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2 Preferred Development Plan Facilities

2.0 Chapter Overview

Manitoba Hydro has identified a Preferred Development Plan that best ensures that adequate supply resources are available to meet all firm domestic load requirements together with existing electricity sale commitments. This plan consists of four main components:

- the 695 megawatt (MW) Keeyask Project with a 2019 in-service date (ISD)
- the 1,485 MW Conawapa Project with a 2026[1] ISD (the ISD is subject to revision)
- the 185 MW North-South Transmission Upgrade Project, with an ISD to coincide with Conawapa
- the 750 MW Manitoba-Minnesota Transmission Project, with a 2020 ISD.

This chapter describes the physical components of each project, ownership structure, and potential environmental and socio-economic effects and benefits. Each section concludes with the capital cost estimate.

The Preferred Development Plan also includes simple-cycle gas thermal units towards the end of Manitoba Hydro's planning period (starting in 2041) to meet currently forecast domestic load growth. This assumption is used consistently in all plans to ensure the forecast load can be met through the end of the planning period without having to bring in additional types of supply. As such, this element of the Preferred Development Plan is not described in this chapter.

2.1 The Keeyask Project

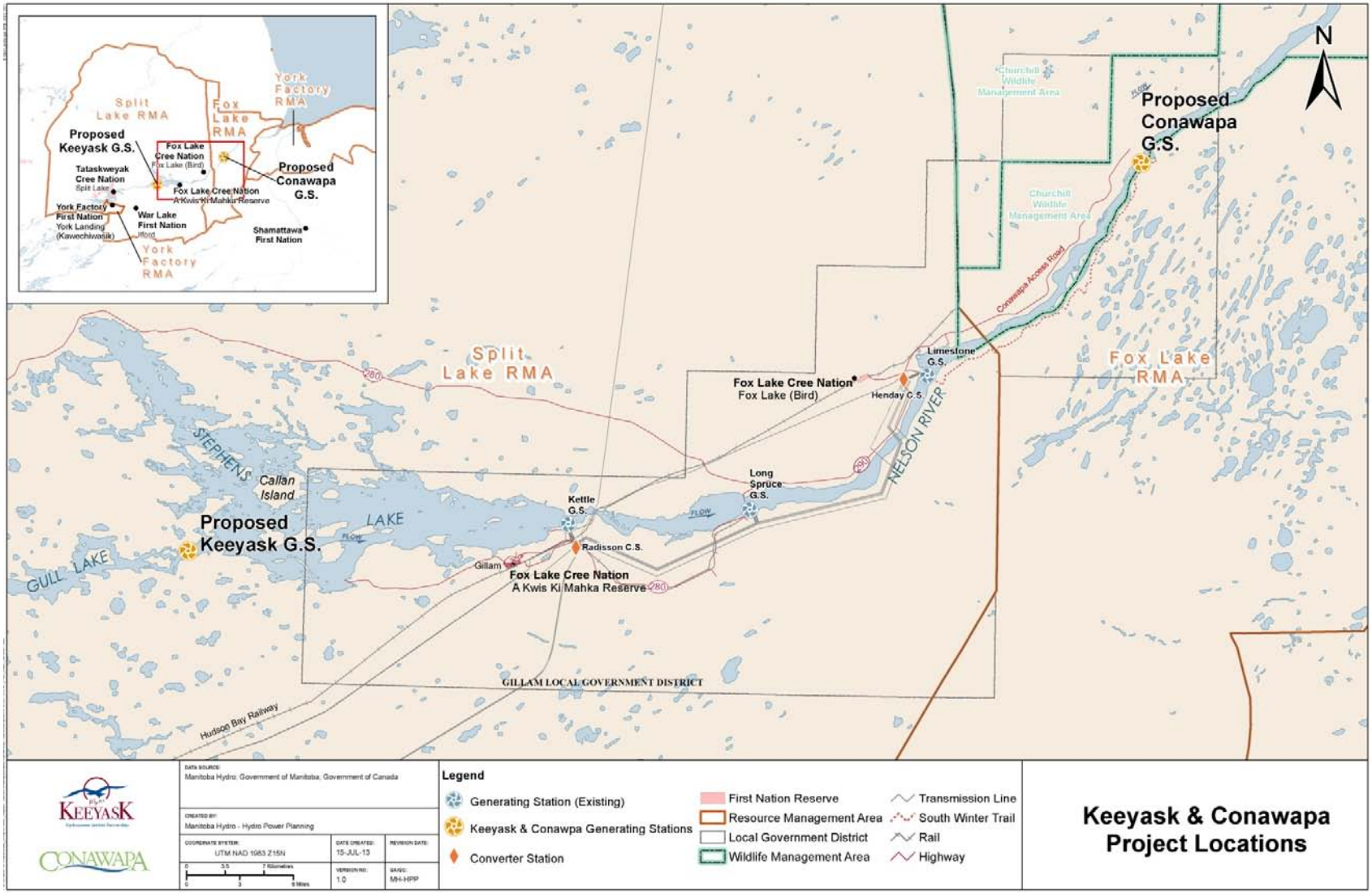
The Keeyask Project consists of three components: the 695 MW Keeyask Generation Project; the Keeyask Infrastructure Project; and the Keeyask Transmission Project. The infrastructure

[1] The Conawapa ISD was recently changed from 2025 to 2026. Economic and financial analysis in the NFAT submission is based on the 2025 ISD.

and transmission projects provide facilities required to construct and operate the generating station.

The station will be located at Gull Rapids, immediately upstream of Stephens Lake on the lower Nelson River shown in Map 2.1. The site is 180 km northeast of Thompson, 60 km northeast of Split Lake, 30 km west of Gillam, and 730 km north of Winnipeg. The generation and infrastructure projects are entirely within the Split Lake Resource Management Area; the transmission project extends into the Fox Lake Resource Management Area.

Map 2.1 KEEYASK AND CONAWAPA PROJECT LOCATIONS



The Keeyask Project will take 11 years to construct. The Keeyask Infrastructure Project began in 2012.The generating station and transmission projects are scheduled to begin in 2014. The construction phase will conclude with decommissioning of infrastructure no longer required for operations and with rehabilitation of the site in 2022. The first of seven generating units will begin producing power in 2019; all seven units will be in production by 2020. The final three years of construction will overlap with the first three years of operation. The budgeted in-service cost for the Keeyask Project, including interest and escalation, is $6.2 billion.

Manitoba Hydro will purchase all energy produced at the generating station from its owner, the Keeyask Hydropower Limited Partnership ("the Partnership"), and integrate the energy into the Manitoba Hydro system for domestic and export customers. Annual average production of renewable electricity will be approximately 4,400 gigawatt-hours (GWh)—sufficient energy to power approximately 400,000 Manitoba homes.

Table 2.1 summarizes several key project design parameters.

Table 2.1 KEEYASK GENERATING STATION DESIGN PARAMETERS

Parameter	Value
Full Supply Level	159 m
Minimum Operating Level	158 m
Initial Reservoir Area	93.1 km^2
Initial Flooded Area	45 km^2
Rated Total Output Power at Stephens Lake at 141.12 m	630 MW
Rated Total Output Power at Stephens Lake at 139.6 m (Low Level)	695 MW
Generator Rated Output	99.3 MW/117 MVA
Net System Capacity Addition	630 MW
Average Annual Energy	4,400 GWh
Annual Dependable Energy	3,003 GWh

2.1.1 Keeyask Ownership Structure

2.1.1.1 Ownership of the Generation and Infrastructure Projects

The partnership will own the generation project under terms outlined in the Joint Keeyask Development Agreement (JKDA) signed in 2009 by Manitoba Hydro and each of the four Keeyask Cree Nations (KCNs): Tataskweyak Cree Nation (TCN) and War Lake First Nation (WLFN) (which act together as the Cree Nation Partners), York Factory First Nation (YFFN) and Fox Lake Cree Nation (FLCN). The partnership also owns the infrastructure project.

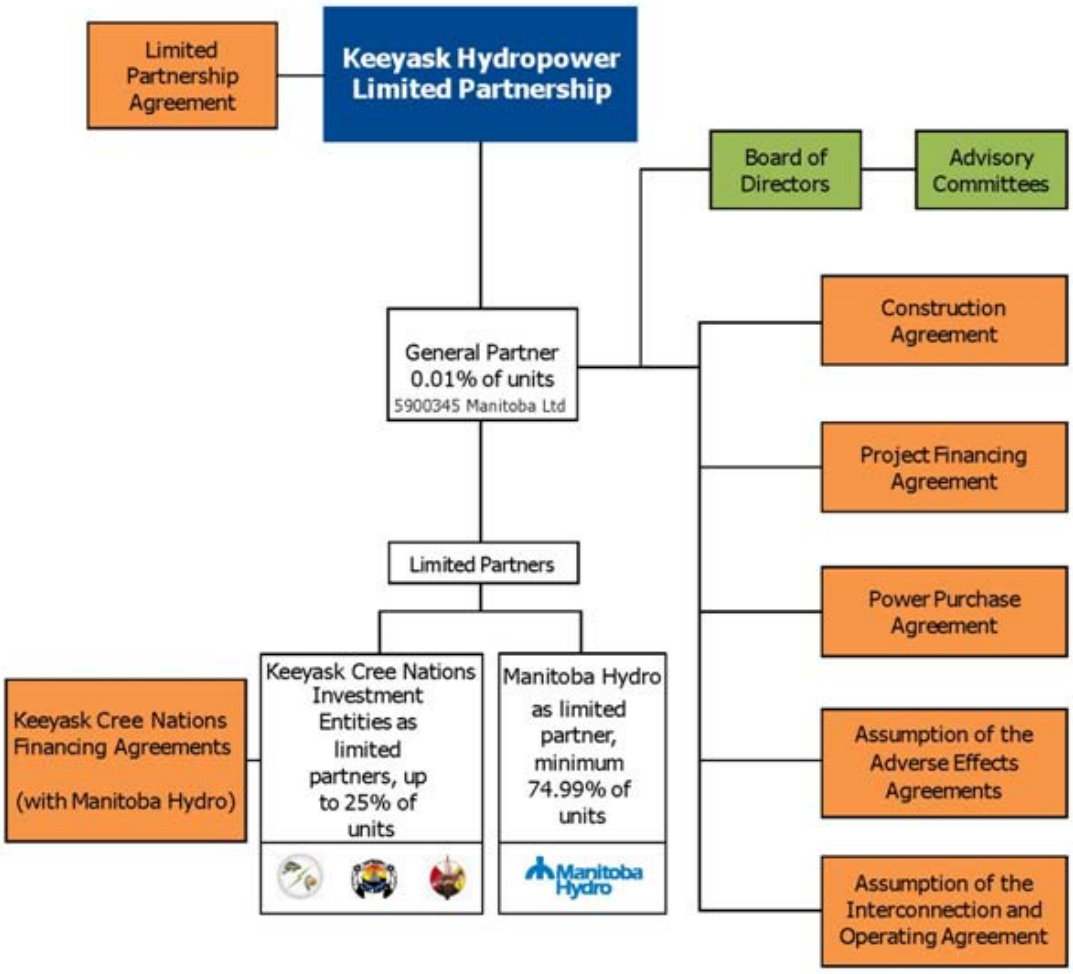
The JKDA, negotiated between 1998 and 2009, shaped key features of the Keeyask Project and the terms of the partnership, including governance, financing and management of the project. Among other matters, the agreement also addresses the KCNs' potential income earnings, training, employment, business opportunities, and involvement in environmental and regulatory affairs. Each KCN partner can choose to invest as a common-unit partner or a preferred-unit partner. As a common unit partner, the KCN would receive annual distributions based on its proportionate share of distributable cash (after equity loan payments). As a preferred-unit partner, it would reduce its risk and receive distributions based on adjusted gross revenues.

Each Cree Nation consulted with its members and held a referendum on whether to ratify the JKDA as well as adverse effects agreements for each community. The core of each adverse effects agreement is a set of offsetting programs to provide appropriate replacements, substitutions or opportunities to offset unavoidable adverse effects on the practices, customs and traditions integral to the First Nations' distinctive cultural identity. The following were the results of the JKDA referenda: TCN, 61% in favour; WLFN, 94%; YFFN, 83%; and FLCN, 87%.

Under the agreement, there are four limited partners—Manitoba Hydro and three Cree investment entities (Cree Nation Partners Limited Partnership, York Factory First Nation Limited

Partnership and Fox Lake Cree Nation Keeyask Investment Inc.); and one general partner, a wholly-owned subsidiary of Manitoba Hydro (Figure 2.1).

Figure 2.1 PROJECT PARTNERSHIP STRUCTURE



The general partner is responsible for the management and operation of the business of the partnership, and liable for all partnership debts. The general partner will contract all the planning, construction and operation of the project to Manitoba Hydro, and will contract with Manitoba Hydro to provide all the debt financing required to construct the project.

Manitoba Hydro will subcontract a majority of the services and supplies required to build the project. A number of contracts for construction work, services, labour and materials will first be offered to the KCNs or businesses controlled by them. Once the project is built, the general

partner will contract with Manitoba Hydro to provide the necessary services to manage and operate the project.

Manitoba Hydro and the general partner will own at least 75% of the partnership, and the KCNs, through their respective investment entities—Cree Nation Partners—will have the opportunity to own the remainder: (TCN and WLFN, 15%; and YFFN and FLFN, 5% each). The affairs of the general partner are subject to the direction of its board of directors. The board will include three members nominated by Cree Nation Partners (two from TCN and one from WLFN) and one member from each of YFFN and FLCN. Members nominated by Manitoba Hydro will constitute the majority of the board. These appointments will be made before construction of the generating station begins.

2.1.1.2 Ownership of the Transmission Project

Manitoba Hydro will own and operate the Keeyask Transmission Project.

2.1.2 Keeyask Project Components

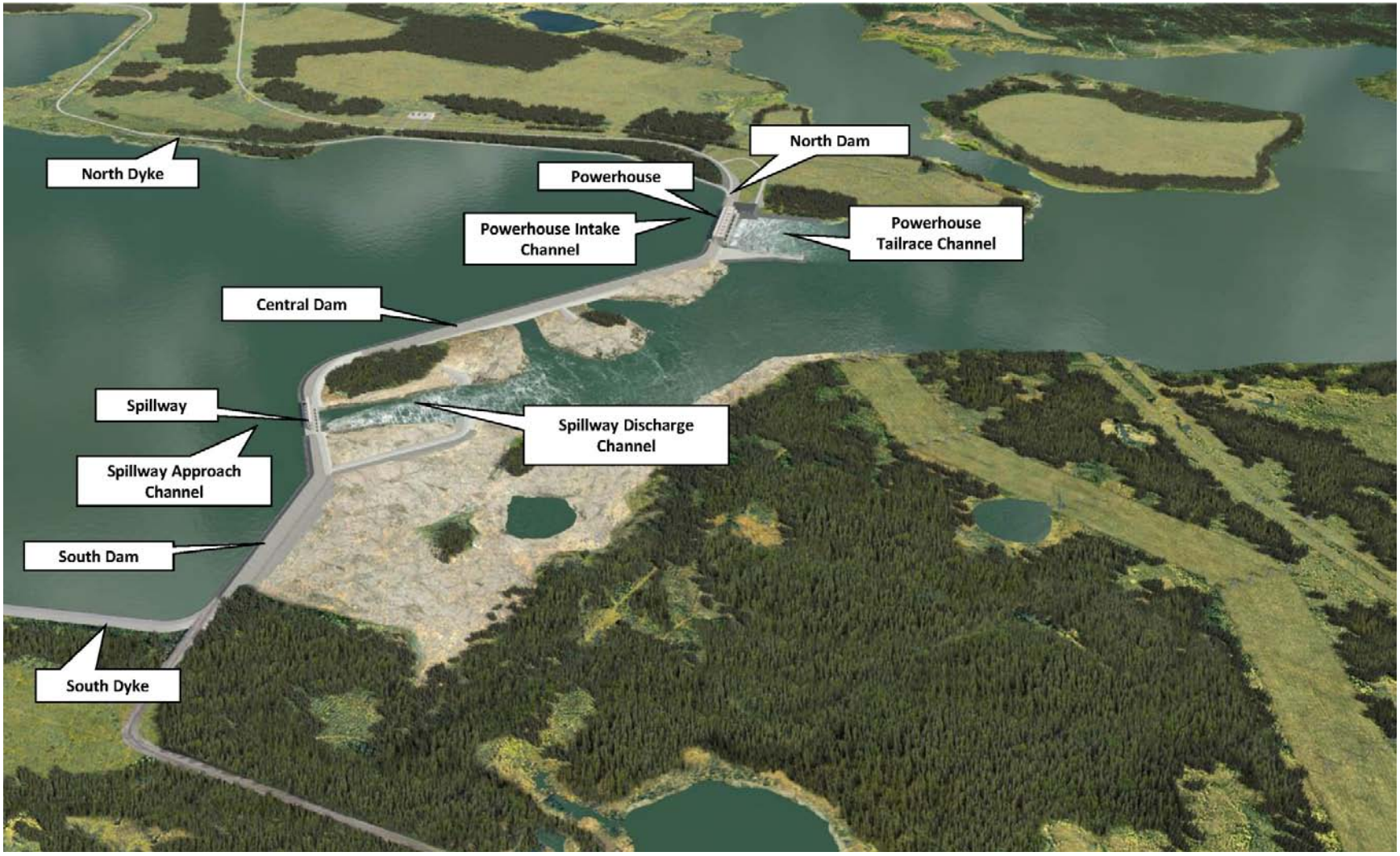
2.1.2.1 Components of the Generation Project

The Keeyask Generation Project consists of principal structures and supporting infrastructure. Some of the supporting infrastructure is being constructed as part of the Keeyask Infrastructure Project.

Principal Structures

Principal structures will consist of a powerhouse, a spillway, three dams, and two dykes seen in Figure 2.2. The powerhouse contains equipment for producing electricity, including seven turbines and generators, a control room and service bay complex. The seven-bay spillway is required to manage diverted flows when the project is being constructed and to manage surplus water flows once it goes into production, and the dams and dykes will contain a reservoir created upstream of the principal structures. The principal structures will stretch 2.7 kilometers (km) across the Nelson River, with the dykes extending 11.6 km on the north shore and 11.2 km on the south. The reservoir will extend 42 km upstream from the generating station to an area between Clark Lake and Birthday Rapids. The project will flood 45 km^2 of land which, when combined with 48 km^2 of existing waterways, will initially create a 93 km^2 reservoir. The reservoir is predicted to expand by 7 to 8 km^2 due to shoreline erosion and peatland disintegration over the first 30 years of operations.

Figure 2.2 KEEYASK PRINCIPAL STRUCTURES



Supporting Infrastructure

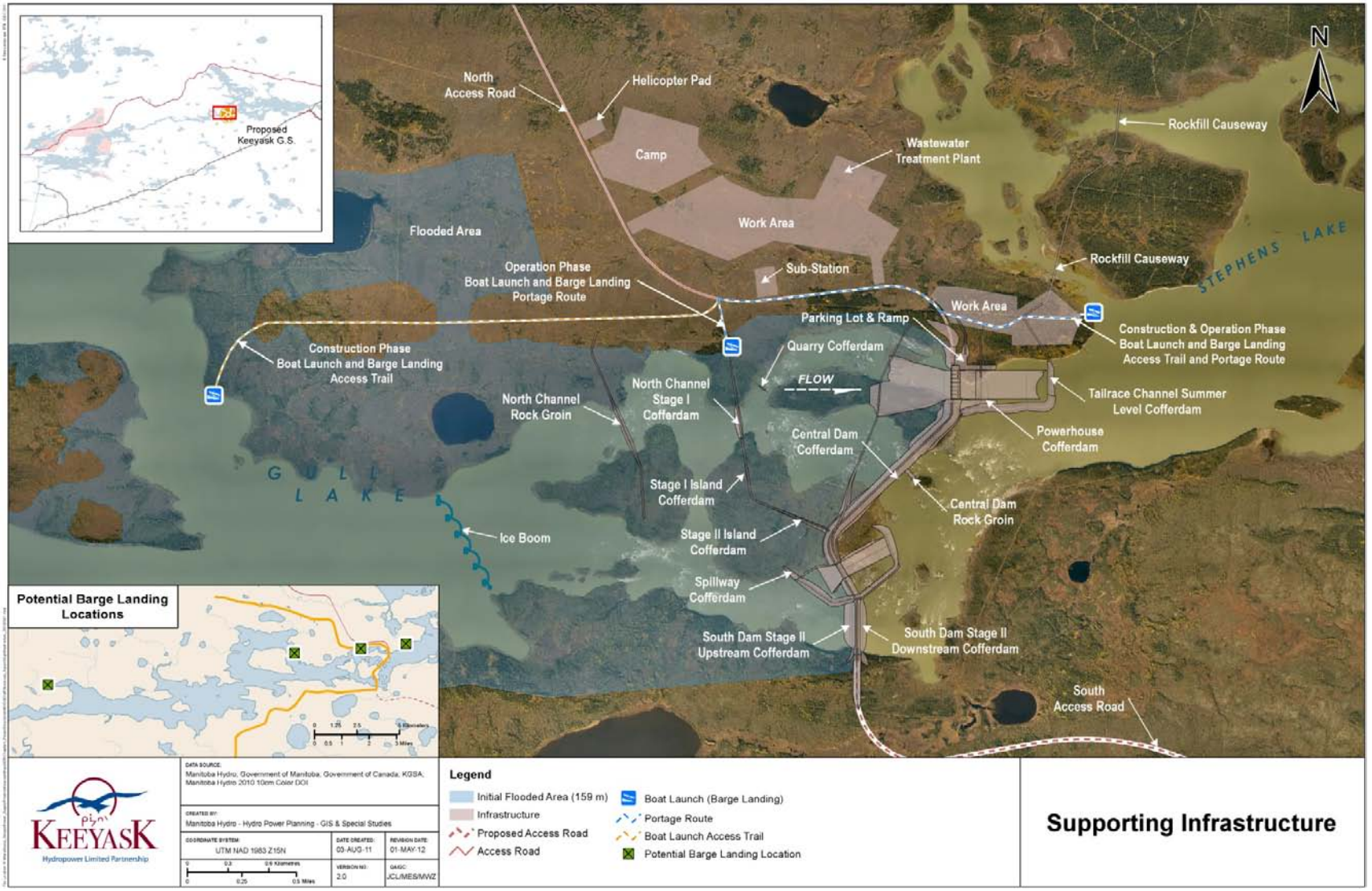
Supporting infrastructure, (see Figure 2.3) will consist of permanent facilities to construct and operate the generating station, and temporary facilities required only to construct the principal structure.

Permanent supporting infrastructure will include a 25 km north access road, 35 km south access road, transmission tower spur, communications tower, placement area for excavated materials, remnants of some cofferdams and rock groins, boat launches, portage, barge landings, and public safety and security measures, as well as some haul roads and borrow areas required for operations. Once the generating station is completed, the north and south access roads will be connected across the principal structures and integrated into the provincial transportation network.

Temporary supporting infrastructure will include the main camp, work areas, concrete batch plant, water and waste water treatment facilities, explosives magazine, ice boom, boat launches, cofferdams, rock groin, causeways, and safety and security facilities, as well as haul roads and borrow areas not required for operations.

The generation project will also rely on other infrastructure that exists or is being constructed, including the infrastructure project. The Gillam Redevelopment and Expansion Program is also being undertaken to refurbish and enhance that community's infrastructure and services to meet the needs of the existing and expanding population.

Figure 2.3 SUPPORTING INFRASTRUCTURE



2.1.2.2 Components of the Infrastructure Project

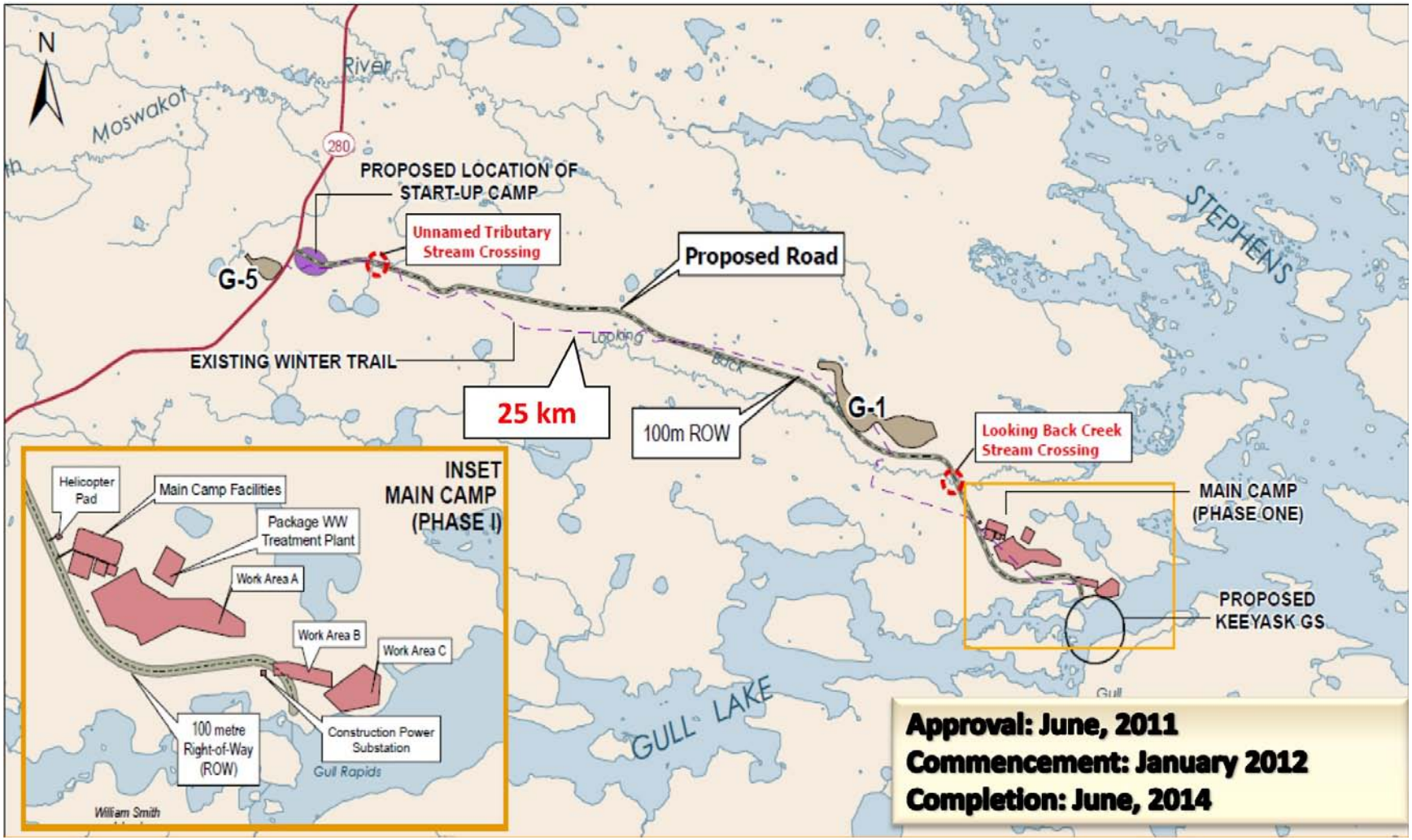
The 25 km north access road and a 500-person camp at the Keeyask site are being constructed under the Keeyask Infrastructure Project shown on (Map 2.2). The infrastructure project will be completed by June 2014, in time for the scheduled start of construction of the generation project.

In addition to providing facilities required to start construction of the generation project, the project was undertaken prior to approval of the generation project to achieve the following objectives:

- to provide early business opportunities for the KCNs
- to reduce risks to KCN businesses arising from a potentially tight construction schedule,
- to provide more time for KCN businesses to develop management capacity
- to provide early employment opportunities for First Nation members and other northern Aboriginal and northern Manitoba workers
- to accelerate investment to support the promotion of sustainable development in Manitoba
- to provide for timely and efficient construction of the generating station once a construction decision is made upon receipt of regulatory approvals
- to reduce risks to delays in infrastructure construction progress.

The infrastructure was assessed and appropriately licensed before construction began. If the generating station does not proceed, the project will be decommissioned and disturbed sites remediated.

Map 2.2 KEEYASK INFRASTRUCTURE PROJECT



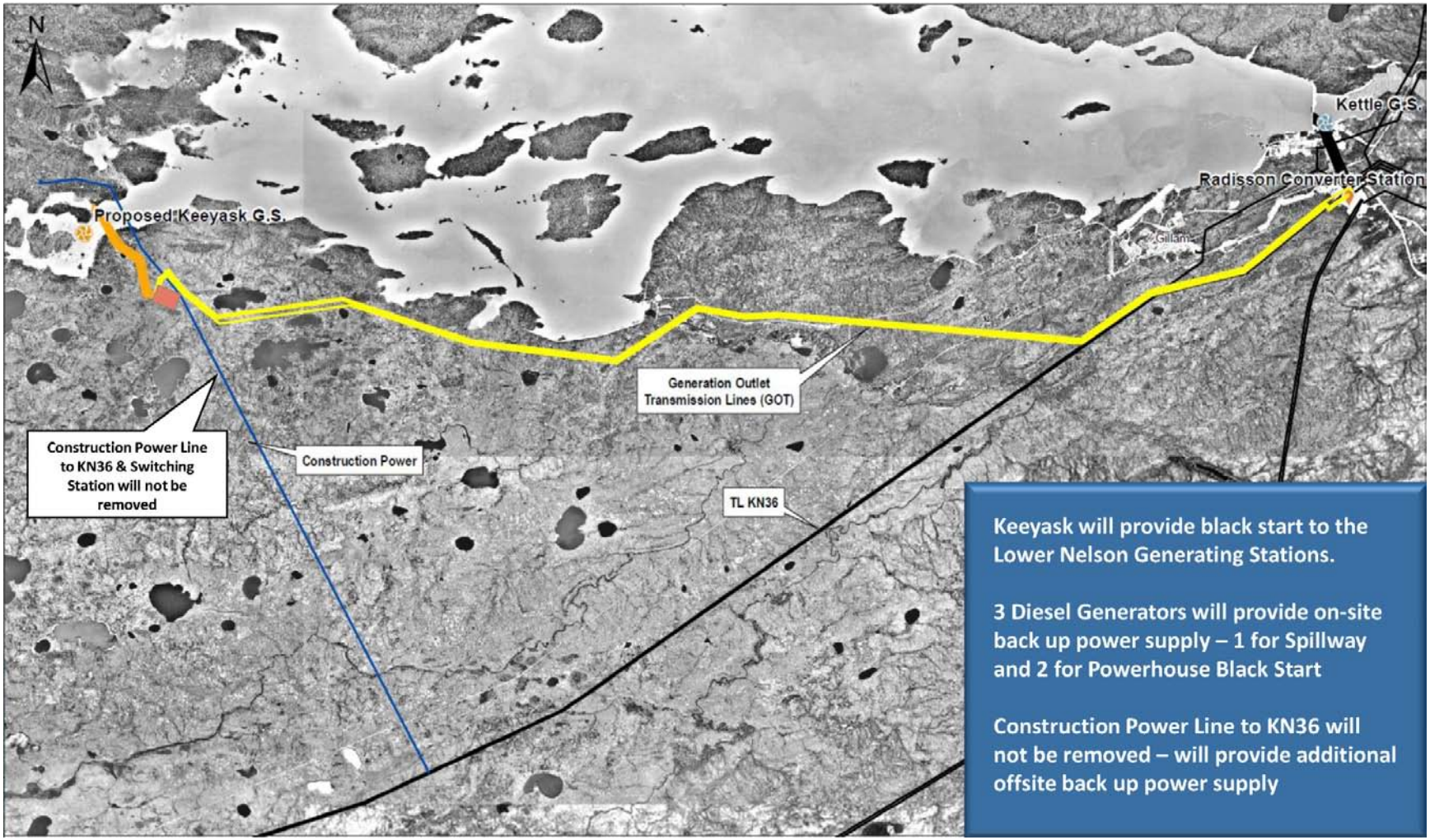
2.1.2.3 Components of the Transmission Project

The Keeyask Transmission Project (Map 2.3) will provide construction power to construct the generation project and generation outlet transmission facilities to transmit the power produced at the generating station once operational.

A new transmission line in a single right-of-way will be constructed from an existing 138 kilovolt (kV) line (KN36) 22 km south of Gull Rapids, terminating at a new substation north of the Nelson River to provide construction power. The line and substation will be retained to provide a backup source of offsite power to the generating station once it goes into operation.

Four 3.4 km transmission lines will transmit the power from the generating station to a new Keeyask switching station south of the generating station, and three 35 km lines in a single route will transmit the power from the switching station to the Radisson Converter Station, where the power will enter Manitoba Hydro's integrated power system. One of the three lines will be built prior to the other two to serve as a back-up source of construction power. Upgrades to terminate the three lines will also be required at the Radisson Converter Station.

Map 2.3 KEEYASK GENERATION OUTLET LINES



2.1.3 Environmental and Socio-economic Effects

The follow sections provide a high-level summary of detailed material in the environmental impact statements for the Keeyask Infrastructure, Generation and Transmission projects. The reports have been filed with federal and provincial regulators and are subject to review under the *Canadian Environmental Assessment Act* and *The Environment Act* (Manitoba). The Minister of Conservation and Water Stewardship has referred the provincial review to the Clean Environment Commission, which will hold hearings and provide recommendations to the Minister. Matters before the commission, including the environmental impact statements, are explicitly beyond the scope of the NFAT review. Manitoba Hydro is providing this high-level summary to assist with a comparative analysis of the macro-environmental and socio-economic effects of the Preferred Development Plan and alternative plans, as set out in the NFAT Terms of Reference.

2.1.3.1 Plans to Avoid and Mitigate Generation and Infrastructure Effects

The hydro-electric potential of the lower Nelson River has undergone decades of study, going back almost a century, originally by the Governments of Canada and Manitoba and later with Manitoba Hydro. The early studies examined the feasibility of multiple development options. More recently, the local Cree Nations have taken an active role in planning the Keeyask Generation Project, assessing the potential effects and developing mitigation measures. Other First Nations, the Manitoba Métis Federation and public have also been engaged through bilateral meetings, public involvement programs and self-directed studies[2]. Through this

[2] The MMF is being funded to undertake a Métis-specific Traditional Land Use and Knowledge Study, historical narrative and socio-economic impact assessment. Discussions are on-going with Pimicikimak Cree Nation for a self-directed study. The partnership has undertaken a review of existing information sources and, based on that information, is not aware of project effects that would directly affect First Nations or Aboriginal groups beyond the KCNs. The partnership remains committed to considering any additional information provided on the use of lands and resources for traditional purposes by other Aboriginal groups. Upon review of any information provided, the partnership will consider the need to develop appropriate mitigation strategies, if necessary.

process, Manitoba Hydro is able to avoid, reduce and mitigate many potential adverse effects while enhancing potential benefits.

Manitoba Hydro has also restricted its planning for new projects to waterways already managed for hydropower production (i.e., the Churchill, Burntwood, and Nelson systems), rather than rivers unaffected by previous hydro-electric development[3].

The following examples illustrate potential adverse effects that have been avoided, reduced or mitigated through the planning and assessment process:

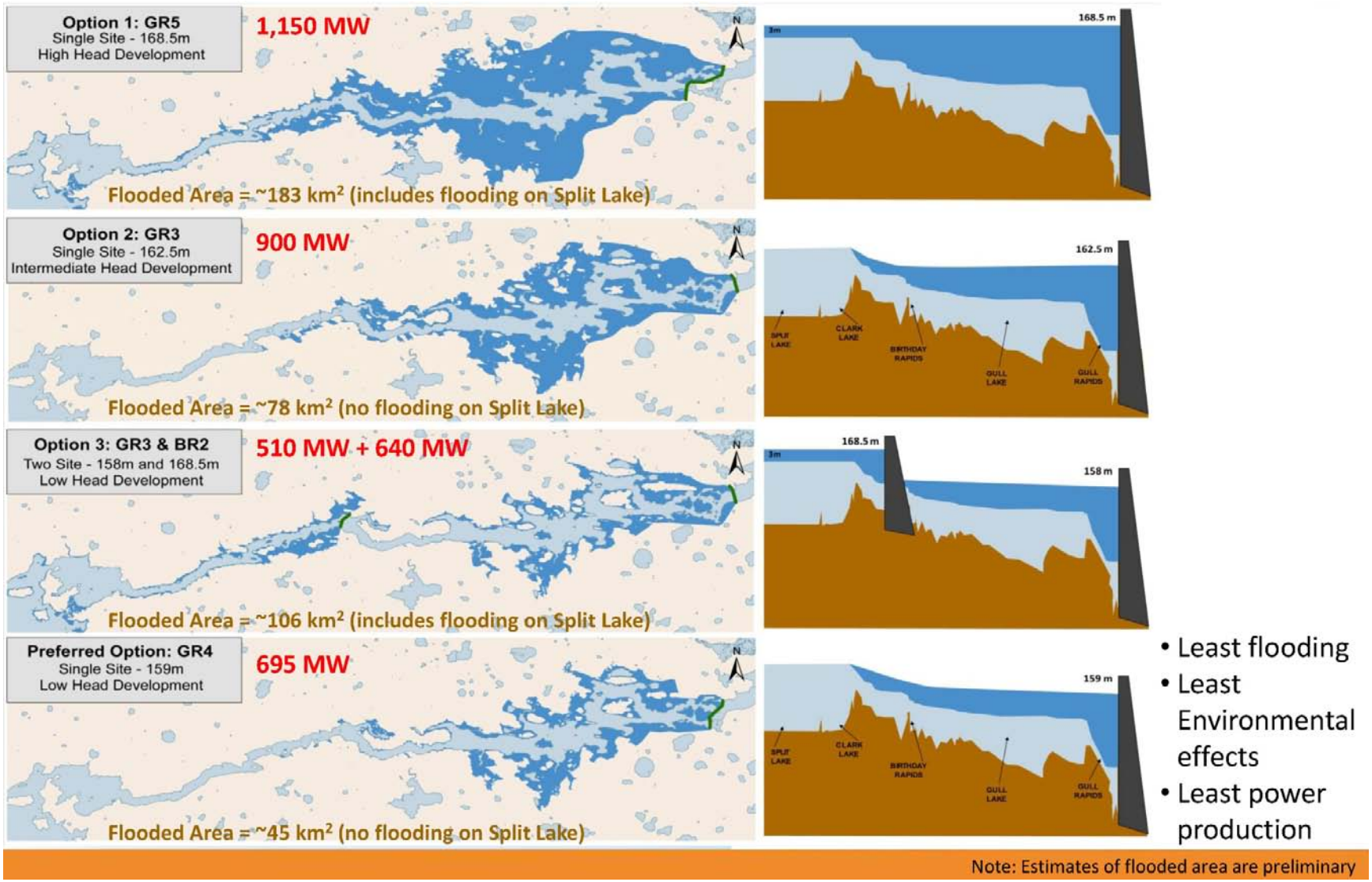
- By reducing the generating station from 1,150 to 695 MW, the initial flooded area was reduced from 180 km^2 to 45 km^2 (see Figure 2.4), which avoids flooding on Split Lake where TCN and YFFN have their home reserves.
- Keeyask's normal operating range will be 1 m, very small for a major generating station in Manitoba, Canada or internationally.
- The north access road was routed away from sensitive sites, such as caribou calving habitat and regionally rare habitat types.
- Turbines that minimize fish mortality were selected for the project; over 90% of the fish up to 500 mm in length passing downstream through the generating station are expected to survive.
- Most of the reservoir will be cleared before it is flooded.
- Important fish habitat, nesting sites for birds, and wetlands will be developed.
- New caribou calving habitat on islands in the reservoir will offset most losses caused by the project.

[3] Under the Treaty Land Entitlement Framework Agreement in 1997, Manitoba Hydro released many sites with technical potential for hydro-electric development, so those areas could be selected for treaty land entitlements; the remaining 16 sites protected for hydro-electric development are on rivers managed under the Lake Winnipeg Regulation and Churchill River Diversion projects or are on the Hayes River. Manitoba Hydro subsequently agreed to a policy supporting the designation of the Seal River and Hayes River (which has three of the 16 TLE-designated sites) under Canada's Heritage Rivers program.

- Appreciating that the partnership is among many entities with ongoing roles respecting caribou in the region, the partnership is working to develop a process to coordinate its activities with government authorities, caribou management boards and resource management boards.

Manitoba Hydro and its KCN partners are giving special attention to lake sturgeon. The Committee on the Status of Endangered Wildlife in Canada has designated the Nelson River population as endangered, and the federal government is considering it for listing under the *Species at Risk Act.* Various measures will be implemented to address potential effects caused by the project; these include habitat replacement and a stocking program. For more information about sturgeon enhancement initiatives by Manitoba Hydro, in collaboration with local Cree Nations and government resource managers, see ***Appendix 2.1 - Lake Sturgeon - Mitigation and Enhancement.***

Figure 2.4 OPTIONS STUDIED FOR KEEYASK WITH MWS AND FLOODED AREA



The Cree Nation Partners (TCN and WLFN) are also developing Fish and Moose Harvest Sustainability Plans, which will be presented to the Split Lake Resource Management Board and provincial resource management regulators.

Efforts have been taken to identify and address socio-economic effects. Each of the Keeyask Cree Nations has negotiated an adverse effects agreement to address anticipated adverse effects foreseen or foreseeable with the exercise of due diligence. The agreements set out a hierarchy for addressing adverse effects, with prevention of adverse effects as the first priority, and then in descending order: reduction, replacements, substitutions and offsets, and compensation. The core of each agreement is programming to offset unavoidable adverse effects on the practices, customs and traditions integral to each Cree Nation's distinctive cultural identity. For example, members of each community are able to fly to areas unaffected by the project to hunt, fish and gather their traditional foods. The agreements also compensate for residual effects, address Manitoba Hydro's on-going liabilities, and resolve effects to each Cree Nation's treaty and Aboriginal rights.

As noted in section 2.1.1.1, each of the KCNs is also a partner in the Keeyask Hydropower Limited Partnership. Under the JKDA, they will have opportunities to invest in the project, gain access to favourable financing from Manitoba Hydro, participate in the partnership's governance, negotiate business contracts, gain hiring preferences for their members, and participate in the environmental assessment, licensing and monitoring of the project. The agreement also has provisions for hiring qualified KCN members for Keeyask construction and system-wide operating positions. As with the adverse effects agreements, each community had an extensive consultation period with its members concerning the agreement, culminating with a referendum. For more information about the JKDA, **see *Appendix 2.2 – Joint Keeyask Development Agreement – Benefits Summary*.**

Northern First Nation and Métis people received training under a $60 million, decade-long program sponsored by the federal and provincial governments and Manitoba Hydro. People

were trained for positions in the designated and non-designated trades and construction support positions, as well as non-occupational programs.

A variety of measures have also been identified to address other socio-economic effects. For example:

- Qualified northern Aboriginal people will be given a hiring preference for most construction positions (i.e. those processed by the job referral service).
- Construction workers will be housed in camps with recreational and lounge facilities.
- In addition to providing KCN members with access to off-system areas to harvest traditional foods, they and other resource users will be given information about the risks of eating fish from Gull and Stephens lakes where mercury levels in fish will increase.
- Appropriate ceremonies and rituals consistent with local culture and spirituality will be conducted at key project milestones.
- Over 40 heritage sites have been investigated as part of the project's field studies, and valuable artifacts have been salvaged from sites that will be affected by the project.
- A new cemetery will be consecrated for the reburial of human remains, in the event any are discovered.
- PR 280 is being upgraded, and safe travel programs will be instituted for summer and winter travel on the river and lakes.
- The partnership is working collaboratively with the Town of Gillam, FLCN, the Northern Regional Health Authority, RCMP and others to address issues with respect to public safety, community health and the potential for undesirable interaction between workers and local residents.

2.1.3.2 Residual Effects of the Generation and Infrastructure Projects

Environmental Residual Effects

Some of the generation and infrastructure projects' most notable residual environmental effects are summarized below.

Physical Environment

The Keeyask Generation and Infrastructure projects will require 136 km^2 of land for construction and 140 km^2 for operation. Of that, 93 km^2 is for the reservoir, of which 48 km^2 is for existing waterways previously affected and currently managed for hydropower production.

The Pembina Institute compared the life-cycle greenhouse gas emissions of power generating technologies and found the life-cycle greenhouse gas emissions per GWh are much lower for Keeyask than for generators fueled by coal or natural gas. The Keeyask Project will produce fewer greenhouse gases in a century of operation than an equivalent coal-fired generating station would produce in 100 days or a gas-fired station in half a year.

In other words, considering all life-cycle greenhouse gas emissions, Keeyask will produce less than 1% of a combined-cycle gas turbine and even less when compared to a simple-cycle gas or a coal-fired generator. The analysis also found Keeyask compared favourably to commercial-sized wind farms, with only 25% of the greenhouse gas emissions per unit of energy. Since Manitoba Hydro operates an electrical system that facilitates the sale of surplus electricity to inter-connected neighbouring provinces and states, the energy produced by Keeyask would displace a variety of regional fossil-fuelled generating stations and, in doing so, would reduce global greenhouse gas emissions. For more information, see ***Appendix 7.3 – Life Cycle Greenhouse Gas Assessment Overview***.

Aquatic Environment

Effects to water quality will be very limited. Water quality will be suitable for aquatic life in the main stem of the reservoir, and in most locations and at most times in the flooded area. Adverse effects on walleye (pickerel) and lake whitefish will be limited during the construction phase; in the operations phase their populations are expected to increase in the reservoir and remain stable in Stephens Lake.

Northern pike (jackfish) may decline in the short-term in the reservoir, but are expected to remain stable over the long-term in the reservoir and Stephens Lake. As noted earlier, lake sturgeon will be stocked in the Keeyask reach of the Nelson River. Stocking is a proven technique for increasing sturgeon populations, and it is expected to increase regional populations in the Kelsey-Kettle reach of the Nelson River.

Terrestrial Environment

Overall effects to the terrestrial ecosystem diversity are expected to be regionally acceptable because no ecosystem types are lost, the proportion of habitat types is not expected to change substantially, and the cumulative changes for all priority habitat types will remain below 10% of the historical area. New wetlands will be developed to replace the loss of high-quality, off-system marshlands. Effects to intactness[4] are also expected to be regionally acceptable with the core area remaining at over 80%.

Effects on animals, including birds, beaver, moose and caribou, are expected to be regionally acceptable. A small amount of breeding habitat will be lost to three *Species at Risk Act (SARA)*-listed species – the olive-sided flycatcher, rusty blackbird and common nighthawk – but habitat

[4] Intactness is the degree to which an ecosystem remains unaltered by human features that remove habitat and increase fragmentation. Fragmentation is a landscape-level process in which human features progressively subdivide habitat blocks into smaller and more isolated fragments.

for these species is widespread in the area, and new open- and edge-habitat preferred by the flycatcher and nighthawk will be created.

Less than one percent of the total moose and caribou habitat will be lost, and Environment Canada's[5] benchmark for undisturbed caribou habitat will be maintained. With the exception of recognized population ranges near Thompson, *SARA*-listed boreal woodland caribou have not been identified by provincial or federal resource managers/regulators in the Keeyask regional study area.

Socio-economic Residual Effects

Some of the generation and infrastructure projects' most notable residual socio-economic effects are summarized below.

Economy

In an area with relatively low education and income levels and high unemployment, construction of the project will have a positive impact. The infrastructure and generation projects are estimated to result in 4,300 person-years of direct[6] construction employment in Manitoba[7] and another 3,400 person-years of indirect and induced employment in the province. Approximately 15,500 person-years of employment are expected to be created in the rest of Canada. For more information about employment estimates, see ***Appendix 2.3 – Economic Impact Assessment***.

[5] Environment Canada. 2012. Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. xi + 138pp.

[6] Direct employment is on-site direct employment of Manitoba Hydro (including incremental Manitoba Hydro off-site employees) and contractor employees, which are directly generated by the project. Other direct employment is employment of people who supply raw materials, equipment or services to the initial direct suppliers of the project.

[7] These estimates have been updates since the environmental impact statement was completed.

The environmental impact statement estimated that between 500 and 1,700 person years of construction employment will be filled by qualified northern Aboriginal people; and the JKDA targets 630 person-years of pre-construction and construction employment for qualified KCN members.

About 40 positions are expected to be directly created to operate the project. Under the JKDA, 182 jobs in Manitoba Hydro's existing operations will be targeted for KCN Members over the next 20 years.

KCN businesses have negotiated 11 contracts associated with the infrastructure project, with more to be negotiated for the generation project.

Each of the KCNs expects its investment in the partnership will yield substantial long-term returns that will contribute to community projects and programs.

Infrastructure and Services

Few non-resident project workers are expected to return to live in the communities, which currently have housing shortages. Once the project goes into operation, the KCN communities may choose to apply revenue from their partnership investment to new infrastructure and services. An expansion of infrastructure and services is expected to address the needs of a growing population in Gillam. Once PR 280 is re-routed over the generating station, travel from Gillam to Split Lake and Thompson will be reduced by 53 km.

Personal, Family and Community Life

Undesirable interaction between construction workers and local residents is expected to be much reduced from previous experiences, but this issue will remain a priority for the Town of Gillam, KCN communities, Manitoba Hydro, RCMP and local service providers. It is not possible to fully predict the nature and extent of effects, but residual adverse effects are anticipated; alcohol and drug abuse is an example of one such effect.

Resource Use

The adverse effects agreements are expected to offset adverse effects to KCN resource users. Based on a review of existing information regarding other Aboriginal resource use, adverse effects to other Aboriginal resource users are expected to be minimal.

Heritage Resources

Project-related studies have identified 43 archaeological sites, seven of which will be lost to the project. Materials from these sites will be recovered before they are flooded. The project's studies now provide an archaeological record extending to *ca.* 4800 BP (years before present).

2.1.3.3 Plans to Avoid and Mitigate Transmission Effects

Manitoba Hydro uses a Site Selection and Environmental Assessment (SEAA) process to determine the most appropriate sites and routes for transmission projects. The overarching objective is to minimize adverse effects wherever practicable through siting and routing choices and to maximize environmental management opportunities at each stage of development.

Within a given corridor or region, more than one route is usually available by which two points can be joined. Four such routes were considered for the Keeyask Transmission Project with the selected route representing the greatest balance of economic, environmental and social considerations as determined by the engineers and environmental specialists on the planning team.

Integral to the process was public involvement. Two rounds of public engagement were conducted for the Keeyask Transmission Project to gather public comments on preliminary siting and routing choices, and Manitoba Hydro funded self-directed studies undertaken by TCN, FLCN and the Manitoba Métis Federation.

The final route, which is a combination of two of the four alternatives considered during the public engagement program, has the following advantages:

- has the fewest water crossings
- follows existing or proposed roads and transmission lines to the extent practicable
- has fewer rare, uncommon and cultural plants
- is shortest and among the least costly routes
- separates construction power from backup sources.

A variety of measures have been identified to address potential environmental effects, such as the following:

- Vegetation management activities will be restricted during the spring when birds are nesting.
- Bird diverters will reduce the risk of birds colliding with lines.
- Manitoba Hydro will work with provincial resource managers and resource management boards to develop access controls and hunter-related signage.

The following are measures to address potential socio-economic effects:

- Under the Transmission Line Collective Agreement between Manitoba Hydro, the International Brotherhood of Electrical Workers and the International Union of Operating Engineers, all non supervisory staff must be hired through a project specific hiring preferences that includes northern or local Aboriginal residents as the first preference for employment on transmission construction projects.
- registered trappers will be compensated.
- Workers will be required to participate in cross cultural awareness training; camp rules will be instituted.
- Ceremonies with local Cree Nations will be held to recognize the cultural and spiritual importance of the area.

- A Heritage Management Plan will set out procedures to follow if human remains or heritage resources are found.

2.1.3.4 Residual Effects of the Transmission Project

Residual Environmental Effects

The project will require 7.4 km^2 of land and – as is typical of other transmission project—there will be effects to the terrestrial environment but very little effect on the aquatic environment.

Terrestrial environment

As with the generation projects, overall effects to terrestrial ecosystem diversity are expected to be regionally acceptable because no ecosystem types are lost, the proportion of habitat types is not expected to change substantially, and the area of all priority habitat types will remain above 90% of the historical area. No globally, nationally or provincially significant wetlands will be affected. Effects to intactness are also expected to be regionally acceptable, with the core area remaining over 80%.

Effects on animals, including birds, beaver, moose and caribou, are expected to be regionally acceptable. A small amount of breeding habitat will be lost to three *SARA*-listed species – the olive-sided flycatcher, rusty blackbird and common nighthawk – but habitat for these species is widespread in the area, and the effects will be somewhat offset by new open- and edge-habitat preferred by the flycatcher and nighthawk that will be created.

These small birds are also less likely to collide with transmission wires because of their high maneuverability. A very small percentage of the total moose and caribou habitat will be lost. With the exception of recognized population ranges near Thompson, *SARA*-listed boreal woodland caribou have not been identified by provincial or federal resource managers/regulators in the Keeyask regional study area.

Residual Socio-economic Effects

Residual effects on the economy are anticipated to be positive and residual effects on heritage resources are anticipated to be neutral. A discussion about other socio-economic topics follows.

Land and Resource Use

Residual effects to domestic resource use, commercial trapping and forestry use related to the Keeyask Transmission Project were determined to be small in magnitude and not significant. The effects of past and current projects in the project study area were included in this assessment. These conclusions considered the site selection process, which minimized the impact of a transmission line through routing and resulted in preferred routes that follow existing or planned infrastructure to the extent feasible. Any potential effects that may stem from the line that are not addressed through the site selection process are addressed through additional mitigation measures.

Effects on domestic and commercial resource use are anticipated to overlap in geographic extent only with the proposed Keeyask Generation Project. A consideration of potential cumulative effects is not expected to alter the consideration of residual effects characteristics of the Keeyask Transmission Project, and no additional mitigation is recommended.

Population, Infrastructure and Services

Key concerns of interactions with future projects relates to additional demands on health and emergency services, and transportation infrastructure in the 2017-2018 period. With proposed mitigation measures in place, the residual effects of the transmission project are not expected to be significant, a conclusion which does not change when future projects are also considered.

Personal, Family and Community Life

The effects of the transmission project need to be considered in conjunction with other projects. Given the sizeable increase in the number of potential visits to Gillam by non-local

construction workers and added adverse interaction opportunities, the planning for each of the future projects will be planned, addressed and monitored in a coordinated manner.

Future projects and activities will add to the physical alteration of the land and water in the area. These changes will result in additional effects on culture and spirituality for the local Cree communities and others. Manitoba Hydro will work with these communities and others so that these future projects are planned, constructed and developed in a way that minimizes potential effects as much as possible.

2.1.3.5 Cumulative Effects of Keeyask and Other Past, Present and Future Projects

Cumulative effects assessments were undertaken for the generation and transmission projects. In addition to the effects of the generation and transmission projects, the cumulative effects assessments considered the adverse effects of past, present and future projects on **Valued Environmental Components** (VECs). The cumulative effects assessments concluded that the addition of the generation and transmission projects to the effects the past, current and future projects would not magnify residual adverse effects on any **VECs** beyond acceptable levels.

2.1.3.6 Monitoring Programs

The generation and transmission projects will each implement environmental monitoring and management programs. The monitoring is required to determine if the predictions in the environmental impact statement are correct and if the mitigation measures are working as anticipated. If unexpected effects are detected through monitoring, adaptive management measures will be applied. As part of these programs, the local Cree Nations will be engaged to share their Aboriginal traditional knowledge to monitor the project effects and assist in developing adaptive management measures.

2.1.4 Regulatory and Community Reviews

The Keeyask Project, in particular the generation project, has undergone many years of environmental studies involving Manitoba Hydro, the KCNs (including Aboriginal traditional knowledge from Elders, resource users and other community Members), and a team of scientific experts. The generation project, in effect, has been subject to two environmental evaluations. The first was conducted by the KCNs based on their own Cree worldview; the second was by the partnership for the regulatory reviews currently being conducted by the federal and provincial governments.

2.1.4.1 Community Reviews

The KCNs' evaluation process has been underway for more than a decade with the support of Manitoba Hydro. The process assisted the KCNs in understanding the generation project and its impacts on their communities and members, and to determine the conditions under which they would approve the JKDA and support the project. The project was evaluated by each of the KCNs in terms of their own worldview, values and experience with past hydro-electric development, as well as their relationships with *Askiy*[8].

The KCNs' evaluations are summarized as follows in the Keeyask Generation Project Environmental Impact Statement[9]:

Cree Nation Partners (i.e., TCN and WLFN):

> "The Cree Nation Partners concluded that, like previous hydroelectric development, the Project will have certain major, unavoidable effects. Knowing

[8] Askiy is the word used by the Cree for the whole of the land, water, animals, plants, people, all other creatures and the interrelationship of all things. All things are alive, have spirit and come from *Askiy. Askiy* and all things come from greater than us – Manitou. The Cree culture, spirituality and history are part of *Askiy*. Everyone and everything on *Askiy* is sacred to the Cree.

[9] Executive Summary of the Keeyask Environmental Impact Statement, page 15.

this, they are nevertheless hopeful because they believe their Adverse Effects Agreements and benefit provisions in the Keeyask Joint Development Agreement will enhance their culture by providing opportunities to engage in the customs, practices and traditions integral to their distinctive Cree cultural identity. Similarly, they are hopeful that other benefits – employment, business opportunities and potential income opportunities from the sale of the Project's power – will sustain them physically and culturally and that their homeland ecosystem, although transformed by the Project, can be sustainable, harmonious and balanced."

York Factory First Nation:

"York Factory First Nation Members are cautious *(ayakohmisewin)* about what lies ahead but, as they have had to do many times before, they see the need and importance of adapting while maintaining their culture, teachings and way of life. They are approaching the Keeyask partnership with hope and are determined to keep their values and are intent on participating in mitigation, monitoring, follow-up and adaptive management. They especially want to provide opportunities for their youth and future generation who will inherit the larger outcomes of the Project and the Partnership."

Fox Lake Cree Nation:

"Fox Lake Cree Nation and its Members are continuing to grow and move forward while maintaining their culture, traditional knowledge and ways of being. By understanding and reuniting with their history, values and language, Fox Lake Cree Nation is better able to take control and to self-determine the future. Through their involvement in the Project, Fox Lake Cree Nation Members want to ensure a repeat of the past will never occur again and hope to be better prepared to work to mitigate the potential negative impacts of the Project. Fox Lake Cree Nation intends to take full advantage of positive opportunities

resulting from the Project, while protecting and maintaining their Treaty and Aboriginal rights."

2.1.4.2 Regulatory Reviews

The Environment Act (Manitoba) requires a regulatory review of each of the Keeyask infrastructure, generation and transmission projects. The environmental assessment of the Keeyask Infrastructure Project was completed before the Director of Environmental Assessment and Licensing issued a licence in 2011. The provincial review of the generation project is currently underway, with the Clean Environment Commission scheduled to hold hearings later in 2013. The commission will provide recommendations to the Minister of Conservation and Water Stewardship, who has the authority to issue a licence. The assessment of the transmission project has been submitted to the Director who, after receiving input from other government experts and the public, will determine if a licence will be issued. The infrastructure and transmission projects are included in the cumulative effects assessment of the generation project. Manitoba Conservation and Water Stewardship is also reviewing the transmission project from a more technical perspective as part of the process to respond to the partnership's application for a *Water Power Act* licence.

The generation project also requires a review under the *Canadian Environmental Assessment Act*. Under this Act, the transmission project is included as an ancillary project to the generation project, and the infrastructure project is included in the cumulative effects assessment. The Canadian Environmental Assessment Agency is currently writing a comprehensive study report for the Minister of Environment's consideration. Following the Minister's decision, regulatory departments (e.g. Fisheries and Oceans Canada and Transport Canada) can make their decisions regarding authorizations and approvals. The regulatory processes for the generation and transmission projects are currently on-going.

The Keeyask Hydropower Limited Partnership offered the following conclusion in the generation project's environmental impact statement[10]:

> "The Keeyask Generation Project will cause numerous and widespread environmental and social effects, some of which would have had the potential to be significant. However, using past experience, Aboriginal traditional knowledge and leading scientific and engineering techniques, the Keeyask Hydropower Limited Partnership has mitigated, remediated and/or compensated for these effects, such that the Partnership is confident the Project should proceed. The Project will also produce substantial environmental, social and economic benefits, all of which are consistent with the principles of sustainable development established by the Governments of Canada and Manitoba. The Project will contribute to reductions in greenhouse gases and increases in lake sturgeon populations; it will provide training and employment for hundreds of Aboriginal and northern workers; it will enable the KCN Partners to build capacity and profit from construction contracts and their investment as equity partners; and it will produce clean renewable energy for Manitobans and export markets. As such, the Partnership believes the Partnership should be granted regulatory approval to proceed."

2.1.5 Capital Cost Estimate

The Keeyask capital cost estimate was developed following recommended estimate-development practices of the Association for the Advancement of Cost Engineering International. The estimate development process is a structured approach that builds the estimate from the bottom up as shown in Figure 2.5. For more information see ***Appendix 2.4 - Developing the Keeyask and Conawapa Capital Cost Estimates.***

[10] Response to the EIS Guidelines, page 10-4

Figure 2.5 MANITOBA HYDRO'S COST ESTIMATE DEVELOPMENT PROCESS

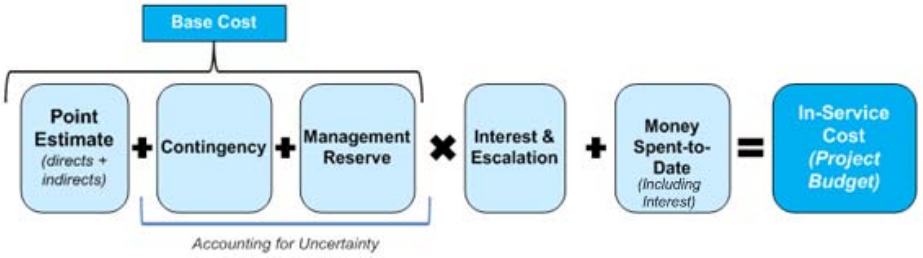


Table 2.2 SUMMARY OF KEEYASK CAPITAL COST ESTIMATE

	Keeyask 2019/20 CEF 12/IFF12
	(Billions of Dollars)
Generating Station (G.S.)	
Point Estimate	3.05
Contingency	0.53
Management Reserve	
Labour Reserve	0.38
Escalation Reserve	0.12
Total Base Dollars	**4.1**
Total Dollars Spent as of March 31, 2012	0.50
2012 Base Estimate	4.08
Escalation at Consumer Price Index levels	0.40
Capitalized Interest	0.85
G.S. In-Service Cost:	**5.8**
Interest On MH Equity	**0.2**
Generation Outlet Transmission (GOT)	
Total Dollars Spent as of March 31, 2012	0.00
2012 Base Estimate	0.16
Escalation at Consumer Price Index levels	0.02
Capitalized Interest	0.03
GOT In-Service Cost:	0.2
Total In-Service Cost	**6.2**

The project in-service cost estimate (Table 2.2) includes all base costs as well as money spent to date, interest costs and escalation costs: it represents the total cost of the project once in service. The total budgeted in-service cost for the project is $6.2 billion. This includes $0.3 billion for the Keeyask Infrastructure Project and $0.2 billion for the Keeyask Transmission

Project. This is the cost budgeted in the CEF/IFF; this cost has a higher probability of being higher— rather than lower—than the actual cost.

2.2 The Conawapa Project

The Conawapa Project consists of two components, the 1,485 MW Conawapa Generation Project and the Conawapa Transmission Outlet Project.

The generating station will be located on the lower Nelson River 30 km downstream of the Limestone G.S. (refer to Map 2.1), 270 km northeast of Thompson, 90 km northeast of Gillam, 31 km northeast of Fox Lake (Bird), and 775 km north of Winnipeg. Most of the project will be located in the Fox Lake Resource Management Area; the upper portion of the reservoir will stretch into the Split Lake Resource Management Area, and the lower portion of the hydraulic zone of influence reaches into the York Factory Resource Management Area.

The generation project will take over 10 years to construct, scheduled to begin in late 2017 and concluding with decommissioning of temporary infrastructure and site rehabilitation in 2028. The first of 10 generating units will begin producing power in May 2026; the remaining nine units will be in production by October 2027. The final two years of construction will overlap with the first two years of operation. The budgeted in-service cost for the Conawapa Project, including interest and escalation, is $10.2 billion.

Conawapa will add an annual average of 7,000 GWh of energy, which will be integrated into the Manitoba Hydro system—representing enough energy to power approximately 640,000 Manitoba homes. Table 2.3summarizes several key project design parameters.

Table 2.3 CONAWAPA GENERATING STATION DESIGN PARAMETER

Parameter	Value
Full Supply Level (FSL) Winter/Open Water	57.2 m asl/56.7 m asl
Initial Reservoir Area	37.4 km^2
Initial Flooded Area	5.1 km^2
Rated Total Output Power - open water/end of winter	1,485 / 1,410 MW
Net System Capacity Addition – open water / end of winter	1,395 / 1,300 MW
Generator Rated Output	146 MW / 176 MVA
Average Annual Energy- gross	8,170 GWh
Average Annual Energy – net of losses at Limestone G.S.	7,000 GWh
Annual Dependable Energy	4,650 GWh

2.2.1 Conawapa Ownership Structure

2.2.1.1 Ownership of the Generation Project

Although the generation ownership structure has not been finalized, Manitoba Hydro is committed to the following:

- providing early involvement and extensive consultations with First Nations in planning the project
- providing a forum for addressing community issues and concerns, incorporating Aboriginal traditional knowledge, and creating understanding of project impacts and benefits
- providing long-term, sustainable benefits for First Nations in the vicinity of the project. As with Wuskwatim and the proposed Keeyask Project, the focus of these benefits will be on income, training, employment and business opportunities
- providing opportunities for First Nations in the vicinity of the project to participate in the environmental assessment, monitoring and governance of the project.

These commitments go well beyond Manitoba Hydro's obligations regarding adverse effects agreements, which will also be addressed consistent with existing First Nation agreements. The broader regional communities will also have access to project benefits, which may include some form of income sharing; these plans are still being developed.

2.2.1.2 Ownership of the Transmission Project

Manitoba Hydro will own and operate the Conawapa Transmission Outlet Project.

2.2.2 Conawapa Project Components

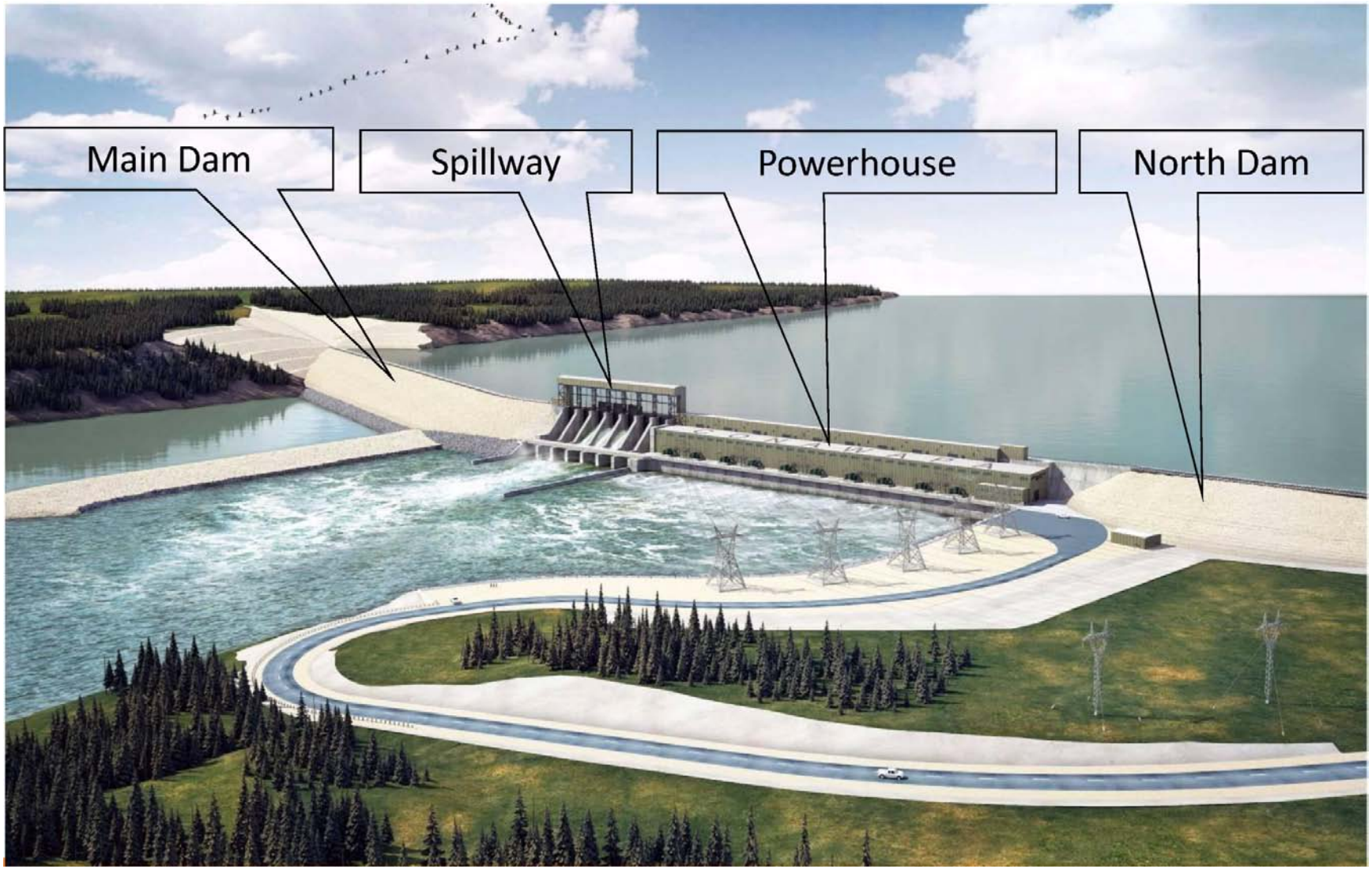
2.2.2.1 Components of the Generation Project

The generation project consists of principal structures and supporting infrastructure.

Principal Structures

Principal structures, as identified in Figure 2.6, will consist of a powerhouse, a spillway, two dams, and a reservoir. The powerhouse contains equipment for producing electricity, including 10 turbines and generators, a control room and service bay. The seven-bay spillway is required to divert the river when the project is being constructed and to manage surplus water flows once it goes into production; the dams will contain the reservoir upstream of the principal structures. The principal structures will stretch 1.46 km across the Nelson River. The reservoir will extend 30 km upstream from the generating station to the Limestone G.S. The reservoir, almost all of which is existing waterway, will initially be 37.4 km^2 in area, expanding by one to two km^2 over the ensuing 30 years. The project will initially flood only 5.1 km^2 of land.

Figure 2.6 CONAWAPA PRINCIPAL STRUCTURES



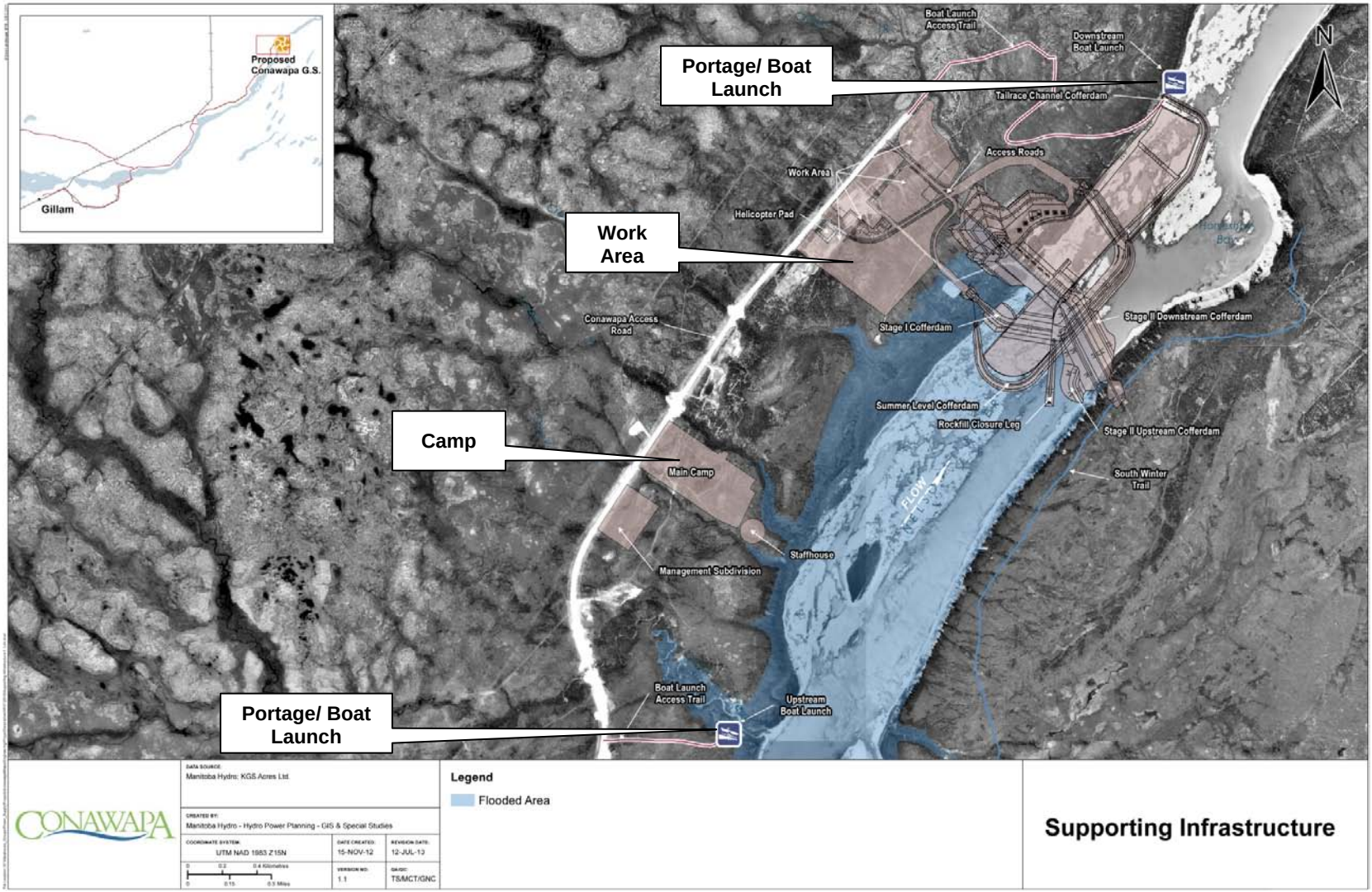
Supporting Infrastructure

Supporting infrastructure see Figure 2.7 will consist of permanent facilities to construct and operate the generating station, and temporary facilities required only to construct the principal structures.

Permanent supporting infrastructure will include a staff house, placement areas for excavated materials, a transmission tower spur, boat launches, a portage, and safety and security facilities, as well as some haul roads, borrow areas, and portions of some cofferdams. An existing 24 km access road, being upgraded as part of the Keewatinoow Converter Station component of the Bipole III Transmission Project, will also be used by the Conawapa Project, as will a communication tower. Conawapa will initially utilize the construction camp originally used for the Keewatinoow Converter Station, prior to a larger construction camp being constructed for Conawapa.

Temporary infrastructure includes a camp and work areas, cofferdams, rock groins, water and wastewater treatment facilities, solid waste collection and disposal, concrete batch plant, explosives magazine, boat launches, safety booms, and other safety and security facilities, as well as some haul roads, borrow areas and portions of some cofferdams.

Figure 2.7 CONAWAPA SUPPORTING STRUCTURES



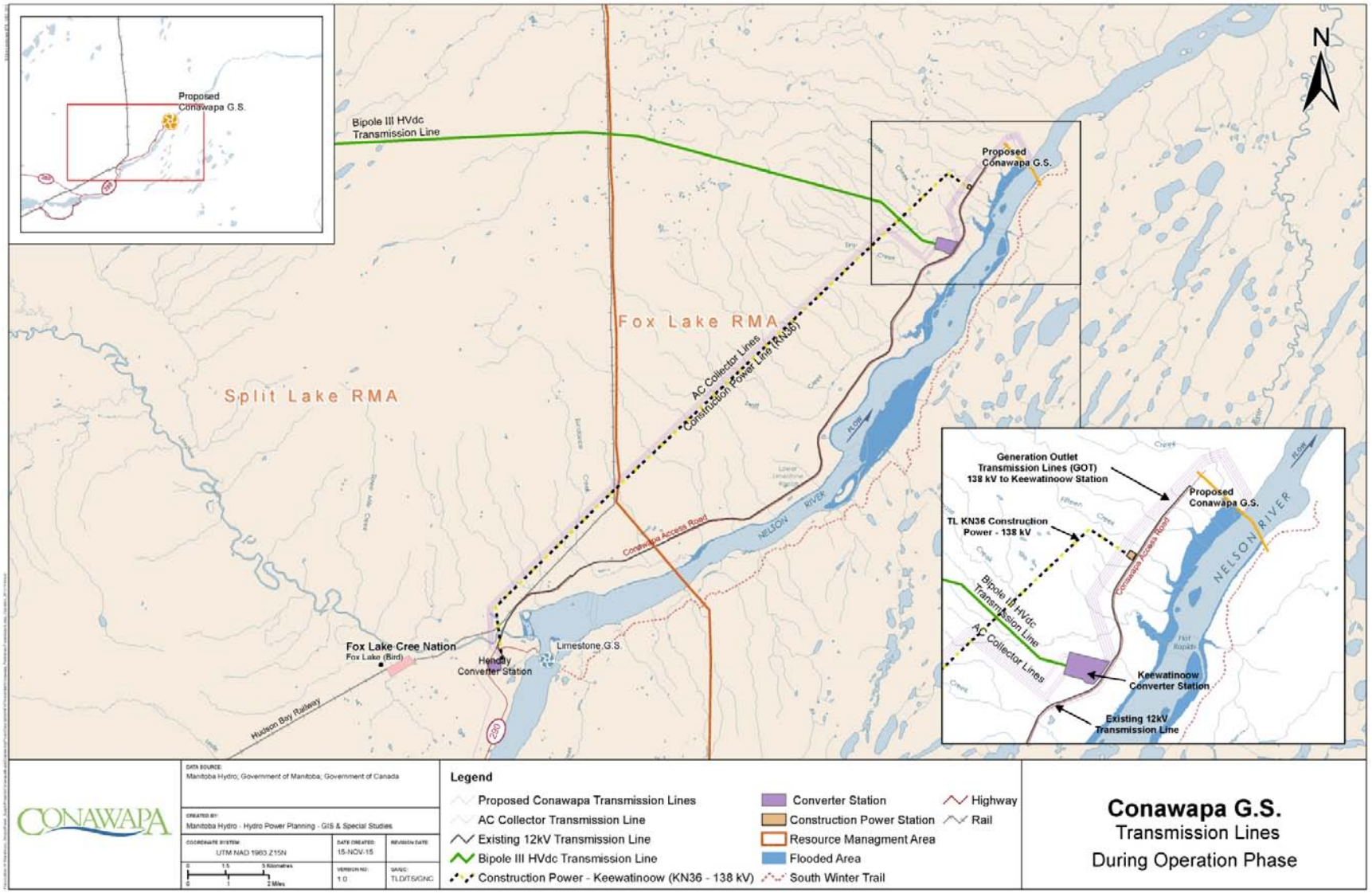
2.2.2.2 Components of the Transmission Project

The Conawapa Transmission Outlet Project (Map 2.4) will provide power to construct the generating station and to transmit the power produced at the generating station once it goes into production (i.e. “generation outlet transmission capacity”).

A new 3 km 230 kV line from the Keewatinoow Converter Station and a 230/12 kV transformer will provide power to construct the generating station. The line and transformer will be salvaged once the generating station goes into operation.

For the outlet transmission facilities, 5 new 7 km transmission lines will be constructed in a single right-of-way between the Conawapa G.S. and Keewatinoow Converter Station, where the power will enter Manitoba Hydro’s integrated power system. Upgrades to terminate the 5 lines will also be required at the Keewatinoow Converter Station.

Map 2.4 CONAWAPA OUTLET TRANSMISSION



2.2.3 Environmental and Socio-economic Effects

Studies for the Conawapa Project, including the environmental assessment, are currently on-going. The following information is based on information collected to date by Manitoba Hydro's study team, information provided by the five local Cree Nations (FLCN, YFFN, TCN, WLFN and, to a lesser extent, Shamattawa First Nation), and Manitoba Hydro's past experience, notably with the Keeyask Project and its extensive engagement of the local Cree Nations.

2.2.3.1 Plans to Avoid and Reduce Generation Effects

As noted in section 2.1.3.1, the hydro-electric potential of the lower Nelson River has undergone decades of study, going back to the 1920s, originally by the Governments of Canada and Manitoba and later with Manitoba Hydro. Studies in the past decade have involved five local Cree Nations in the vicinity of the project. Early feasibility studies examined a number of development options in the Limestone to Gillam Island reach. More recent studies have also considered potential environmental and socio-economic effects.

The following are examples of measures being planned for the Conawapa Project to avoid or reduce environmental impacts:

- The net amount of flooding in the Long Spruce-Conawapa reach of the Nelson River was reduced from 35 km^2 to 7 km^2 by developing two projects instead of one, with Limestone as a lower-head option and Conawapa located at its planned axis.
- An axis was selected that will cause less flooding, avoid a 3,000-year-old heritage find, and reduce construction time by a year.
- The project will normally operate as a run-of-river project with most operations within a small 1.5 m operating range.
- The turbines will enable 90% of the fish up to 500 mm in length passing downstream through the powerhouse to survive.
- The small area of the future reservoir that has trees and woody vegetation will be cleared.

- Existing fish habitat will be enhanced and new habitat developed to offset habitat lost to the project.
- Lake sturgeon are receiving special attention (see ***Appendix 2.1 – Lake Sturgeon – Mitigation and Enhancement***), including a stocking program; a stocking program is also being considered for brook trout, and
- The Conawapa Project will participate in a process being developed through the Keeyask Project to coordinate its caribou-related activities with government authorities, caribou management boards and resource management boards.

.

A number of measures are also in place to address socio-economic effects:

- The Burntwood-Nelson Agreement[11] provides employment preferences for qualified northern Aboriginal people.
- As noted in section 2.1.2.1, the Gillam Redevelopment and Expansion Program is also being undertaken to refurbish and enhance that community's infrastructure and services to meet the needs of the existing and expanding population.
- A corporate-wide, collaborative approach is in place to deal with public safety concerns related to projects in the vicinity of Gillam, including the Conawapa project.
- PR 280 is being upgraded (in advance of the Keeyask Generation Project).
- As noted in section 2.2.1.1, Manitoba Hydro intends to pursue agreements with the five local Cree Nations regarding long-term sustainable benefits (i.e. training, employment, and business opportunities) and their participation in the environmental assessment, monitoring and governance of the project. Manitoba Hydro and the communities currently have processes to involve them in the planning and environmental assessment of the project. The broader regional communities will also have access to project benefits; these plans are still being developed.

[11] The Burntwood Nelson Agreement is the collective agreement between the Hydro Project Management Association, representing Manitoba Hydro management, and the unions of the Allied Hydro Council, representing workers, for construction of hydro-electric projects on the Burntwood and Nelson Rivers.

- Adverse effects agreements will also be required in accordance with existing First Nation agreements.

2.2.3.2 Residual Effects of the Generation Project

Since the environmental assessment is on-going, conclusions about project effects are preliminary and limited at this time. The following is an overview of some of the more notable anticipated effects, based on studies to date and experience with past projects.

Residual Environmental Effects

Physical environment

In total, the generation project will require 20.5 km^2 of land during construction and 8.4 km^2 during operations. The project will flood 5.1 km^2 of land. The reservoir will be 37.4 km^2, of which 32.3 km^2 is higher water on existing waterways.

As with the Keeyask Generation Project, the Pembina Institute has undertaken a life-cycle analysis of greenhouse gas emissions from Conawapa. Based on a 100-year project life, Conawapa is expected to produce approximately 900,000 tonnes of carbon dioxide equivalents. Thus, on a per GWh basis, Conawapa will produce fewer greenhouse gases in a century of operation than an equivalent coal-fired generating station in 50 days or a gas-fired station in 100 days. On a percentage basis, based on life-cycle greenhouse gas emissions, Conawapa will produce less than 0.5% of the greenhouse emissions of a combined-cycle gas turbine and even less when compared to a simple-cycle gas or a coal-fired station. The analysis also found Conawapa compared favourably to commercial-sized wind farms, with only 15% of the greenhouse gas emissions per unit of energy. For more information, see ***Appendix 7.3 – Life Cycle Greenhouse Gas Assessment Overview.***

Aquatic environment

The overall long-term productive capacity of fish habitat is expected to be similar to current conditions, but there may be a shift in species composition. Lake sturgeon may experience some short-term declines, but with the implementation of a stocking program their numbers are expected to increase in the long-term. Mitigation measures for maintaining brook trout populations, including the possibility of a stocking program, are still being studied.

Terrestrial Environment

While the environmental assessment is on-going, Manitoba Hydro expects the limited footprint will also limit the project's terrestrial effects. The assessment includes effects not only along the Nelson River, but also along the regionally-rare ravines and the habitats they contain. Caribou are also receiving special attention, including whether migratory barren-ground, coastal or summer resident caribou may avoid the area during the construction phase of the project. Caribou are expected to continue to use the area during the operation phase.

Residual Socio-economic Effects

Economy

Construction of the generation project is expected to create over 5,000 person-years of direct employment and 4,100 of indirect and induced person-years of employment in Manitoba, and almost another 21,000 total person-years in the rest of Canada. Local and northern communities will benefit from training, employment and business opportunities, but no estimates have yet been calculated for the number of person-years. For more information about employment estimates, please see ***Appendix 2.3 – Economic Impact Assessment.***

Infrastructure and Services; Personal, Family and Community Life; Resource Use; and Heritage Resources

Conawapa is expected to have effects similar in nature to those of Keeyask. As with Keeyask, Manitoba Hydro, in coordination with the local communities, will develop mitigation measures

to eliminate or reduce adverse effects and, in some cases, to enhance benefits. Among these will be adverse effects agreements with the directly-affected local Cree Nations, plans to address potential public safety concerns in Gillam, and the on-going Gillam Redevelopment and Expansion Program to address long-term effects to infrastructure and services in that community.

2.2.3.3 Plans to Avoid and Reduce Potential Transmission Effects

As noted in section 2.1.3.3, Manitoba Hydro uses a Site Selection and Environmental Assessment process to determine the most appropriate sites and routes for transmission projects. The overarching objective is to avoid adverse effects wherever practicable through routing and siting choices and to maximize environmental management opportunities at each stage of development, from pre-licensing through post-construction.

The Conawapa Transmission Outlet Project is still early in the planning process. At this time, Manitoba Hydro is able to ascertain that the Conawapa Transmission Project transmission lines will be short, between 3 and 7 km, and generally near or in a developed area between the Keewatinoow and Conawapa stations.

For the most part, project-specific information about potential effects is not available. However, some potential effects and mitigation measures – besides the primary strategy of routing lines to avoid impacts – can be anticipated, based on many years of successful planning and development of transmission projects. For example:

- Winter construction may reduce effects on the terrestrial landscape.
- Construction may also be timed to avoid animal breeding seasons.
- Buffers may be retained close to sensitive sites.
- Erosion control and sediment management practices may be applied.

- Environmental management programs provide direction on a number of topics, such as erosion control, sediment management, vegetation management and rehabilitation, access, emergency response and monitoring.
- Governmental guidance, such as operational statements from the Department of Fisheries and Oceans, are followed.

Transmission projects also avoid undesirable socio-economic effects to the extent practicable during the site selection process. Other mitigation measures may include the following:

- Trapline holders may also be compensated.
- Small, short-term construction crews may be accommodated in camps or, where appropriate, in a community.
- Heritage resource management plans may be developed with the involvement of local communities.

2.2.3.4 Residual Effects of the Transmission Project

The Conawapa Outlet Transmission Project can be expected to result in the following residual effects, which are typical of transmission projects:

- changes to the land and landscape (due to right-of-way clearing)
- changes in biophysical habitat
- increases in access for resource users
- increases in job creation and in regional economic activity.

2.2.4 Regulatory Reviews

Generation Project

The Conawapa Generation Project has undergone close to a decade of environmental studies involving Manitoba Hydro and local Cree Nations (including Aboriginal knowledge from Elders, resource users and other community members), and a team of scientific experts. An environmental assessment of the generation project is currently proceeding in accordance with process agreements with FLCN, YFFN, TCN and WLFN and a letter of agreement with Shamattawa First Nation. These agreements provide the framework and funding for the communities' involvement in planning and studying the project.

The project will be subject to review under *The Environment Act* (Manitoba) and the *Canadian Environmental Assessment Act.* No application has been filed to begin the official regulatory review process. It will also require a licence under *The Water Power Act* (Manitoba).

Transmission Project

The Conawapa Transmission Outlet Project is subject to environmental regulatory review under *The Environment Act*. This project is in the early stages of planning and assessment, and no application has been submitted to begin the official regulatory process.

2.2.5 Capital Estimates

As with the Keeyask capital cost estimate, the Conawapa estimate was developed following recommended estimate-development practices of the Association for the Advancement of Cost Engineering International. For more information see ***Appendix 2.4 – Developing the Keeyask and Conawapa Capital-Cost Estimates.***

Table 2.4 CONAWAPA CAPITAL COST ESTIMATE

	Conawapa 2025/26 CEF 12/IFF12
	(Billions of Dollars)
Generating Station (G.S.)	
Point Estimate	4.53
Contingency	0.75
Management Reserve	
Labour Reserve	0.51
Escalation Reserve	0.34
Total Base Dollars	**6.1**
Total Dollars Spent as of March 31, 2012	0.23
2012 Base Estimate	6.13
Escalation at Consumer Price Index level	1.24
Capitalized Interest	2.59
G.S. In-Service Cost:	**10.2**
Interest On MH Equity	**N/A**
Generation Outlet Transmission (GOT)	
Total Dollars Spent as of March 31, 2012	0.00
2012 Base Estimate	0.01
Escalation at Consumer Price Index level	0.00
Capitalized Interest	0.00
GOT In-Service Cost:	0.00
Total In-Service Cost	**10.2**

The project in-service cost shown in Table 2.4 includes all base costs as well as money spent to date, interest costs and escalation costs: it represents the total cost of the project once in

service. The total budgeted in-service cost for the Conawapa Project is $10.2 billion[12]. This includes $10 million for the Conawapa Transmission Project. This is the cost budgeted in the CEF/IFF and has a higher probability of being higher – rather than lower – than the actual cost.

2.3 North-South Transmission System Upgrade Project

The majority of Conawapa's power can be transmitted from northern Manitoba to southern customers on Manitoba Hydro's high-voltage direct-current (HVDC) transmission system (including Bipole III, which is expected to be licensed and constructed by that time). To transmit the remainder of the generated power to customers, upgrades are required to the existing northern 230 kV alternating current (AC) system and existing HVDC transmission system. Together, these upgrades are referenced as the North-South Transmission System Upgrade Project.

The project would have an in-service date coinciding with the in-service date of the last Conawapa units.

2.3.1 Project Components

The HVDC collector system upgrades include, but are not limited to, the following:

- splitting northern HVDC collector systems into two
- addition of a new 300 MVar filter at the Radisson Converter Station
- addition of a new synchronous condenser, circuit breaker replacements and a 230 kV AC line sectionalization at the Riel Converter Station
- Kettle Generating unit ring bus connection.

[12] This cost is based on a 2025 in-service date. A new estimate is being prepared for a 2026 in-service date.

All of the HVDC collector system upgrades will occur within or immediately adjacent to the Radisson Converter Station and Kettle G.S. in the north and the Riel Converter Station in the south.

At this time, the required AC upgrades are still under study; however, the following new 230 kV lines have been identified to support an additional 185 MW of north-south transmission:

- Kelsey Generating Station to Birchtree Station (Thompson), approximately 80 km
- Birchtree Station to Wuskwatim G.S., approximately 42 km
- Herblet Lake Station (Snow Lake) to Overflowing River Station (The Pas), approximately 210 km
- Vermillion Station (Dauphin) to Neepawa Station, approximately 130 km.

Manitoba Hydro's first preference would normally be to route the new lines adjacent to existing lines. Although the lines are still under study and no decisions have been made, that may be possible with the first three lines; the fourth upgrade (i.e. Vermillion to Neepawa) will likely require a new route.

2.3.2 Project Ownership

The North-South Transmission Upgrade Project will be owned and developed by Manitoba Hydro.

2.3.3 Environmental and Socio-economic Effects

Section 2.2.3.3 discusses general approaches to avoiding and mitigating potential effects of transmission projects. Those approaches are also applicable to the North-South Transmission Upgrade Project.

As noted earlier, three of the four lines may be routed adjacent to existing lines (subject to the results of further study). If this can be accomplished, some potential effects could be avoided or reduced.

The North-South Transmission Project may also need to develop measures to manage effects on woodland caribou, a *SARA*-listed species that inhabits the project region. Manitoba Hydro has successfully assessed and managed these types of effects with other transmission projects, and will apply that expertise to manage effects related to the North-South Project.

The project will also cross agricultural lands. Where appropriate, Manitoba Hydro has an established approach for compensating owners of agricultural lands affected by transmission projects.

2.3.4 Regulatory Review

The North-South Transmission System Upgrade Project will be subject to environmental regulatory review under *The Environment Act* (Manitoba). This project is in the early stages of planning and assessment, and no application has been submitted to begin the official regulatory process.

2.3.5 Capital Cost

The estimated $498 million capital cost for the North-South Transmission System Upgrade Project includes the HVDC transmission upgrades and AC upgrades. The estimate had been applied to the economic and financial calculations with both Keeyask and Conawapa added to the system.

2.4 Manitoba-Minnesota Transmission Project

The proposed Manitoba-Minnesota Transmission Project is a 750 MW, 500 kV AC transmission line in southeastern Manitoba, connecting at the border with Minnesota Power's proposed Great Northern Transmission Line.

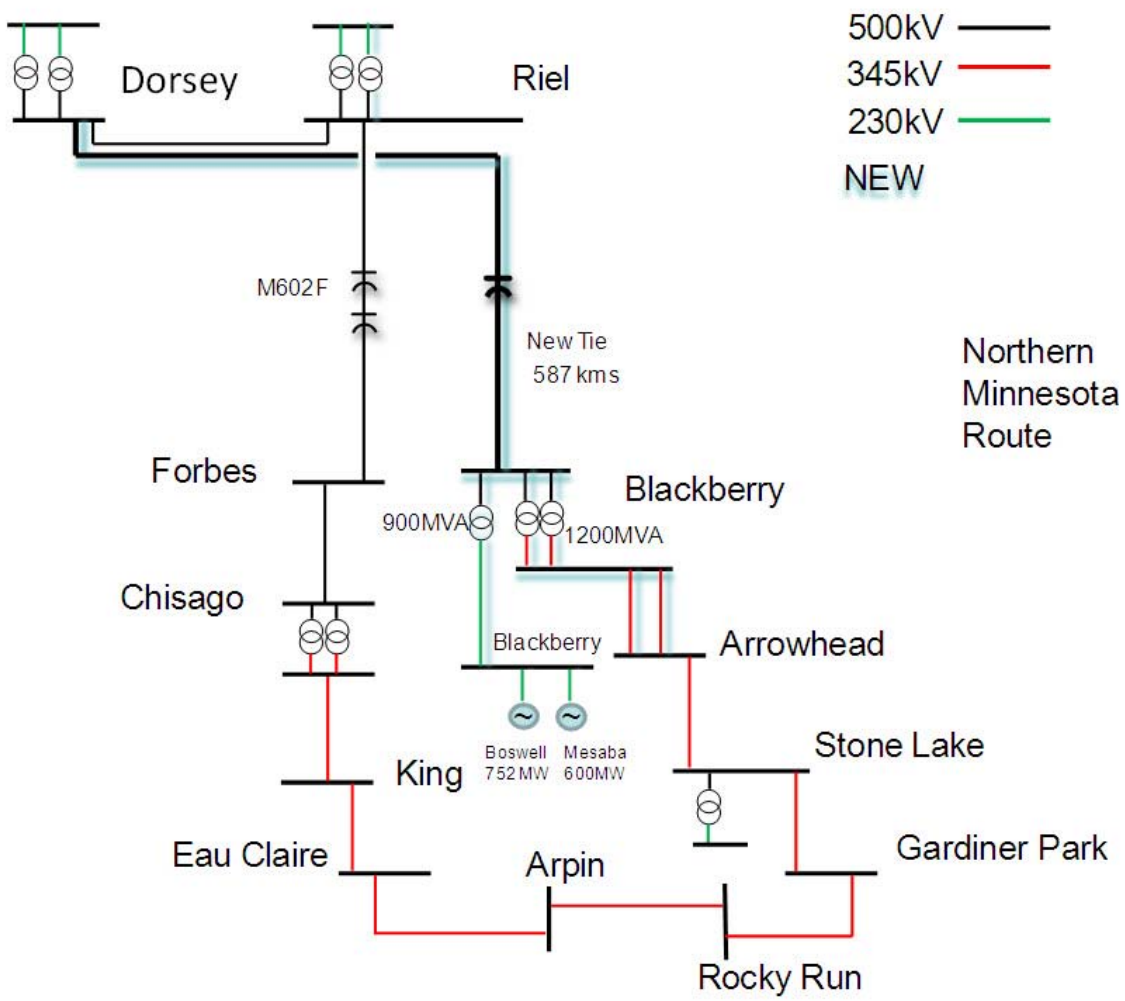
The Manitoba-Minnesota Transmission Project will enable power to be exported to the United States based on current sales agreements, improve reliability and import capacity in emergency and drought situations, and increase access to markets in the U.S. The projected in service date is 2020.

2.4.1 Project Components

The proposed interconnection consists of a new single-circuit 500 kV AC transmission line originating from Dorsey Station, northwest of Winnipeg, running south around Winnipeg, passing near the Riel Station, and then continuing in a south-east direction toward the international border. The scope of work includes the transmission line between Dorsey and the U.S. border; a 300 MVAr shunt reactor, an approximately 75 MVAr shunt capacitor and termination facilities at Dorsey; a 1200 MVA 230/500 kV transformer and an approximately 150 MVAr shunt capacitor at Riel; and a three-phase 300 MVA 230 kV phase-shifting transformer at the Glenboro substation.

After connecting with the Great Northern Transmission Line, the new line will terminate in a new 500 kV substation adjacent to the existing Blackberry substation in Minnesota, located approximately 100 km northwest of Duluth, Minnesota. The approximate total length of the 500 kV transmission line between Dorsey and Blackberry substations is 600 km, with about one-third constructed in Manitoba. An electrical single-line diagram of the interconnection is shown in Figure 2.8.

Figure 2.8 SINGLE LINE DIAGRAM OF MANITOBA TO NORTHERN MINNESOTA TRANSMISSION PLAN



The existing 500 kV transmission line will be sectionalized at Riel in 2014 to improve system reliability. The resultant 500 kV infrastructure between the Riel, Forbes and Chisago substations, as well as a potential 345 kV transmission connection between the Blackberry and Arrowhead substations, is also shown in this figure. If the potential 345 kV line is built, the transfer capability of the interconnection could increase to 1,100 MW (which is not part of the current project).

2.4.2 Project Ownership

The Manitoba-Minnesota Transmission Project will be built, owned and operated by Manitoba Hydro.

See section 2.4.5 for a discussion on the Great Northern Transmission Line.

2.4.3 Regulatory Process

The project will be subject to review under the *National Energy Board Act* and *The Environment Act* (Manitoba). Both regulatory processes require the development of an environmental impact statement that will be subject to review under the respective federal and provincial regulatory processes.

2.4.4 Environmental and Socio-economic Effects

The Manitoba-Minnesota Project is still in the early stages of study. A Manitoba Hydro website was launched in July, and three rounds of a Public Engagement Process are planned between the fall of 2013 and early 2015.

For a review of potential environmental and socio-economic effects and mitigation associated with transmission line construction and operation, please see section 2.3.3.

2.4.5 Capital Cost

The Manitoba-Minnesota Transmission Project in-service cost is estimated to be $350 million. This project and cost is only for the Manitoba portion of the interconnection.

Manitoba Hydro's Preferred Development Plan assumes a 250 MW Sale to Minnesota Power (MP), which will require new transmission service, and a 300 MW sale to Wisconsin Public Service (WPS), of which 200 MW will require new transmission service (100 MW is currently

being delivered over the existing transmission service). For evaluation purposes, it is assumed that the cost of this new transmission service will be reflected in the sale arrangement with MP and WPS. It is also assumed that Manitoba Hydro will be responsible for 40% of the capital and ongoing operating costs associated with the U.S. portion of the 750 MW interconnection facilities, with the remainder of the transmission costs to be borne by MP and WPS.

While the Preferred Development Plan includes a 750 MW, 500 kV interconnection line, some alternative development plans reduce the interconnection capacity to a 250 MW, 230 kV line. The Great Northern Transmission Line is being proposed by MP in order to receive delivery of the 250 MW of power it has agreed to purchase from Manitoba Hydro under the MP 250 MW power agreement during the period 2020 to 2035. The estimated cost of the Minnesota section of the 750 MW, 500 kV line is in the order of $700 million (U.S. 2020 base dollars). For a 750 MW, 500 kV line, Manitoba Hydro will be responsible for a portion of capital or on-going operating costs associated with the U.S. portion of the interconnection facilities. With a 250 MW line, Manitoba Hydro will not be responsible for capital or ongoing operating costs associated with the U.S. portion of the interconnection facilities.

The 250 MW, 230 kV line would begin at the new Riel Converter Station northeast of Winnipeg, rather than the Dorsey Station. It could generally follow the same proposed route as the 750 MW line (500 kV). Some specific routing could change and additional investigation would be required to find the most appropriate route for the 230 kV line.