbance were qualitatively assessed using scientific literature on bald eagles and other raptor species. Decreases in bald eagle habitat quality from the Project are predicted to be within or slightly exceed baseline values. Construction activities could result in local changes to the movement and behaviour of individuals, but effects from sensory disturbance should disappear early in operations. Bald eagles have high reproductive capability (Buehler 2000) and populations for most raptor species are considered ‘very common’ in Saskatchewan (SKCDC 2012). As discussed above, bald eagles likely are able to habituate to human disturbance. In addition, the abundance of bald eagles observed near the Project during baseline surveys was low, which likely is due to natural limited availability of quality breeding habitat near the Project. Changes to habitat quality from the Project are anticipated to have a negligible effect on the abundance and distribution of the bald eagle population.

Residual effects from habitat loss, alteration, and fragmentation on migratory birds could be reversible or irreversible. The reversibility of residual effects is expected to vary among species and could depend on factors such as habitat and food preferences. For example, some ground-nesting species of upland breeding birds could use the reclaimed areas soon after vegetation is established (effect is reversible in the medium-term). The establishment of mature forest could occur within the temporal bounds of the assessment (effect is reversible in the long-term) or could occur outside of the temporal boundary of the assessment (effect could be permanent). Natural succession processes in the RSA are slow and plant community trajectories can be altered by a number of factors (e.g., climate change, fire, and unforeseeable human development). The effect from direct habitat loss and fragmentation on wildlife is continuous over the life of the Project; however, the main sources of residual effects are related to the construction of the Project.

In summary, the incremental and cumulative effects from the Project and previous and existing developments are not predicted to be large enough to alter the state of migratory bird populations and adversely influence self-sustaining populations. The scale of residual effects from the Project interactions, independently or combined,

should not be large enough to cause irreversible changes at the population level and decrease the resilience of migratory bird populations. Overall, the cumulative effects from the Project and previous and existing on migratory bird populations are predicted to be not significant.

8.1.3 Changes to Components of the Environment That Would Occur on Federal or Trans-boundary Lands

Under Section 5(1)(b) of *CEAA 2012*, a designated project is required to describe the potential changes that can occur to the environment that would occur on federal lands, in another province, or outside of Canada. This section summarizes the potential changes to the environment from the Project that may occur on federal lands or on trans-boundary lands.

The Project itself is located on the Chicken Indian Reserve (No.224); this land is set aside for the exclusive use and benefit of the members of the BLFN, and is designated as federal land. In 2009, an Order in Council (P.C.2009-305) was approved by the Governor General in Council, pursuant to paragraph 39(1)(c), and Section 40 of the *Indian Act* (Government of Canada, 1985), designating portions of the Chicken Indian Reserve No. 224, 225, and 226 for exploration and development of minerals, development of a hydroelectric facility, and commercial leasing purposes.

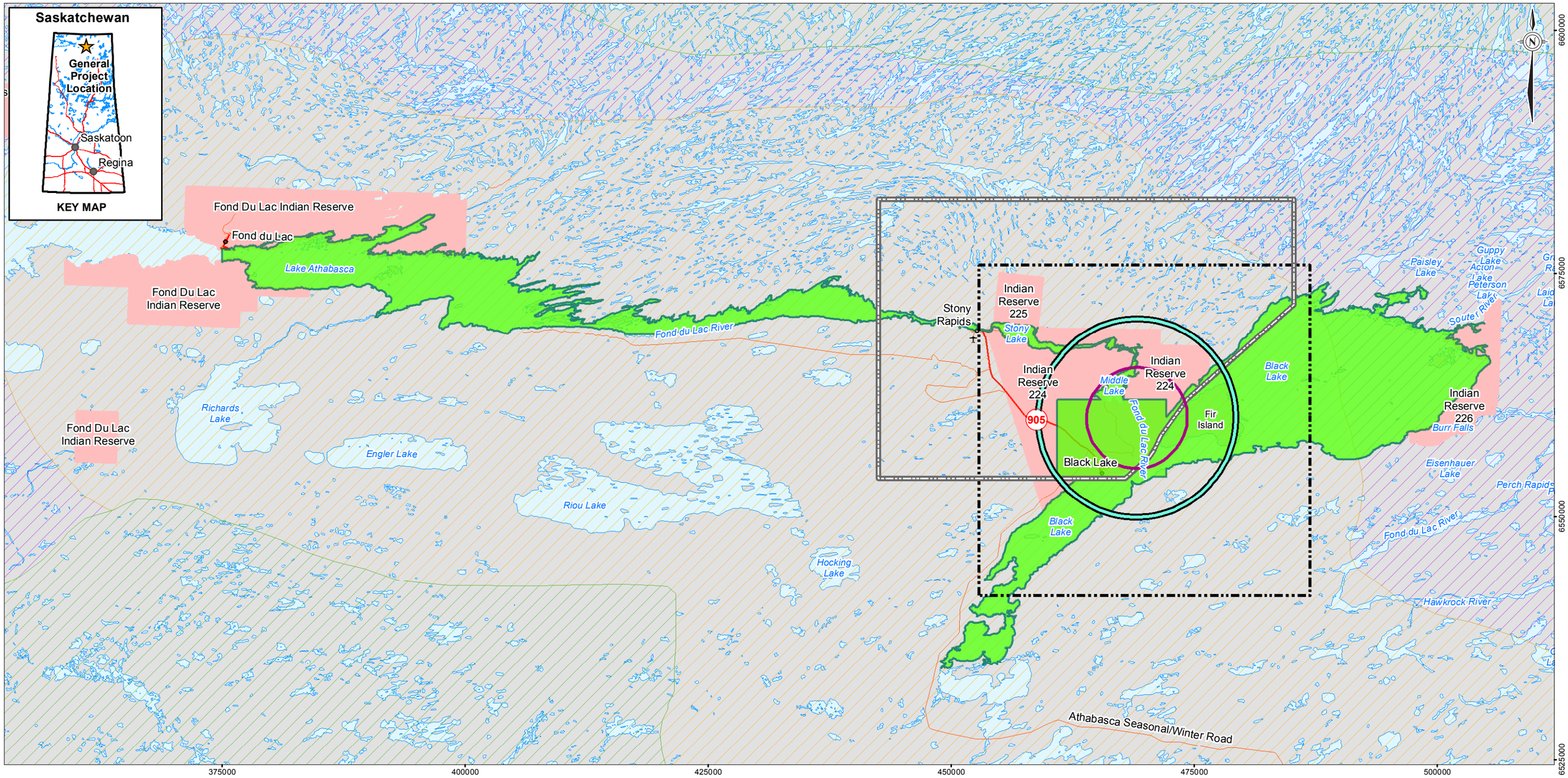
The RSA boundaries for each VC were designed to quantify baseline conditions at a scale that is large enough to assess the maximum predicted geographic extent (i.e., maximum zone of influence) of direct and indirect effects from the Project on VCs. The RSA for each VC is shown in Figure 8-1. Potential changes to VCs of the biophysical and socio-economic environments resulting from the Project will occur on the Chicken Indian Reserve (e.g., federal land) within Saskatchewan. No other federal lands within Saskatchewan will be affected by the Project. The RSAs for each VC do not include other provinces or territories. Therefore, the environmental assessment completed for the Project has determined that there will be no trans-boundary effects because of the Project.

8.1.4 Effects of Changes to the Environment on Aboriginal Peoples

The Project is located within the Chicken Indian Reserve No. 224. The Chicken Indian Reserve No. 224 was created under the OIC 1978-1647; that is the land is set aside for the exclusive use and benefit of the members of the BLFN. The area surrounding the Chicken Indian Reserve No. 224 is provincial crown land and accessible to all aboriginal people for the pursuit of traditional and cultural activities. The BLFN has three registered reserve locations; two are unpopulated. The reserve parcels that have permanent, seasonal, or historical ties to the community and include the following:

- Chicken 224 – populated – 25,819.4 ha;
- Chicken 225 – no resident population – 2,193.4 ha; and
- Chicken 226 – no resident population – 4,216.9 ha (AANDC 2012).

The Chicken 224 reserve parcel includes an earlier settlement at Stony Lake, as well as the current settlement of Black Lake. The reserve extends to an area just east of Stony Rapids, where several BLFN homes are located.



LEGEND

- HAMLET OR COMMUNITY
- RUNWAY
- HIGHWAY
- ROAD
- INDIAN RESERVE
- WATERBODY
- NORTHERN ADMINISTRATION DISTRICT
- ATHABASCA LAND USE PLAN - STAGE 1
- ATHABASCA LAND USE PLAN - STAGE 2
- ATHABASCA LAND USE PLAN - STAGE 3
- HYDROLOGY & AQUATICS REGIONAL STUDY AREA
- AIR QUALITY STUDY AREA
- NOISE STUDY AREA
- GEOTECHNICAL REGIONAL STUDY AREA
- TERRESTRIAL REGIONAL STUDY AREA

REFERENCE

DMTI HIGHWAYS AND ROADS
NTS MAPSHEET 74I, 74J, 74O, 74P
NAD 83 UTM ZONE 13

10 0 10
SCALE 1:400,000 KILOMETRES

PROJECT
TAZI TWÉ HYDROELECTRIC PROJECT

TITLE
LAND ADMINISTRATION WITHIN THE REGIONAL STUDY AREAS FOR THE PROJECT

Tazi Twé Hydroelectric Project

PROJECT		10-1365-0004	FILE No.	
DESIGN			SCALE AS SHOWN	REV. 1
GIS	SM/LR	15/11/13		
CHECK	MT	15/11/13		
REVIEW	MM	15/11/13		

FIGURE: 8-1

The RSA for each VC is designed to quantify the maximum geographic extent of potential effects resulting from the Project. While no other First Nations Reserves will be directly affected, the Project's potential effects may extend outside of the reserve land and may affect the traditional territory of the following communities:

- Fond du Lac Denésuline First Nation;
- Hatchet lake Denésuline First Nation;
- Métis Nation – Saskatchewan (MN-S) Camsell Portage Local 79;
- Métis Nation Saskatchewan Stony Rapids Local 80; and
- Métis Nation Saskatchewan Uranium City Local 50.

This section will describe the effects of any changes the Project may cause to the environment on Aboriginal peoples as described in Section 5(1)(c) of *CEAA 2012*; this includes the effects of any changes:

- to health and socio-economic conditions;
- to physical and cultural heritage;
- to the current use of lands and resources for traditional purposes; and
- to any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

8.1.4.1 Health and Socio-economic Conditions

The analysis of residual effects on human population and health considers two factors: potential effects associated with non-local construction workers and local resident interactions and potential effects associated with traffic accidents. For both of these factors, mitigation practices will be implemented to reduce the potential for effects to occur.

In the case of non-local construction workers and local resident interaction, adaptive management practices have also been identified to address issues as they arise. Effects on human population and health related to non-local construction workers and local resident interactions are expected to result in negative residual effects that are primarily related to construction activities. Residual effects are predicted to be noticeable or detectable change relative to the existing conditions and local in geographic extent. However, the consequences of a negative effect (e.g., an altercation resulting in injury) could be longer lasting. No significant adverse effect of the Project on human population and health are expected because of non-local construction workers and local resident interactions, however, it is recognized that even a single incident could have a significant effect on the individual and local communities. Early engagement with local residents and service providers will be completed so that potential risks can be identified prior to the on-set of construction, and strategies can be devised to address issues as they arise.

Results of the noise assessment predict that noise levels at all three receptors will be below Health Canada's guidelines for noise-induced hearing loss, sleep disturbance, interference with speech comprehension, complaints, and change in percent highly annoyed. Therefore, it is anticipated that the construction noise will not

result in nuisance for the people living in the area. Construction traffic will however be audible, especially activities resulting in a noise peak, such as passing traffic, back up alarms, and dropping of hard material in empty trucks. During operations, most of the incremental daytime and nighttime noise levels from the Project are predicted to be confined to the Powerhouse. Based on the results of the noise assessment, the nighttime sound contributions from the Project on local receptors during operations are predicted to be below the permissible sound level (PSLs) for the nighttime (Section 8.5.5.3). The predicted total noise levels due to the Project operation at 1.5 km Buffer are also below the daytime PSL.

The cabin owner who is a year around resident at Middle Lake places a high value on the serenity of the LSA. While the noise assessment indicates that noise and vibrations associated with construction, traffic, excavation, blasting, and operations are anticipated to remain below limits at each receptor, these noises and vibrations may periodically become notable. The Proponent is committed to working with the receptors living in the area and will address noise and vibration complaints should they arise. Overall, changes to noise levels from the Project during construction and operations are predicted to be below guideline limits (i.e., Health Canada and Rule 012). Therefore, the residual effects from changes in noise levels from the Project on the local human population and health are expected to be negligible.

Effects related to traffic accidents are expected to remain with the LSA (with traffic accidents extending to Highway 905). The increased traffic volume is expected to be noticeable or detectable change relative to the existing conditions and have a negative residual effect that is primarily related to the construction phase. Mitigation practices and policies are anticipated to limit the risk to local human population and health from the increase in Project-related vehicle traffic. It is acknowledged that any vehicle collision resulting in the death of an individual would have a significant effect on the immediate family and local community.

The socio-economic environment is divided into two main components including economy, and infrastructure and community services. The potential effects on the local economy and infrastructure and community services are described in this EIS in Section 18.6 and Section 19.6, respectively.

The analysis of residual effects on economy considers several relevant indicators including potential changes to education and training, employment, contracting and businesses, and to income (i.e., individual and community). In most instances, the overall magnitude of effects is expected to be most discernible during the construction phase, when training and employment opportunities will be the greatest. However, the effects from operation are most likely to produce meaningful outcomes for the community, be it through long-term permanent employment opportunities, or through the equity associated with BLFN's partnership in the Project.

Based on the analysis of effects described in Section 18.5 of this EIS, effects on economy are expected to result in a noticeable or detectable positive change relative to the existing environment. Residual effects are predicted to be long-term in duration and regional in geographic extent. Depending upon how equity and other Project income is spent by the BLFN, the magnitude of these effects may even be higher and is likely to represent a significant source of improvement to various measurement endpoints for economy. Overall, there is no significant adverse effect of the Project on economy.

For economy, numerous existing and potential projects have the potential to overlap with the Project, particularly given that the geographic extent of the RSA extends to the entire province of Saskatchewan. A complete list of potential projects has not been examined, however would include projects such as northern uranium mining operations and proposed mines in northern Saskatchewan. Conceptually, the issues in relation to economy,

particularly the local economy, result from the fact that additional projects or developments represent opportunity and competition for local resources (e.g., employment or contracting). Cumulative effects on the economy would translate into higher levels of local and regional employment and business opportunities. These higher levels of economic activity, while beneficial overall, could place additional demands on the local and regional workforce and businesses and could lead to capacity challenges, particularly in the LSA. However, this could result in additional benefits in the RSA. Given the overall positive nature of effects on economy, no significant adverse effects from the Project, combined with existing and reasonably foreseeable developments on economy are predicted.

The analysis of residual effects on infrastructure and community services considers potential changes to health care, childcare, and education services and facilities, traffic volumes, and quality and development of infrastructure income resulting from BLFN partnership in the Project. Effects on infrastructure and community services are expected to result in a noticeable or detectable positive change relative to the existing environment. Residual effects are predicted to be long-term in duration and local in geographic extent. Depending upon how equity and other Project income is spent by the BLFN, the magnitude of these effects may even be higher, which could result in meaningful changes to BLFN infrastructure and community services, given the positive rating of the effect. Overall, there is no significant adverse effect from the Project on infrastructure and community services.

For infrastructure and community services, one additional development was identified as having potential spatial overlap with the RSA: the Highway 968 All-weather Road Project, a proposed 88.5 km road from Highway 905 near Stony Rapids to the community of Fond du Lac. The proposed roadway would extend from approximately 3.5 km south of the Stony Rapids airport at its intersection with Highway 905 and generally follow the existing winter road location west for 31.9 km toward Fond du Lac. The remaining 56.6 km of roadway would be entirely new, terminating on the south shore of Lake Athabasca near Fond du Lac. The project would take approximately three years to construct and would result in an estimated 300 person years of employment. With respect to infrastructure and community services, this could result in additional workers accessing services in communities in the region, in addition to additional air and road traffic associated with transporting personnel and equipment to the site (Ministry of Highways and Infrastructure 2010). These higher levels of activity, while beneficial overall, could place additional demands on the local infrastructure and community services and could lead to capacity challenges, particularly in the LSA. However, this could result in additional benefits in the RSA.

At present, there is no evidence to suggest that there would be a temporal overlap with construction activities for the Project and the development of the proposed roadway. The Ministry of Highways and Infrastructure budget announcements for 2013-2014 do not include the proposed road, and the environmental assessment process has not moved beyond the submission of a Project Description in 2010 (Ministry of Highways and Infrastructure 2010; Government of Saskatchewan 2013). Based on the assumption that construction phase for the Project and the road development are unlikely to overlap, no significant adverse effects from the Project, combined with existing and reasonably foreseeable developments on infrastructure and community services are predicted.

A Project Advisory Committee, including equal representation from the EFHLP and SaskPower will meet at least monthly or as otherwise agreed to by the Committee, and will review the status of the Project including environmental, engineering and construction activities including community matters that relate to the completion of the Project. It is anticipated that this committee will discussion on-going concerns about socio-economic

effects and that the EFHLP and SaskPower will work together collaboratively on measures to address any community concerns.

8.1.4.2 Physical and Cultural Heritage

Heritage resources in Saskatchewan include all archaeological, historical, and paleontological objects and sites, as well as any property deemed to be of interest for its architectural, historical, cultural, environmental, aesthetic, and scientific value (Government of Saskatchewan 1980). As such, potential effects that may cause changes to any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance are considered in this section.

Potential effects on heritage resources are limited to direct disturbance and loss of archaeological sites during Project construction activities. A database and literature search, Elder interviews, and a pre-construction field assessment was carried out as part of baseline studies to determine if heritage resources were present in heritage sensitive areas of the Project footprint (Annex V). No heritage resources were identified in conflict. However, a historical Dené cemetery (IgNj 6) is within 60 m of an existing road extending north from Camp Grayling towards the weir structure. Appropriate mitigation (e.g., flagging off or barricading access) should be taken to avoid this cemetery in the event that any road upgrade activities are planned. In a letter dated July 17, 2013 (Appendix 16.1) the Heritage Conservation Branch agreed with the above findings and recommendations outlined in the baseline assessments and have no concerns with the Project proceeding. As such, there are no expected effects on heritage resources from the Project footprint.

8.1.4.3 Use of Lands and Resources for Traditional Purposes

Resource use and associated activities is a way of life for individuals in northern Saskatchewan, particularly the communities in the Athabasca region. Renewable resource uses include traditional resource uses by Aboriginal people, such as domestic hunting and fishing, along with resource use for commercial purposes, such as commercial fishing, trapping, and outfitting. The assessment of effects on traditional and domestic resource use focuses on activities undertaken by members of the BLFN. By virtue of the Project's location on BLFN reserve land, domestic resource use by other communities is limited.

The analysis of residual effects on use of lands and resources considers the potential changes to traditional and domestic resource use and potential changes to outfitting and lodge activities.The discussion of traditional and domestic resource use includes consideration of a principal resource user, who is most likely to experience effects related to Project construction and operation. Other community resource use is discussed; however, while effects on other community resource users is expected to be similar, the extent of effects on the broader community will be less than those experienced by the principal resource user.

Habitats with high or moderate potential to support traditional use plant species are expected to decrease by 6.3% and 6.2%, respectively, relative to existing conditions in the local study area. Most of the reclamation activities are expected to occur during and immediately following construction, with some reclamation activities occurring during operations. Reclamation activities following construction will include the removal of portions of the temporary construction infrastructure not required during operation. Overall, the residual effects from the Project and previous and existing developments are not predicted to be large enough to alter the state of plant communities and significantly influence self-sustaining plant populations and communities.

There also will be habitat loss for important locally harvested species, including beaver, moose, marten, and waterbirds. Effects from direct loss, alteration, and fragmentation of habitats from the Project and previous and existing developments are not expected to have a measurable residual effect on wildlife populations. Overall, the Project was conservatively estimated to disturb 1.4% of the RSA during construction. These changes should have negligible effects on the movement of individuals and connectivity of wildlife populations. Overall, the incremental and cumulative effects from the Project and previous and existing developments are not predicted to be large enough to alter the state of wildlife populations and adversely influence self-sustaining wildlife populations; effects are predicted to be not significant.

Some fish currently drift downstream out of Black Lake into the Fond du Lac River through the Black Lake outflow; during Project operation, fish are expected to drift downstream through the natural river outflow and the water intake. However, the total number of fish leaving the Black Lake fish community is not expected to change over the current level of out-migration because overall Black Lake outflow rates and volumes will not change with the development of the Project. Out-migration of fish from Black Lake once the Project is operating is expected to be similar to current levels. It is anticipated that hydrological changes in the Fond du Lac River will alter the relative abundance of prey items available to Arctic grayling and other fish species; however, this change is not expected to extend beyond the resilience limits of fish populations in the Fond du Lac River. The successful design and implementation of a Fish Habitat Offsetting Plan is expected to result in a no net loss of fish habitat resulting from the Project footprint or construction of Project components.

Overall, the combined residual effects from the Project are not predicted to be large enough to alter the state of fish health, abundance, distribution, or habitat, and therefore influence the maintentance of self-sustaining fish populations. Therefore, domestic fishing on Middle Lake is predicted to continue as it does presently. In addition, other local lakes, such as Stony Lake and Black Lake, will be unaffected by the Project and will continue to be accessible for domestic fishing.

Resource management strategies, including the prohibition of firearms, hunting, trapping, harvesting, and fishing for all employees will be implemented to reduce pressures on wildlife and fish populations. These strategies should assist in limiting the number of people exploring the LSA, which will help to reduce any potential interactions between the cabin owner and the non-local workforce at Middle Lake.

The Proponent is committed to working with the principal resource user and the general community to mitigate for Project-related disruption occurring in regular resource use areas. The Proponent will provide effective and timely communication about Project activities and about any restrictions to activities that will be applied (e.g., for safety concerns). Finally, the Proponent will consider compensation for demonstrated losses resulting from the Project.

Other members of BLFN access areas in the LSA for resource harvesting purposes, though less frequently than the principal resource user. These local resource users typically access and harvest resources in nearby areas within the LSA and RSA. Although changes to vegetation, fish, and wildlife have the potential to affect broader community resource use (i.e., similar to changes that will be experienced by the primary resource user), other community members tend to be active within the LSA, RSA, and beyond; so suitable alternative locations for resource use will continue to be available for use.

There is one outfitter, Camp Grayling, operating a fishing lodge adjacent to the Project site on the Fond du Lac River. Camp Grayling facilities include a lodge and cabin buildings, as well as storage facilities. The camp

offers sport-fishing activities on the Fond du Lac River, as well as on several lakes in the LSA and RSA, focusing on sport (rod) fishing for Arctic grayling on the Fond du Lac River near Elizabeth Falls and northern pike on Black Lake. Camp Grayling provides access through leases to 22 regional lakes including Middle Lake and receives half of the commercial fishery allocation on Black Lake.

As with the effects on domestic fishing for other resource users, Project effects on the majority of lakes used by Camp Grayling are expected to be negligible or not measurable. This includes Black Lake and Middle Lake. Effects of Project operations on Arctic grayling on the Fond du Lac River relate to changes in the quantity and quality of habitat, in addition to the potential for injury and mortality. It is anticipated that hydrological changes in the Fond du Lac River will alter the relative abundance of prey items available to Arctic grayling and other fish species; however, this change is not expected to extend beyond the resilience limits of fish populations in the Fond du Lac River. The overall size of the Arctic grayling population in the Fond du Lac River and Black Lake outlet near Grayling Island, as well as in the lower section of the Fond du Lac River near Middle Lake, is expected to remain similar to current levels. The Arctic grayling population in the middle, by-passed section of the Fond du Lac River is expected to persist, but may be reduced in numbers due to lower flows and volumes in the river. However, reduced flows on the Fond du Lac River because of Project operations may improve access for shoreline fishing.

It is difficult to predict with certainty the extent of potential effects on Camp Grayling, particularly with respect to the potential for demonstrable losses. This is due, in part, to the multiple factors that may influence a tourist's decision to visit a location, in addition to the fact that changes in visitor behaviour may or may not be directly or indirectly attributable to the Project. Because of this uncertainty, the Proponent has committed to working with the owner of the lodge to discuss any potential Project effects and the mitigation or compensation that may be appropriate in the circumstances.

9.0 CUMULATIVE EFFECTS OF THE PROJECT

Cumulative effects are those effects from the Project, combined with the effects from prior development, existing activities, and reasonably foreseeable future developments that are sufficiently certain to proceed. Reasonably foreseeable developments or designated projects that would be included in the EIS are activities or projects that:

- would be developed in the spatial and temporal boundaries of the Project;
- have been proposed and scoped to a reasonable level of detail;
- could be induced by the Project;
- are currently undergoing regulatory review; and
- have the potential to change the Project or the effects predictions.

For all VCs, the future case includes baseline and the Project, plus reasonably foreseeable developments or designated projects. The geographic extent (zone of influence) of residual effects from the Project on the biophysical VCs (i.e., atmospheric environment, hydrogeology, hydrology, surface water quality, fish and fish habitat, soils, vegetation, and wildlife) is expected to be limited to the RSA. No other major developments in the region are located within the RSA's defined for each biophysical VC. Therefore, the zones of influence associated with the Project and existing developments are not expected to overlap and generate cumulative

effects on biophysical VCs. Currently, there are no reasonably foreseeable developments that could have an overlapping temporal boundary with the Project and potential to generate cumulative effects on the biophysical VCs.

For economy, numerous existing and potential projects have the potential to overlap with the Project, particularly given that the geographic extent of the RSA extends to the entire province of Saskatchewan. A complete list of potential projects has not been examined, however would include projects such as northern uranium mining operations, and proposed mines in northern Saskatchewan. Conceptually, the issues in relation to economy, particularly the local economy, result from the fact that additional projects or developments represent opportunity and competition for local resources (e.g., employment or contracting). Cumulative effects on the economy would translate into higher levels of local and regional employment and business opportunities. These higher levels of economic activity, while beneficial overall, could place additional demands on the local and regional workforce and businesses, and could lead to capacity challenges, particularly in the LSA. However, this could result in additional benefits in the RSA. Given the overall positive nature of effects on economy, no significant adverse effects from the Project, combined with existing and reasonably foreseeable developments on economy are predicted.

For land and resource use, infrastructure and community services, and human population and health, one additional development was identified as having potential spatial overlap with the RSA: the Highway 968 All-weather Road Project, a proposed 88.5 km road from Highway 905 near Stony Rapids to the community of Fond du Lac. The proposed roadway would extend from approximately 3.5 km south of the Stony Rapids airport at its intersection with Highway 905 and generally follow the existing winter road location west for 31.9 km toward Fond du Lac. The remaining 56.6 km of roadway would be entirely new, terminating on the south shore of Lake Athabasca near Fond du Lac. The project would take approximately three years to construct and would result in an estimated 300 person years of employment. With respect to infrastructure and community services, this could result in additional workers accessing services in communities in the region, in addition to additional air and road traffic associated with transporting personnel and equipment to the site (Ministry of Highways and Infrastructure 2010). These higher levels of activity, while beneficial overall, could place additional demands on the local infrastructure and community services and could lead to capacity challenges, particularly in the LSA; however, this could result in additional benefits in the RSA.

At present, there is no evidence to suggest that there would be a temporal overlap with construction activities for the Project and the development of the proposed roadway. The Ministry of Highways and Infrastructure budget announcements for 2013-2014 do not include the proposed road, and the environmental assessment process has not moved beyond the submission of a Project Description in 2010 (Ministry of Highways and Infrastructure 2010; Government of Saskatchewan 2013). Based on the assumption that construction phase for the Project and the road development are unlikely to overlap, no significant adverse effects from the Project, combined with existing and reasonably foreseeable developments on land and resource use, infrastructure and community services, and human population and health are predicted.

10.0 MONITORING AND FOLLOW-UP PROGRAMS

Monitoring programs are proposed to deal with the uncertainties associated with the effect predictions and environmental design features. Monitoring verifies effect predictions and determines the effectiveness of environmental design features. Monitoring is also used to identify unanticipated effects and implement adaptive management. Monitoring can include compliance inspection, environmental monitoring, and follow-up programs. If monitoring or follow-up detects effects that are different from predicted effects or the need for improved or modified design features is identified, then adaptive management will be implemented. This might include increased monitoring, changes in monitoring plans, or additional mitigation.

Monitoring and follow-up programs will be designed and implemented under the following categories:

- **Compliance Monitoring -** confirms compliance to regulatory requirements, company commitments, and implementation of approved design standards and mitigation. Compliance inspections will be undertaken as part of a comprehensive EnvPP.
- **Environmental Monitoring -** tracks conditions or issues during the Project lifespan and is a key component of adaptive management (e.g., monitoring for soil erosion and rare plant species during construction or monitoring water quality and discharge volumes), and for continuous improvement of the EnvPP. Information obtained during environmental monitoring programs can be used to implement further mitigation as required.
- **Follow-up Monitoring -** designed to verify the accuracy of effects predictions, reduce uncertainty, determine the effectiveness of environmental design features and mitigation, and to provide feedback to operations for modifying or adopting new mitigation designs, policies, and practices.

Environmental monitoring plans are designed to measure the actual effects of the Project, test predictions, or identify unanticipated effects. SaskPower's monitoring and follow-up plans will be developed prior to the start of construction and will include recommendations made by regulatory agencies and stakeholders, as appropriate, during the EIS review process. Monitoring and follow-up plans will be developed by SaskPower to comply with regulatory requirements, permits, and corporate commitments. The program will focus on forward planning requirements, evaluating the environmental effect predictions made in the EIS, and will act as an early detection system if residual effects are identified. The follow-up portion of the Plan will integrate the results of the monitoring programs and evaluate the effectiveness of mitigation. Monitoring and follow-up will continue throughout the life of the Project. A summary of monitoring and follow-up activities for the Project is shown in Table 10-1.

Table 10-1: Summary of Monitoring and Follow-up Activities

Valued Environmental Component	Environmental Monitoring and Follow up
Atmospheric Environment	■ The results of the air quality assessment indicate that no additional monitoring or follow-up programs are required. ■ The results of the noise assessment indicate that no additional monitoring or follow-up programs are required.
Hydrogeology	■ The rate of groundwater inflow will be monitored as power tunnel construction progresses so there is advanced warning if flow volumes increased faster than expected. ■ Groundwater quality will be monitoring during construction and operation of the Project, and following closure. Results from this monitoring program will be used to support development and adjustments to the Decommissioning and Reclamation Plan.
Hydrology	■ Continuous water level sensors can be installed on Black Lake to monitor predicted effects on these waterbodies. These sensors can be regularly surveyed using an engineer's rod and level to correct for potential movement. ■ Continuous flow records can be maintained in the bypassed section of the Fond du Lac River to verify environmental effects predictions. ■ Some of the streamflow and water level data collected during the monitoring and follow-up programs can be used in the hydrological models applied to this assessment allowing for verification and validation of model results. These data also can be used to verify the hydrologic function of the weir at the outflow of Black Lake.
Surface Water Quality	■ A program will be established to verify predicted changes in water quality in the Fond du Lac River given the discharges from the settling ponds. ■ A program will be established to monitor potential changes in water quality in Black Lake, Middle Lake, and several small lakes near the Project to verify the prediction of no effects on water quality due to acid deposition from the Project. If monitoring detects effects that are different from predicted effects, or the need for improved or modified design features, then adaptive management will be implemented.
Fish and Fish Habitat	■ It is anticipated that monitoring of fisheries offsetting activities, as defined in the Fisheries Offsetting Plan, will be required during the Project operation. The objectives and methods used to offset serious harm to fish within the LSA will be determined with input from regulators and local communities.
Soils	■ Soil conditions will be monitored to estimate reclamation success, and soil quality issues such as erosion, admixing, and compaction will be assessed as part of this task.
Vegetation	■ Monitoring of re-vegetation techniques and success. ■ Environmental monitoring for weed species during construction and operation and the implementation of a Weed Management Plan.

Table 10-1: Summary of Monitoring and Follow-up Activities (continued)

Valued Environmental Component	Environmental Monitoring and Follow up
Wildlife	■ Prior to construction, detailed site assessments will be completed to identify listed wildlife species that may be present in the areas to be disturbed, which were not identified during previous surveys. ■ Additional wildlife surveys will be completed prior to construction if construction activities are to take place during the breeding season.
Heritage	■ An additional Heritage Resource Impact Assessment is required for portions of the access road that traverse native boreal forest located 250 metres from unnamed creeks that drain into Middle Lake prior to construction activities.
Land use	■ Monitoring and follow-up programs associated with fish and fish habitat, vegetation, and wildlife are also relevant to land and resource use. ■ Community concerns on resource use will be monitored and managed by a Project Advisory Committee consisting of SaskPower and the EFHLP.
Economy Infrastructure and Community Services Population and Health	■ Community concerns on the economy will be monitored and managed by a Project Advisory Committee consisting of SaskPower and the EFHLP. ■ With respect to the longer-term effects associated with Project operation, BLFN may want to consider monitoring how their equity is invested and what the associated outcomes for the community would be.

BLFN = Black Lake First Nation EFHLP = Elizabeth Falls Hydroelectric Project; LSA = local study area

11.0 CONCLUSIONS

Based on the detailed Project information and assessment of effects provided in this EIS, the proponent believes that the Project can be constructed and operated in a manner that, taking into account environmental design features and mitigation, is not likely to cause significant residual effects on the biophysical or socio-economic environments. That is, residual effects on components of the environment are not predicted to be large enough to alter the following:

- ability of surface water quality for aquatic and terrestrial ecosystems and human use;
- maintenance of self-sustaining fish populations;
- maintenance of self-sustaining plant populations and communities;
- maintenance of self-sustaining wildlife populations;
- protection and preservation of heritage resources;
- continued opportunity for traditional and non-traditional activities such as hunting, fishing, trapping, and plant and berry gathering;
- continued opportunity for employment;
- continued access to health care, family services, education, and recreation; and

- human health and maintenance of quality of life.

Additionally, it is anticipated that many of the socio-economic residual effects from the construction and operation of the Project would yield a positive outcome. The proposed Project is expected to cost approximately $500 million to develop, which will generate a number of benefits during both the construction and operational phases. The construction phase of the Project will provide local economic and employment opportunities using northern Saskatchewan companies, as much as possible. The magnitude and extent of these benefits will be dependent on the capacity and capabilities of local contractors.

After construction, new infrastructure such as roads, as well as improvement to existing roads and other facilities, will benefit the community. Another post-construction benefit for local residents that have completed the education and training program is that their skills can be used to seek employment opportunities elsewhere in the Athabasca Basin. Larger scale benefits from the Project include increasing the production of renewable energy in Saskatchewan, as well as enhancing the supply and reliability of electrical energy transmission in northern Saskatchewan using the existing Far North electrical system.

A Project Advisory Committee, including equal representation from the EFHLP and SaskPower will meet at least monthly or as otherwise agreed to by the Committee, and will review the status of the Project including environmental, engineering and construction activities including community matters that relate to the completion of the Project. It is anticipated that this committee will discussion on-going concerns about socio-economic effects, and that the EFHLP and SaskPower will work together collaboratively on measures to address any community concerns.

12.0 REFERENCES

AANDC (Aboriginal Affairs and Northern Development Canada). 2012. First Nation Profiles: Reserves/Settlements/Villages. Available from http://pse5-esd5.ainc-inac.gc.ca/FNP/Main/Search/FNReserves.aspx?BAND_NUMBER=359&lang=eng (accessed March 24, 2012).

Acton, D.F, G.A. Padbury, and C.T. Stushnoff. 1998. The Ecoregions of Saskatchewan. Canadian Plains Research Centre, University of Regina. Hignell Printing Limited, Winnipeg, Manitoba. 205pp.

ALUPIAP (Athabasca Land Use Planning Interim Advisory Panel). 2003. Athabasca Land Use Plan - Background Document - 4.0 How People Use the Land and Resources. Available at: http://www.environment.gov.sk.ca/Default.aspx?DN=77e08791-38ff-4b6c-bbd3-79c2af8320cc. Accessed: July 24, 2013.

Andrén, H. 1999. Habitat Fragmentation, the Random Sample Hypothesis and Critical Thresholds. Oikos 84:306–308.

Athabasca Health Authority. 2013. Available at: http://www.athabascahealth.ca/blacklake.html (accessed May 7, 2013).

Bayne, E.M., L. Habib, and S. Boutin. 2008. Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22:1186-1193.

Black Lake and Stony Rapids KPI Program. 2012. KPI Program Conducted in Black Lake and Stony Rapids in February 2012.

Blood, D.A. and G.G. Anweiler. 1994. Status of the bald eagle in British Columbia. B.C. Environment, Lands and Parks, Victoria, B.C. Wildlife Working Report No. WR-62.

BNA (Birds of North America Online). 2013. The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna. Accessed: June, 2013.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/506. Accessed: September, 2012.

Cameco Corporation. 2011. Annex V: Socio-Economic Environment Baseline in Cigar Lake Water Management Project Environmental Impact Statement. Prepared by InterGroup Consultants Ltd.

Canada. 2012. House of Commons. Standing Committee on Aboriginal Affairs and Northern Development. Evidence, (Meeting No. 35, Tuesday, May 15, 2012). 41st Parliament, 1st session, 2011-. Available from http://www.parl.gc.ca/HousePublications/Publication.aspx?DocId=5590709&Language=E&Mode=1 (accessed October 19, 2012).

Ceballos, A. 2010. Supreme Court of Canada clarifies 'duty to consult'. The Lawyers Weekly, November 12, 2010 issue. Available at: http://www.lawyersweekly.ca/index.php?section=article&articleid=1291 (accessed June 11, 2013).

Cousins, B. and D. Coneghan. 2006. Ferries and Barges. The Encyclopedia of Saskatchewan. Available from http://esask.uregina.ca/entry/ferries_and_barges.html (accessed October 19, 2012).

Dahlgren, R.B., and C.E. Korschgren. 1992. Human disturbances on waterfowl: an annotated bibliography. Resource Publ. No. 188, U.S. Department of the Interior, Washington, D.C.

Fahrig, L. 1997. Relative effects of habitat loss and fragmentation on population extinction. Journal of Wildlife Management 61:603-610.

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology, Evolution, and Systematics 34:487-515.

Fahrig, L. and T. Rytwinski. 2009. Effects of roads on animal abundance: an empirical review and synthesis. Ecology and Society 14:21. Available at: http://www.ecologyandsociety.org/vol14/iss1/art21/. Accessed: July 10, 2012.

Flather, C.H., and M. Bevers. 2002. Patchy reaction-diffusion and population abundance: the relative importance of habitat amount and arrangement. The American Naturalist 159:40-56.

Fortin, D., and M. Andruskiw. 2003. Behavioral response of free-ranging bison to human disturbance. Wildlife Society Bulletin 31:804–813.

Fung, K (ed.). 1999. Atlas of Saskatchewan: Celebrating the Millennium. University of Saskatchewan. Saskatoon, Saskatchewan. 335p

Gill, F.B., R. A. Canterbury, and J.L. Confer. 2001. Blue-winged Warbler (*Vermivora cyanoptera*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/584/articles/introduction. Accessed August 16, 2013

Gillespie, B. C. 1976. Changes in territory and technology of the Chipewyan. Arctic Anthropology 13(1): 6-11. Available from http://www.jstor.org/stable/40315884. Accessed May 15, 2013.

Government of Canada. 1985. *Indian Act*. R.S.C, 1985., c.I-5.

Government of Saskatchewan. 1980. The Heritage Property Act. Chapter H-2.2 of the Statutes of Saskatchewan. The Queen's Printer, Regina.

Government of Saskatchewan. 2013. *News Release – Highways and Infrastructure.* March 20, 2013. Available online at http://www.gov.sk.ca/news?newsId=a5eaa33c-30b5-4b24-9ec4-35d93085be15, accessed August 20, 2013.

Habib, L., E.M. Bayne, and S. Boutin. 2007. Chronic industrial noise affects pairing success and age structure of ovenbirds Seiurus aurocapilla. Journal of Applied Ecology 44: 176-184.

Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M.A. Barker. 1992. Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. Journal of Environmental Management 36: 253–286.

Korschgren, C.E., L.S.George, and W.L. Green. 1985. Disturbance of diving ducks on a migrational staging area. Wildlife Society Bulletin 13: 290–296.

Meyer, D. 1981. Overview of Chipewayan Ethnohistory and Organization. In: Stony Rapids Community and Resource Access Road, Stage 2: Environmental Evaluation of Alternative Corridors. MacLaren Plansearch, ALUPIAP, 2003.

Minni, S.J. 1975. The Prehistoric Occupations of Black Lake, Northern Saskatchewan. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Northern Economic Summit. 2012. Athabasca Analysis Report. Available at: http://www.northerneconomicsummit.com/. Accessed: May 9, 2013.

NLSD (Northern Lights School Division). ND. Stony Rapids. Available from http://www.nlsd113.com/schlcom/north/stony/ (accessed November 15, 2011).

Pomeroy, J., de Boer, D., and Martz, L. 2005. Hydrology and Water Resources of Saskatchewan Centre for Hydrology Report #1. Available at: http://www.usask.ca/hydrology/Reports.php. [accessed May 9, 2013].

Poston, B., D. Ealey, P. Taylor, and G. McKeating. 1990. Priority Migratory Bird Habitats of Canada's Prairie Provinces. Canadian Wildlife Service, Edmonton, AB. 107 pp.

SKCDC (Saskatchewan Conservation Data Centre). 2012. Saskatchewan Conservation Data Centre Tracked Species List for Vertebrates. Available at: http://www.biodiversity.sk.ca/Docs/vertstrak.pdf. Accessed: August, 2012.

SKCDC. 2012. Sensitive Species Web Site – Interactive Map. Saskatchewan Ministry of Environment. Available at: http://gisweb1.serm.gov.sk.ca/Wildlifelogin/form.asp. Accessed: July 24, 2013.

Slattery, S. 2013. Waterfowl of the Boreal Forest. Ducks Unlimited. Available at: http://www.ducks.org/conservation/western-boreal-forest/waterfowl-of-the-boreal-forest. Accessed: July 25, 2013.

Statistics Canada. 2007. Census of Canada 2006. Government of Canada.

Swift, T.L., and S.J. Hannon. 2010. Critical thresholds associated with habitat loss: a review of the concepts, evidence, and applications. Biological Reviews 85: 35-53.

Ward, D.H., and R.S. Stein. 1989. Response of Brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final Report to the Minerals Management Service, Anchorage, AK. 193 p.