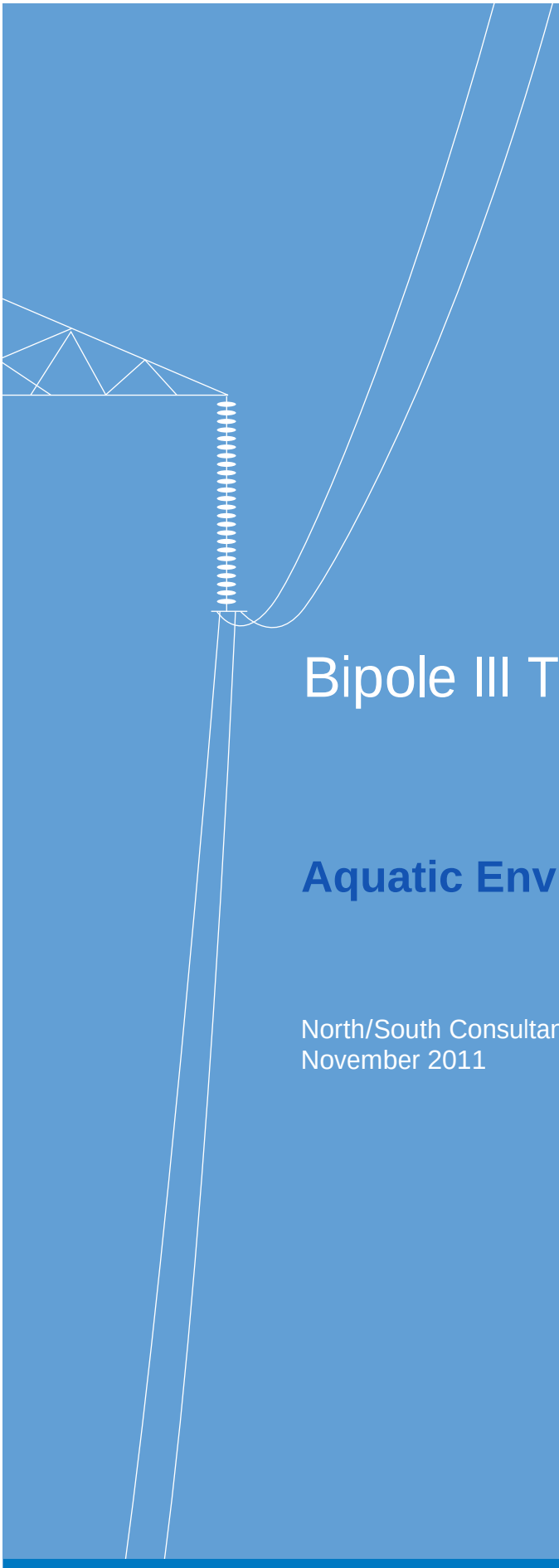

Bipole III Transmission Project

Aquatic Environment Technical Report

North/South Consultants Inc.
November 2011

Manitoba Hydro

Bipole III Transmission Project

Environmental Assessment Technical Report

AQUATIC ENVIRONMENT

North/South Consultants Inc. · Aquatic Environment Specialists

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BIPOLE III TRANSMISSION PROJECT

Environmental Assessment Technical Report

Aquatic Environment

Report Prepared for

Manitoba Hydro

November 2011

By

North/South Consultants Inc.

In Association with:

MMM GROUP

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EXECUTIVE SUMMARY

Manitoba Hydro is currently proposing the development of a new high voltage direct current (HVdc) transmission line, known as Bipole III, to improve the overall reliability and dependability of transporting hydroelectric power from northern Manitoba to the south. This transmission line would link a new northern converter station (Keewatinoow Converter Station), located near the proposed site of the Conawapa Generating Station (GS) with a new southern converter station located at the existing Riel Station site in the Rural Municipality of Springfield.

Other components of Bipole III include permanent onsite staff facilities at Keewatinoow, an offsite construction camp near Keewatinoow, ancillary transmission lines (collector lines and lines for construction power), ground electrode sites for each converter station, a northern ground electrode line, borrow sites, and construction access trails to the HVdc transmission line.

This technical report is intended to provide a description of the existing aquatic environment, prescribed mitigation, and an assessment of potential effects of the project on the aquatic environment. Ultimately, this report will serve as supporting material for the development of the Environmental Impact Statement (EIS) for the project.

A Site Selection and Environmental Assessment (SSEA) process was undertaken to select a preferred route (PR) for the Bipole III transmission line. The Bipole III PR right-of-way (RoW) is 66 m in width and within a 3 mile wide study corridor. The extent of the study area for the aquatic environment focused on the 66 m RoW. Where sensitive aquatic features were recorded within the RoW, information gathering was extended beyond the RoW, but remained within the 3 mile corridor.

The study area for both the collector and construction power lines included a 5 km wide study corridor centered on their RoWs; a collective 310 m shared RoW (for most of their length) and a 60 m RoW where lines ran separately. The study area for the northern ground electrode line also included a 5 km wide study corridor centered on its 50 m RoW. The study area for the Keewatinoow Converter Station site was confined to a 1 km^2 area. The northern ground electrode study area was 4 km^2 to allow for the specific siting of the electrode to be made in the most appropriate location. The study area for the southern ground electrode site was approximately 2.6 km^2 (1 mile x 1 mile). The study area for the construction camp included an area of approximately 10 km^2, but was focused on the immediate footprint of the camp; an area of approximately 0.5 km^2. Currently borrow sites and excavated placement material locations have been identified in the Keewatinoow area. The study area for the Keewatinoow borrow sites and placement areas was restricted to the mapped deposit and placement areas buffered by approximately 1 km.

The assessment of the aquatic environment and the effects of the Bipole III project employed the use of valued ecosystem components (VECs). Fish habitat and surface water quality were the two VECs used in this assessment.

Since predicted project-related effects on surface water quality can be mitigated through implementation of the protection plans proposed to protect fish habitat, it was discussed conjointly as the Fish Habitat VEC. Provincial guidelines for surface water quality as it relates to humans and aquatic life (Manitoba Water Stewardship 2011) were also given consideration.

Fish habitat is considered a VEC (Section 35.1 of the *Fisheries Act* prohibits HADD of fish habitat) and is generally used as a surrogate for measuring productive capacity. Watercourses at the transmission line crossings and within the ground electrode, converter station, and construction camp sites were assessed

based on fish habitat quality and the sensitivity of the habitat to disturbance. These assessments were used to determine the potential effect of the project components on the existing aquatic habitat and to guide the prescription of mitigation measures. Classification of fish habitat quality and sensitivity to disturbance were developed using the rationale described in "Habitat Conservation and Protection Guidelines" (DFO 1998). "Fish habitat quality" refers to the habitat within the potentially impacted portion of the stream as it currently exists. "Sensitivity to disturbance" considers the potential for immediate or residual impacts that could result from disturbance of the streambed, banks, or riparian zones.

Existing aquatic environment information was collected and analyzed for the project areas. This information included the review of available fish and fish habitat information, local knowledge and Aboriginal Traditional Knowledge (ATK), and field studies conducted at a selected subsample (57) of the stream crossing sites for the PR transmission line, converter station, and ground electrode sites.

Waterbodies near transmission line RoWs that would require protection under "Forest Management Guidelines For Riparian Management Areas" (Manitoba Conservation and Manitoba Water Stewardship 2008) were also identified. Waterbodies within a 50 m 'buffer zone' of the RoW route were included in this assessment. This 50 m buffer zone consisted of a 20 m riparian area (a conservative average for most waterbodies) plus a 30 m Riparian Management Area (RMA) extending beyond the riparian area (based on the riparian guideline for perennial waterbodies with important fish habitat). Waterbodies within the buffer zone were evaluated and site-specific RMA sizes determined for each based on flow regime and fish habitat. The riparian guidelines suggest protection measures for forest clearing within RMAs, which will be applied where applicable.

The transmission line PR crosses a total of 317 watercourses. Of these, 54 were classified as No Fish Habitat, 185 as Marginal, 78 as Important, and none of the watercourses were classified as Critical fish habitat. The sensitivity of watercourse crossing sites to disturbance was rated as Low for 172 sites, Moderate for 137 and High for eight sites. The Moderate rating was due to the presence of soft/saturated floodplains and/or unstable stream banks; the High designation was due to the presence of unstable banks with active slumping and erosion and the presence of Important fish habitat. The eight sites with High habitat sensitivity and fish habitat included the Burntwood, Mitishto, Steeprock, Woody, North Duck, Assiniboine, Red, and Rat rivers.

The Bipole III PR had 57 waterbodies within the 50 m buffer zone for the RoW that would require mitigation under riparian management guidelines. Of these, 39 were assessed as No Fish Habitat, 15 as Marginal, and three as Important. No waterbodies were assessed as Critical. Twenty-one of these waterbodies had ephemeral flow regimes, 32 waterbodies had intermittent flow regimes, and four had perennial flow regimes. Perennial waterbodies or waterbodies with Important fish habitat were assigned a 30 m Riparian Buffer (RB); waterbodies with Marginal fish habitat were assigned 15 m RBs; ephemeral or intermittent streams with No Fish Habitat were assigned 7 m RB.

Twenty five of the 44 construction access trails have stream crossings with a total of 125 crossings. All access trails are on existing linear disturbances with some existing stream crossing structures.

There are 43 watercourse crossings within the RoW of the five collector lines and one construction power line. The majority of the watercourses along the route were small headwater streams and isolated wetlands. Four had No Fish Habitat, 31 were Marginal, and eight were classified as Important (e.g., Limestone and Nelson rivers, Goose and Wilson creeks). Most crossing sites (38) were rated as Moderate with respect to their sensitivity to disturbance. The smaller watercourses tended to have soft floodplains susceptible to rutting and the larger watercourses had banks with instability. Five crossing sites had Low sensitivity to disturbance ratings.

The collector and construction power line RoWs contained only one waterbody within the 50 m buffer zone. This waterbody was a small unnamed pond within a larger wetland characterized by an intermittent flow regime. It was assigned a 7 m RB.

There are five watercourse crossings within the RoW of the northern ground electrode line. Two of these crossings were assessed as Important fish habitat (Swift and Goose creeks), while the rest were assessed as Marginal fish habitat. All were assessed as having moderate sensitivity due to unknown bank stability or soft floodplain areas. One waterbody, a section of Swift Creek, was within the 50 m buffer zone. This portion of Swift Creek was assessed as Important fish habitat, and was assigned a 30 m RB.

The northern ground electrode site (NES6) contained an unnamed tributary of the Nelson River, which was rated as Marginal fish habitat. A Low sensitivity rating was assigned to this watercourse. The southern ground electrode site (SES1c) contained no waterbodies, but was adjacent to two roadside ditches and to Cooks Creek that were rated as Marginal and Important fish habitat, respectively.

The proposed Keewatinoow Converter Station site includes saturated land that is directed to a ditch and through a culvert on the Conawapa Access Road. This area contains the headwaters of a drainage that has limited connectivity to the Nelson River (through vegetation). This tributary was rated as Marginal fish habitat, not directly supporting fish. It provides indirect fish habitat in the form of water, nutrients and food (lower trophic levels) to the Nelson River.

No watercourses were identified within the footprint of the northern construction camp. However, one watercourse (Creek Fourteen) adjacent to the camp site is a candidate for camp sewage effluent discharge. This creek was rated as Marginal fish habitat and does not support fish directly. The creek provides indirect fish habitat in the form of water, nutrients, and food to the Nelson River.

Five of the Keewatinoow borrow sites overlap waterbodies. Three sites overlap Swift Creek (i.e., borrow site N-4, N-5, and N-6) and two sites overlap unnamed creeks (N-8 and N-10-2). Sites N-4 and N-5 overlapped Important fish habitat and had groundwater sites near them. Site N-6 overlapped fish habitat within Swift Creek and did not have any identified groundwater sites near it. Sites N-8 and N-10-2 were found to overlap intermittent unnamed tributaries of the Nelson River that were fish habitat and did not have any identified groundwater sites near them. None of the excavated material placement areas overlap or encroach on waterbodies.

The construction and operation of overhead transmission lines poses a low risk to fish habitat as indicated in DFO's Operational Statement (OS) for overhead line construction (DFO 2007c). The two main potential effects to fish habitat from construction and operation of overhead transmission lines are loss of riparian habitat and instream sedimentation. With implementation of appropriate mitigation measures, the residual effects from the construction and operation of the PR, collector, and construction power lines and northern ground electrode line is expected to have no measureable effect on surface water quality and fish habitat. Similarly, stream crossings on the temporary construction access trails will be made under DFO OS' for temporary stream crossings and/or ice bridges and snow fills (DFO 2007d, 2007f) and will have no measurable effect to the fish habitat.

The construction of the ground electrodes at NES6 and SES1c poses a low risk to fish habitat. There is no watercourse at SES1c. However, two roadside ditches directly south and north of the SES1c will be protected during construction; erosion and sedimentation controls will be implemented as necessary. Construction of the ground electrode at NES6 will include isolated or dry open-cut stream crossing construction. Potential effects from construction include loss of riparian cover, erosion and sedimentation, improper streambed restoration, alteration of stream flow, and fish stranding. These can all be mitigated

through the implementation of DFO's OS for Isolated or Dry Open-cut Stream Crossings (DFO 2007a); thereby eliminating adverse residual effects.

Coke leachate is not expected to have a significant effect on the aquatic environment due to the lack of groundwater or subsurface water flow into surface waters at the preferred ground electrodes sites. To prevent an accidental spill of coke into the aquatic environment, coke materials will be stored greater than 100 m from the ordinary high water mark. Coke will be adequately contained and will be protected from wind and rain to prevent entry of fine particulates into streams through runoff or dust deposition.

The construction and operation of the converter station poses a low risk to fish habitat. The three main potential effects to fish habitat are the loss of habitat due to infilling, downstream sedimentation caused by construction, and the effects of wastewater effluent from staff facilities on receiving waters.

The approximate linear distance of the converter station site to the Nelson River is 1.5 km. The converter station's footprint includes 622 m of this linear distance. The area surrounding the converter station footprint is flat, saturated land that drains towards the Conawapa Access Road ditch similar to the converter site's area, and is directed through the same culvert. The surrounding area also has similar substrate and vegetation as the footprint area. The infilling of the footprint's wetted area would be displaced proportionally to adjacent low-lying areas. The potential for increased local and downstream suspended and streambed sediment burdens caused by construction will be effectively mitigated through proper control measures and best management practices. Therefore, no significant residual effects are expected from converter station construction.

Aggregate and concrete wash water from construction of Keewatinoow will be directed to settling ponds for the removal of suspended sediments and treatment of elevated pH. The requirement for discharge from the settling ponds will be minimal and if required will meet end-of-pipe criteria and occur through adjacent vegetation and therefore have no effect on the aquatic environment.

It is proposed that Goose Creek near the converter site be used to receive the facility wastewater discharge. Sewage will be treated to meet effluent criteria set by Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG). Based on baseline Goose Creek water quality and discharge range, predicted facility effluent discharge rate and regime, and effluent quality, the effects of treated sewage effluent in Goose Creek are expected to have no measureable effect in the fully mixed condition; however, small, localized increases in TSS may occur near the effluent outfall.

Waste water treatment will also require the construction of an outlet structure to Goose Creek. Preference will be given to design and construction of an outlet that does not reduce the amount of fish habitat and represents a low risk of impacts to fish habitat. Effluent carried to receiving waters via an excavated channel or an outlet pipe on the bank are examples of structures rated as Low for scale of negative effect that would have a negligible effect on fish habitat. Mitigation to control erosion and sedimentation, minimize riparian vegetation clearing, and stabilize stream banks would be implemented during outlet structure construction.

The Construction Camp footprint does not overlap any watercourses and with appropriate setbacks there will be no effect on fish habitat, and therefore no significant residual effects. It is proposed that Creek Fourteen be used to receive the wastewater discharge from the Construction Camp. This will require the construction of an outlet structure to the creek. Creek Fourteen is a small ephemeral creek with an undefined connection to the Nelson River. Creek Fourteen is not a fish bearing water. Exceedences of MWQSOGs for the protection of aquatic life (PAL) are expected to occur in Creek Fourteen during periods of effluent discharge (twice annually). Due to recovery of the aquatic biota between discharge events and the lack of quality fish habitat in Creek Fourteen, there is no significant residual effect to fish habitat from waste water effluent. The effects of treated sewage effluent once it reaches the lower Nelson River are also expected to not be

significant in the fully mixed condition. Preference will be given to design and construction of an outlet that does not reduce the amount of fish habitat and represents a low risk of impacts to fish habitat; such as an excavated channel or an outlet pipe on the creek bank. Mitigation to control erosion and sedimentation, minimize riparian vegetation clearing, and stabilize stream banks would be implemented during outlet structure construction.

Borrow activities may have a negative effect on fish and fish habitat through erosion and sedimentation of streams, as well as contamination of and changes to groundwater flow. Siting of the borrow pit areas and material placement areas away from waterbodies is proposed to avoid potential effects of activity on fish and fish habitat. Other mitigation measures include not excavating below the water table, not refueling in borrow areas to avoid fuel spillage in groundwater recharge areas, not dumping oil or other machinery lubricants in borrow and/or groundwater recharge areas, and the construction of berms around material placement areas. Appropriate mitigation measures will result in no residual effects for borrow pits and material placement areas.

A review of existing and future projects (next 20 years) was conducted with either the reported or anticipated residual effect to the aquatic VECs summarized. The Bipole III project will not result in any significant residual effects on the aquatic environment VECs and when considered in conjunction with past and future activities, no significant cumulative effects are not anticipated.

Construction monitoring will be employed to ensure the effectiveness of mitigative measures utilized for this project. Temporary and permanent facilities installed to maintain natural cross-flow drainage across the construction sites will be inspected on a regular basis to ensure that drainage is not being inhibited by the construction activities. Water quality monitoring will be implemented at crossing sites where there is potential for sediment introduction into surface waters (e.g., stream bed disturbance during stream isolations).

All disturbed bed and bank sites will be restored comparable to pre-disturbance conditions. Reclamation efforts will be monitored as required by proponent personnel. Once reclamation success is deemed acceptable, temporary erosion control structures will be removed.

Municipal and industrial waste water facilities operate under a *Manitoba Environment Act* License issued and monitored by Manitoba Conservation. The license requirements will be followed by the proponent for effluent quality and monitoring.

ACKNOWLEDGMENTS

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1.0 INTRODUCTION

1.1 Background

Manitoba Hydro is currently proposing the development of a new high voltage direct current (HVdc) transmission line, known as Bipole III, to improve the overall reliability and dependability of transporting hydroelectric power from northern Manitoba to southern Manitoba (Map 1).

The major components of the Bipole III project include:

- A new northern converter station, the Keewatinoow Converter Station, to be located near the proposed site of the Conawapa Generating Station (GS). The converter station includes permanent onsite staff facilities, an offsite construction camp, and transmission lines (for construction power);
- A new southern converter station located at the existing Riel station site in the Rural Municipality of Springfield;
- A 500 kV HVdc transmission line originating at the Keewatinoow Converter Station and terminating at the Riel station (approximately 1384 km);
- New 230 kV transmission lines linking the Keewatinoow Converter Station to the northern collector system at the existing 230 kV switchyards at Henday Converter Station and Long Spruce GS; and
- New ground electrode sites for each converter station, connected to the station by a low voltage feeder line.

The Bipole III project potentially affects fish habitat as numerous waterbodies lie within the area of the project components. Fish habitat, according to the *Fisheries Act*, includes any place that fish depend upon, directly or indirectly for their requirements of food, shelter, water, reproduction, and growth. These habitats include ponds, lakes, and watercourses (i.e., streams and rivers). Habitat in the watercourses to be crossed is variable and includes areas that support only a few species of fish for short periods of time, to habitats that support a wide range of species and all life requisites throughout the year.

1.2 Scope

Manitoba Hydro transmission projects utilize a Site Selection and Environmental Assessment (SSEA) process to better understand the potential issues and concerns associated with the routing and siting of the transmission line and components, to assess the potential for adverse effects and identify appropriate mitigation measures to manage the overall effect of the proposed project on the environment. This process was undertaken for the Bipole III transmission line project.

The specific objectives of the SSEA process were to:

- Provide a description of the proposed transmission facilities to all stakeholders and the public;
- Select alternate routes and sites for transmission lines and associated facilities in a technically, economically, and environmentally sound manner;

- Assess the potential impacts of the proposed transmission line and its associated facilities;
- Conduct the SSEA process with consideration of local input from potentially affected First Nations and aboriginal communities, other communities and municipalities, land and resource users, interest groups, resource managers, and the public at large in a responsive, documented, and accountable fashion;
- Find practical ways to mitigate potential negative effects and enhance benefits; and
- Prepare an Environmental Impact Statement (EIS) that documents the results of the SSEA process.

Initial transmission line routing consisted of identifying sensitive biophysical, socio-economic, and cultural features and technical (engineering and cost) considerations. This part of the SSEA process utilized data from aboriginal traditional and local knowledge, existing published sources, and supplemental field studies, and incorporated feedback through public and government consultation. Three alternative route corridors were identified.

The aquatic resource evaluation of the alternative routes (North/South Consultants Inc. 2011) was based on the following features:

- Density of watercourse crossings;
- Distance of crossings to confluences (streams and lakes);
- Span of crossings; and
- Crossings with high value habitat.

The conclusion of the route evaluation and overall analysis process resulted in the selection of a Preferred Route (PR) for the Bipole III transmission line.

1.3 Purpose

This report represents an assessment of potential impacts of the proposed transmission line and its associated facilities as they relate to the aquatic environment, and proposes mitigation to offset those impacts. The findings in this report are intended to support the Project's EIS and include the following:

- An assessment of proposed PR, collector, and construction power transmission line watercourse crossings;
- An assessment of watercourses within the areas of the ground electrode sites, converter station, construction camp, and borrow areas; and
- An assessment of potential impacts to the aquatic environment as a result of the project and a description of management measures to avoid or mitigate those impacts.

2.0 STUDY AREAS

The study areas for this aquatic environment technical report are specific to the project components as described below. A larger Bipole III study area has been described in detail in the alternative routes evaluation report (North/South Consultants Inc. 2011) and in the existing environment section of the project EIS.

2.1 Transmission Lines

2.1.1 Preferred Route

The Bipole III PR right-of-way (RoW) is 66 m in width and within a 3 mile wide study corridor (Map 1 and Map Series 100). The potential impacts of an overhead transmission line to the aquatic environment are highly site-specific and largely offset through appropriate mitigation. Therefore, the extent of the study area for the aquatic environment focused on the 66 m RoW. Where sensitive aquatic features were recorded within the RoW, information gathering was extended beyond the RoW, but remained within the 3 mile corridor.

2.1.2 Collector and Construction Power Lines

The study area for both the collector and construction power lines included a 5 km wide study corridor centered on the RoW (Maps 2a, 2b, 2c). This corridor width was chosen to capture the more sensitive downstream areas of Nelson River tributaries crossed. However, attention was focused on the RoW area; a collective 310 m shared RoW (for most of their length)or a 60 m RoW where lines ran separately.

2.1.3 Northern Ground Electrode Line

The study area for the northern ground electrode line was similar to the collector and construction power lines and included a 5 km wide study corridor centered on the RoW (Map 2a). However, attention was focused on the 50 m RoW area.

2.2 Converter Station and Ground Electrodes

The study areas for the Keewatinoow Converter Station site was confined to a 1 km^2 area (Map 3). The preferred northern ground electrode study area was 4 km^2 to allow for the specific siting of the electrode to be made in the most appropriate location (Map 4).

2.2.1 Southern Ground Electrode

The study area for the preferred southern ground electrode site was approximately 2.6 km^2 (1 mile x 1 mile) (Map 5).

2.3 Construction Camp

The study area for the construction camp included an area of approximately 10 km^2, but was focused on the immediate footprint of the camp; an area of approximately 0.5 km^2 (Map 3).

2.4 Borrow

The study area for the Keewatinoow area borrow sites and excavated material placement areas was restricted to an area extending 1 km beyond the boundary of the deposit of placement area (Maps 7a, 7b).

3.0 METHODS

3.1 Desktop

Existing aquatic environment information was collected and analyzed for the project areas. The analysis included mapping and classification of study area watercourses and the review of available fish and fish habitat information. Similarly, a desktop analysis of watercourses in the immediate area of the construction camp was performed and potential effects of camp waste water discharge were assessed.

3.1.1 Transmission Lines

3.1.1.1 Mapping

The National Hydro Network (NHN) (Geobase 2009) was identified as the best available geographic information system (GIS) vector water feature data set for the entire Bipole III study area. The NHN provides geospatial vector data describing hydrographic features such as lakes, reservoirs, rivers, and streams and meets the federal standard adopted in 2004 by the Canadian Council on Geomatics (CCOG). An important feature of the dataset is the inclusion of a linear drainage network, in addition to the basic cartographic features. The network features are intended for water flow analysis, water and watershed management, and other environmental and hydrographical applications. The data set is constructed primarily from National Topographic System (NTS) 1:50,000 digital vector topographic data. NHN work units were acquired for the entire Bipole III study area and placed into a GIS database.

Watershed boundaries were obtained from Manitoba Conservation's Manitoba Land Initiative (MLI) website. The MLI watershed dataset was identified as the most complete coverage for the Bipole III study area and the PR within the province.

The Bipole III PR, collector/construction power line, and northern ground electrode line routes were plotted and intersected with the NHN layer using ArcGIS® Version 10. Stream crossings were generated using ArcGIS to create a point where the transmission line intersected the NHN watercourse (line) dataset. Where the transmission line crossed the NHN waterbody (polygon) dataset, clip function was used. The clip result line shapefile was converted to a point at the midpoint. The 2-point shapefiles were merged and each point was assigned a unique identifier and considered a 'stream crossing'. A spatial connection of the stream crossing shape file was done with the MLI watershed data.

The same mapping tools as described above (NHN, Bipole III PR and collector/construction lines, and ArcGIS® 10) were used to identify waterbodies adjacent to transmission lines that would require protection under "Forest Management Guidelines For Riparian Management Areas" (Manitoba Conservation and Manitoba Water Stewardship 2008). Waterbodies within a 50 m 'buffer zone' of the RoW route were identified and included in this assessment. This 'buffer zone' consisted of a 20 m riparian area (a conservative average for most watercourses) plus a 30 m Riparian Management Area (RMA) zone past the riparian area (based on the riparian

guideline for perennial waterbodies with important fish habitat). Waterbodies within the buffer zone were evaluated and site-specific RMA sizes were determined for each. The riparian guidelines suggest protection measures for forest clearing within RMAs, which will be applied where applicable.

Construction access to the preferred route transmission line will be required and stream crossings were generated for the preliminary access trails using the same mapping tools described above. Further assessment of construction access trail stream crossings was not performed as these trails are temporary in nature, occur on existing RoW and stream crossings will fall under Operational Statements (OS) developed by the Department of Fisheries and Oceans (DFO) for temporary crossings.

3.1.1.2 Habitat Assessment

3.1.1.2.1 Stream Crossings

A fish habitat assessment was performed for each transmission line stream crossing using remote data sources. Manitoba Hydro acquired aerial photography of the PR in July 2009, which was geo-referenced producing digital ortho imagery (DOI). In addition, Red Hen video was obtained for most of the PR in July and October 2010. Both sources of imagery were used to conduct a synoptic fish habitat assessment for each waterbody based on standard fish habitat assessment guidelines (e.g., DFO and BCMOE 1989). Where DOI and/or Red Hen video were not available (i.e., route adjustments, collector lines, and construction power line), Google Earth™ software and imagery was used.

The DOI was used to measure channel and riparian widths at each crossing. Red Hen video provided the best image of other physical habitat conditions at the site. Information recorded from the DOI, video, and Google Earth™ included:

<u>General</u>

- *Data Source* – the imagery data source used for the habitat assessment (e.g., Red Hen, DOI, or Google Earth™).
- *Waterbody Type* – each crossing site was identified as either a lake or stream.
- *Size* – surface area for lakes or channel (bank to bank) and wetted width (water margins) for streams/rivers.

<u>General Morphology</u>

- *Stream Pattern* – Straight (ST), Sinuous (SI), Irregular Meander (IM), Regular Meander (ME), Tortuous Meander (TM), or Braided (BR).
- *Confinement* – Entrenched (EN), Confined (CO), Frequently Confined (FC), Occasionally Confined (OC), or Unconfined (UN).
- *Stage* – describes water level in relation to bankfull and was classified as Low (30% bankfull), Moderate (30-90%), High (90-100%), or Flood (>100%).
- *Flow Regime* – describes the permanence of flow and was classified as:
    - Perennial (PER): Contains water at all times throughout the year, except during extreme drought.

- Intermittent (INT): Carries water a considerable portion of the time, but ceases to flow occasionally or seasonally because bed seepage and evapotranspiration exceed available water supply.
- Ephemeral (EPH): Streambed is above the water table; stream flow is a direct response to a precipitation event (snowmelt or rainfall).

- *Stream Morphology* –Riffle-Pool (RP), Cascade-Pool (CP), Step-Pool (SP), or Large Channel (LC).

Bank Stability

Bank stability (proportion of stable bank [%])within the RoW was estimated. Indicators of stable banks included: banks materials composed of large boulders or bedrock; banks that are well vegetated; and no evidence of erosion, such as slumping, large silt depositions or exposed soil.

Cover

The total available cover within the RoW was indicated as percent of the stream area. The percent of the total cover represented by each type of cover was also estimated. Cover types included:

- Large woody debris (LWD) (or coarse woody debris);
- Overhanging vegetation (OV);
- Instream vegetation (IV);
- Pool (P);
- Boulder (B);
- Undercut banks (UC);
- Surface turbulence (ST); and
- Turbidity (T).

Riparian Area/Floodplain

- *Riparian Vegetation Width* – riparian vegetation distance (vegetation directly influenced by the watercourse) was measured perpendicularly from the shoreline.
- *Riparian Vegetation* – general riparian vegetation type classified as: none; grasses/sedge; shrubs; conifers; deciduous trees; or mixed forest.
- *Floodplain Width* – where a visible floodplain exists (the area flooded annually resulting in vegetation tolerant of saturate soil (e.g., willows, sedges), the width was measured perpendicularly from each bank.
- *Riparian Canopy* – riparian forest overhanging the stream was estimated (% covering stream channel).

Substrate

Stream substrate type was classified as: fines; gravel; cobble; boulder; and/or bedrock.

Turbulence

The relative proportion (%) of turbulent flow was estimated.

Habitat Inventory

The percent composition of habitat types within the RoW reach was assessed. Habitat types were classified as follows:

- Falls - vertical drop;
- Cascade - high gradient and velocity, extremely turbulent, armored substrate;
- Chute - area of channel constriction, typically bedrock;
- Rapids - high velocity, deeper than a riffle, coarse substrate;
- Riffle - high velocity/gradient (vs. run), surface broken, shallow (<0.5m);
- Run - moderate to high velocity, surface mostly unbroken, deeper than a riffle;
- Flat - low velocity, near-uniform flow, differentiated from a pool by high channel uniformity;
- Pool - portion of the channel with increased depth and reduced velocity, formed by channel scour;
- Impoundment - pools formed behind dam (dam from debris, beaver or landslide);
- Dam - creates the impoundment (debris, beaver or landslide);
- Backwater - localized area of reversed flow direction; and/or
- Boulder Garden - significant occurrence of large boulders, providing significant instream cover, in association with other habitat unit such as riffle or run.

Photos

Representative images of the site were taken from available DOI, Red Hen video, or Google Earth™ to illustrate the existing habitat conditions. Images collected at each site included:

- Two images captured from the DOI or Google Earth™:
    - Centreline and RoW, approximately 100 m wide; and
    - Centreline and RoW approximately 1000 m wide, capturing the upstream and downstream areas.
- One overhead view captured from the Red Hen video.

3.1.1.2.2 RoW Riparian Buffer

A similar remote fish habitat assessment was conducted for waterbodies within the transmission line buffer riparian zone as for RoW stream crossings (as described in Section 3.1.1.2.1). These assessments included General Morphology, Riparian Area/Floodplain, and Habitat Inventory as for stream crossings, as well as a measure of the distance from the RoW to the waterbody itself, and to its riparian area. Special attention was paid to the flow regime of waterbodies, as this was an important classification tool used to determine riparian management areas. Only DOI and

Google Earth™ images were used, as Red Hen video was not available for areas outside the RoW.

3.1.1.3 Literature

Searches of existing literature, both published and 'grey' literature (e.g., technical reports, government documents, theses) were performed for information on the study area's aquatic environment, particularly fish and fish habitat at watercourses intersected by the transmission lines. The Fisheries Inventory and Habitat Classification System (FIHCS) developed by Manitoba Water Stewardship's Fisheries Branch (FIHCS 2009) was searched during the alternative routes evaluation and the results were used in the transmission lines assessment.

3.1.2 Converter Station and Ground Electrodes

Preferred northern and southern ground electrode sites and the preferred Keewatinoow Converter Station site were assessed. These sites were selected by Manitoba Hydro from a larger set of candidate sites that were excluded from the final selection due to their proximity to high value fish habitat.

The assessed sites for both southern and northern ground electrodes were mapped and overlaid with the NHN GIS layer, as was the preferred site for the Keewatinoow Converter Station. The ground electrode sites were mapped as provided: the northern preferred site was mapped as a 2 km x 2 km square and the south preferred site as a 1.6 km x 1.6 km square (1 mile x 1 mile). Waterbodies lying within the various site boundaries and/or within the site study areas were identified through desktop assessments, and a literature search for fish and fish habitat data was performed.

Ground potential rise and the stray of electrical current from the ground electrodes along watercourses was investigated. A review of existing literature was performed to identify information on the potential effects of such current stray on the aquatic environment and expert opinion was sought (e.g., B. Bailey, Exponent Engineering and Scientific Consulting). The potential effects of petroleum coke used in ground electrodes on surface water quality and fish habitat was also investigated through a literature review and site evaluation.

3.1.2.1 Waste Water Effluent

The assessment of waste water effluent discharge from the Keewatinoow Converter Station to Goose Creek was based on a number of assumptions and included the following information:

- Goose Creek Water Quality: water quality data measured during the Conawapa environmental baseline studies in Goose Creek (open-water season 2004; Appendix 1, Table A1-1);
- Effluent Discharge Rate and Discharge Regime: the effluent discharge rate and discharge regime are based on Project information in Chapter 3 of the EIS; and
- Effluent Quality: the range of measured effluent quality at the Wuskwatim GS camp in 2010 (Table 3, Savard and Schneider-Vieira 2011) and Manitoba Municipal sewage effluent discharge standards (Appendix 1, Table A1-4, Manitoba Water Stewardship 2011).

A mass-balance model was used to estimate fully-mixed water quality conditions in Goose Creek based on the aforementioned information.

3.1.3 Construction Camp

The preferred site for the construction camp was mapped and overlaid with the NHN GIS layer. Waterbodies lying within the site boundary or adjacent to the site and potentially receiving effluent were identified through a desktop assessment. Searches of existing literature (both published and grey literature) were performed to identify information on the aquatic environment, particularly fish and fish habitat at those watercourses potentially affected.

3.1.3.1 Waste Water Effluent

The assessment of waste water effluent discharge to Creek Fourteen was based on a number of assumptions and included the following information:

- Creek Fifteen Water Quality: due to its proximity and similar geography to Creek Fourteen (Map 3), water quality data measured during the Conawapa environmental baseline studies in Creek Fifteen (open-water season 2004; Appendix 2, Table A2-1) was used for estimating background water quality in Creek Fourteen;
- Effluent Discharge Rate and Discharge Regime: the effluent discharge rate and discharge regime assessed in the Wuskwatim Environmental Impact Assessment (Volume 5, Manitoba Hydro and NCN 2003); and
- Effluent Quality: the range of measured effluent quality at the Wuskwatim GS camp in 2010 (Table 3, Savard and Schneider-Vieira 2011) and Manitoba Municipal sewage effluent discharge standards (Appendix 2, Table A2-4, Manitoba Water Stewardship 2011).

A mass-balance model was used to estimate fully-mixed water quality conditions in Creek Fourteen based on the aforementioned information.

3.1.4 Borrow

A desktop review of the Keewatinoow area borrow sites and excavated material placement areas was conducted based on the locations indicated in Maps 7a and 7b. Assessments of fish habitat and groundwater in watercourses transected by the borrow sites was performed using existing literature, in addition to a remote fish habitat assessment similar to the assessment for transmission line stream crossings (Section 3.1.1.2.1).

3.2 Field Work

Field studies were conducted at 54 of the 317 stream crossing sites for the PR transmission line, the watercourse potentially infilled by the Keewatinoow converter station site, one stream within the northern ground electrode site, and one stream potentially affected by construction camp waste water discharge. Field studies consisted of physical watercourse measurements and assessment of fish habitat. Standard fish and fish habitat assessment protocol was used as described below.

3.2.1 Transmission Line

Stream crossing sites selected for field studies included: classified sites (during desktop assessment); sites known to contain Important fish habitat (see Section 3.5.1); sites with unique fish habitat features (e.g., spawning riffle); sites considered to be of Moderate or High sensitivity to disturbance (e.g., sites with unstable banks); and/or sites where concern was raised during public consultation (e.g., stream crossings near Camperville). Field studies were not conducted at collector and construction power line stream crossings as the alignment was not available before the end of the 2010 field season.

Attempts were made to conduct site assessments within the RoW for each site visited. Where site access was not possible (i.e., helicopter could not land near a site or lack of permission for private land access), sites were assessed from the air or from the nearest accessible location.

The field study reach consisted of the 66 m wide RoW. A minimum of one transect was established at the centre of the RoW. Where habitat was variable within the RoW, three transects were established; one each at the upstream extent, downstream extent, and centreline of the RoW. Where unique or sensitive habitat features were identified within the RoW, the study area was extended to a 300 m reach centred on the RoW. Within this 300 m reach, habitat was mapped to serve as a comparison to that found in the RoW.

Each transect location was recorded using a hand held GPS. The transect distance and direction from the crossing location was also noted. Additional parameters recorded during field studies included:

Channel Profiles

The wetted width (water margins) and the channel width (bank to bank) were measured at each transect. Water depth at 25%, 50%, and 75% of the wetted width and maximum depth were recorded. The left and right bank designations were determined while facing upstream.

General Morphology

The general stream morphology, including pattern, confinement, flow regime, and stage were classified as described in Section 3.1.1.2.1. Channel profile, a description of the cross-sectional shape of the channel, was classified as: notched; U-shaped; V-shaped; or planar.

Banks

At each transect, the following parameters regarding channel banks were collected:

- *Bank Slope* – bank slope angle (degrees) was estimated; and
- *Bank Stability* – bank stability was visually assessed and the proportion of bank that was stable was estimated as described in Section 3.1.1.2.1.

Cover

Within the study reach, the total available cover for fish (%) was estimated. Of the available cover, the composition of cover types (%) was determined. Cover types are described in Section 3.1.1.2.1.

Riparian Area/Floodplain

At each transect the floodplain and riparian vegetation width was measured perpendicularly from each bank. The vegetation type within the riparian zone and floodplain (if applicable) was classified as: none; grasses/sedge; shrubs; conifers; deciduous trees; or mixed forest. The riparian canopy cover over the stream (%) was also estimated.

Substrate

At each transect, stream substrate composition (%) was visually estimated. Substrate composition was based on the following size classifications:

- Fines - <2 mm;
- Small gravel - 2 – 16 mm;
- Large gravel - 17 – 64 mm;
- Cobble - 65 – 256 mm; and
- Boulder - >256 mm.

Habitat Inventory

The percent composition of habitat types within the study reach was visually assessed. Habitat types were classified as described in Section 3.1.1.2.1.

Photos

A minimum of four photographs were taken per site: upstream of the crossing; downstream of the crossing; the right bank (RB) approach; and the left bank (LB) approach. Throughout the survey, additional photographs were taken as needed.

3.2.2 Converter Station, Ground Electrode, Construction Camp

Field studies of fish and fish habitat were conducted at the Keewatinoow Converter Station site, construction camp waste water receiving creek and the northern ground electrode site. The objective of these field studies was to characterize fish habitat in waterbodies that may be impacted by the infrastucture. Transects were established within an approximate 1 km long study reach of each watercourse in the target area. Attempts were made to space transects by approximately 200 m, but access influenced the location of sample transects. Physical measurements were recorded at a series of transects (typically five) on each watercourse. Physical parameters and methods were the same as described in Section 3.2.1; however, additional parameters were recorded including:

Surface Water Quality

Surface water quality was measured *in situ* at the onset of each assessment prior to disturbance of the stream or streambed materials. Temperature, dissolved oxygen (DO), conductivity, and pH were measured with either a Horiba multi-meter or a YSI meter (63 and/or 550A). Turbidity was measured with an Analite NEP-160.

Ground Water

Groundwater surveys were conducted on foot at watercourses within northern electrode and converter station sites. A Fluke 51 K/J thermometer with a 36-inch Cole-Parmer type K heavy duty probe was used to measure intra-substrate temperatures at each transect on a watercourse. At each sampling site, the probe was inserted roughly 20 cm into the stream substrate and once the reading had stabilized, the temperature was recorded in degrees Celsius (ºC). Ambient stream temperature was also measured by suspending the probe in the water column and recording the reading.

Water Velocity Characteristics

At each sample transect water velocity was recorded at two or three locations across the stream channel at 6/10 of the total depth. Velocity was measured using a Swoffer velocity meter.

Bank Stability

Bank stability was visually assessed and categorized as follows:

- High - banks well vegetated or covered in bedrock or large boulders (i.e., armoured);
- Moderate - >50% vegetated or armored and some undercut banks;
- Low - <50% of the bank is vegetated or armored; and
- Unstable - massive slumping, large silt deposition, exposed soil.

Biological Assessments

Fish sampling was conducted within the study reach at each site to determine species presence. Gear type included backpack electrofishing and gillnetting.

During backpack electrofishing surveys, the start and end of each pass were recorded with a handheld GPS. Sample duration, electrofisher settings, and number of passes also were recorded.

3.3 Drainage Analysis

For each assessed watercourse (transmission line stream crossings, converter stations, and electrode sites), the drainage area upstream of the proposed crossing was calculated. Watershed boundaries were created using the Prairie Farm Rehabilitation Administration (PFRA) Incremental Gross Drainage Area dataset (PRFA 2009). Most watercourses crossed by the alignment are minor streams and the drainage area is located within the larger watersheds mapped in the PFRA dataset. The watershed boundaries for these smaller streams were delineated from the larger watershed using the Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM).

The upstream drainage areas for these smaller watercourses were calculated using DEM. DEM CDED 1:50K tiles were downloaded from Geobase and converted to rasters (.tif) then mosaiced to the work unit extent (e.g., 05KK000). Spatial Analyst Hydrology tools ‘Flow Direction’ and ‘Basin’ were run on the mosaic raster. The basin tool created a raster with delineated drainage basins and this raster was converted to a polygon (vector data). Using the MLI watershed dataset

boundaries and the delineated drainage basins vector data boundaries the upstream drainage basin for each stream crossing was generated.

The linear distance from each crossing to the nearest major fish bearing waterbody was determined using ArcGIS® 10. Distances were calculated based on the NHN 1:50,000 watercourse mapping dataset.

3.4 Aboriginal Traditional Knowledge

Local knowledge regarding fish, fish habitat, and aquatic resource use in the Bipole III study area was obtained during Aboriginal Traditional Knowledge (ATK) interviews conducted as part of the Project EIS studies (Bipole III Transmission Project, Bipole III EIS Technical Report, Aboriginal Traditional Knowledge). ATK was used in support of fish habitat assessments. A summary of ATK is available in Appendix 3.

Local knowledge regarding fish, fish habitat, and aquatic resource use in the Bipole III study area was obtained from nine Community Councils (Barrows, Camperville, Cormorant, Dawson Bay, Duck Bay, Herb Lake, Pikwitonei, Pelican Rapids, and Thicket Portage) and six First Nation Communities (Opaskwayak Cree Nation [OCN], Fox Lake Cree Nation [FLCN], Tataskweyak Cree Nation [TCN], Long Plain First Nation [LPFN], Wuskwi Sipihk First Nation [WSFN], and Swan Lake First Nation [SLFN]), as well as the Manitoba Metis Federation (MMF). This information was taken into account in the assessment of all waterbodies potentially affected by project components.

3.5 Environmental Assessment

Watercourses at the transmission line crossings or within the ground electrode, converter station, or construction camp site were assessed based on fish habitat quality and the sensitivity of the habitat to disturbance. Watercourses within the line's 50 m buffer zone were assessed based on fish habitat quality (as described below) and flow regime (as described in Section 3.1.1.2.1). These assessments were used to determine the potential effect of the project component on the existing aquatic habitat and to guide the prescription of mitigation measures. Classification of fish habitat quality and sensitivity to disturbance was developed using the rationale described in "Habitat Conservation and Protection Guidelines" (DFO 1998). The term fish habitat quality refers to the habitat within the potentially impacted portion of the stream as it currently exists. The term sensitivity to disturbance considers the potential for immediate or residual impacts that could result from disturbance of the streambed, banks, or riparian zones.

3.5.1 Fish Habitat Quality

Fish habitat quality was assessed using DOI, Red Hen video, Google Earth™ images, and field studies as described in sections 3.1, 3.2, and 3.3. Following these methods, watercourse characteristics such as channel size, habitat type, and cover were considered to evaluate the potential fish habitat quality. In addition, the distance to the nearest downstream receiving water was used to assess access of the site by fish from downstream areas and the potential use of the habitat at the site by fish.

Existing information from the DFO "Fish Habitat Classification for Manitoba Agricultural Watersheds" (DFO 2008) was also used for the assessment of fish habitat quality. This classification system was available for the southern portion of the project area (south from approximately Mafeking). This system classifies watercourses in regards to fish species

utilization (no habitat, forage fish only, or indicator and forage fish) and type of habitat (simple or complex habitat). Existing information from the FIHCS (2009) on fish presence in waterbodies was also incorporated into the assessment.

Using the information collected from both desktop and field studies, fish habitat was classified using the rating scheme of No Fish Habitat, Marginal, Important, or Critical based on the following considerations:

- importance in sustaining subsistence, commercial, or recreational fisheries;
- productive capacity;
- length of potential season in which habitat is provided;
- life stages of fish directly supported (i.e., spawning, nursery, rearing, feeding, overwintering, migration); and
- diversity of habitat.

Fish habitat was considered to be Critical if it:

- supported a valued subsistence, commercial, or recreational fishery;
- provided a high capacity for fish production within the waterbody by providing habitat for a diversity of fish species through all or most life stages (i.e., overwintering, spawning, nursery, rearing, and feeding habitat); or
- was considered important to the overall productive capacity of the local system by providing critical habitat (such as spawning habitat or a migration route), which was otherwise rare within the local system.

Fish habitat was considered Important if it:

- was utilized by fish for feeding, growth, and migration which, while important to the fish stock, were not critical;
- contained similar habitat that was readily accessible to the fish stock;
- provided a significant capacity for fish production for a limited portion of the year, or for only part of the life cycles of local fish; or
- had been disrupted by past human activity.

Fish Habitat was considered Marginal if it:

- provided habitat for only a short period of each year, if at all; or
- supported a limited number of fish or fish species, and would not contribute significantly to the overall productive capacity of the system.

3.5.2 Aquatic habitat sensitivity to disturbance

Aquatic habitat sensitivity to disturbance was assessed using DOI, Red Hen video, and field studies as described in sections 3.1, 3.2, and 3.3. From these methods, waterbody characteristics

such as bank stability, canopy cover, presence of a soft floodplain, and previous disturbance were considered to evaluate the potential habitat sensitivity to disturbance. The results from the habitat sensitivity to disturbance were used primarily in the prescription of specific mitigation. It should be noted that this sensitivity rating is not the same as that used in the DFO Risk Management Framework described in Appendix 4.

Using this information, aquatic habitat was classified using the rating scheme of Low, Moderate, or High sensitivity based on the following considerations:

- potential for erosion on banks with steep slopes as a consequence of disturbing the vegetation cover during construction activity;
- potential for rutting lowland sites (marshes, floodplains) adjacent to watercourses by heavy vehicles that could also initiate erosion of underlying soils;
- potential for increased local and downstream suspended and streambed sediment burdens resulting from increased bank erosion;
- potential loss of cover habitat along stream margins due to removal of, or damage to, riparian vegetation;
- potential for stream blockage and impediment to fish movement resulting from introduction of slash material and other debris into watercourses; and
- potential consequences of the introduction of pollutants such as fuels and lubricants into watercourses, directly or indirectly via the floodplain, from vehicles during construction and maintenance activities.

A High sensitivity rating was assigned where disturbance of the streambed, banks, or riparian zone was likely to result in the immediate disturbance of fish, and the natural recovery of the streambed, banks, and/or riparian zone would be insufficient to avoid residual impacts.

A Moderate sensitivity rating was assigned where instream work is likely to disrupt fish habitat for a short time, but the residual impacts of disturbance of the streambed, banks, and/or riparian zone would have no measurable effect due to anticipated rapid natural recovery.

A Low sensitivity rating was assigned where minimal immediate disturbance of fish would occur at the time of construction; however, the natural recovery following construction would minimize the potential for residual impacts.

4.0 PROJECT INFORMATION

A detailed description of the Bipole III Transmission Project is provided in Chapter 3 of the Bipole III EIS. Specific project components and activities likely to affect the aquatic environment are discussed below.

4.1 Transmission Lines

The Bipole III 500 kV HVdc transmission line will originate at the Keewatinoow Converter Station and terminate at the new southern converter station on the Riel site. The overall length of the line is approximately 1384 km located on a 66 m wide RoW.

Bipole III collector lines and construction power lines collectively run approximately 58 km, extending from the Long Spruce GS to the construction power station north of the proposed Keewatinoow Converter Station. Collector lines consist of five lines (C61H, C62H, C63H, LC4H, L61C) running 27 km between the Henday Converter Station and the Keewatinoow Converter Station, with the L61C line continuing to the Long Spruce GS. The construction power line (KN36) runs 28 km from the construction power station to the Henday Converter Station. For the majority of their length, the collector and construction power lines have a shared 310 m RoW, and a 60 m RoW where the L61C and KN36 lines run separately.

The Bipole III northern ground electrode line will connect the Keewatinoow ground electrode to the Keewatinoow Converter Station. The overall length of the line is 9 km located on a 50 m wide RoW.

Prior to construction, the RoW alignment and required easements will first be surveyed and flagged. Clearing and disposal of trees on the proposed RoW will be undertaken in advance to facilitate construction activities. Clearing requirements for the new transmission line RoW will also require selective clearing of "danger trees" beyond the RoW. Such trees could potentially affect the function of the transmission line or result in safety concerns, and are normally identified during initial RoW clearing activities and removed.

A variety of methods are available for RoW clearing. Typically, these include conventional clearing done by tracked bulldozers, mulching by rotary drums, or selective tree removal by feller bunchers (e.g., for removal of danger trees with minimal adverse effect to adjacent vegetation and trees). Ground vegetation will not be "grubbed" except at tower sites, where the foundation area will typically be scraped to allow unencumbered access for equipment and safe walking areas for workers.

Construction access to the RoW will be required along the PR RoW. Access trails will make use of existing linear disturbances, including all-weather roads, forestry roads, trails and overhead transmission lines. Where existing stream crossing structures (e.g., culvert, bridge) are not in place, temporary crossings will be required.

The primary issues of concern with regard to transmission line development and aquatic environments relate to construction at watercourse crossings. This includes construction of the conductor crossing of a watercourse and construction of towers near watercourses as described below:

- Improper construction practices causing loss of riparian zones, erosion, and sedimentation at stream crossings and adjacent waterbodies;
- Accidental spills and leaks of substances harmful to the aquatic environment (e.g., fuels and lubricants);
- Workforce presence and improved access to sensitive habitat;
- Improper use of herbicides during RoW maintenance resulting in herbicides entering waterways; and
- Contamination and/or habitat loss from structure foundations and installations.

4.2 Ground Electrodes

One ground electrode will be required for both the Keewatinoow and Riel converter stations. The ground electrode for the Keewatinoow Converter Station will be located approximately 10 km south of the converter station site on the west side of the Conawapa access road. The ground electrode required for the Riel Converter Station will be located approximately 20 km from the station site. The preferred electrode configuration will be a buried iron ring approximately 800 m in diameter for Keewatinoow and 400 m in diameter for Riel, placed approximately 3 m under the ground. This ring will be surrounded by a layer of solid, carbonaceous, petroleum coke to increase its conductive area. It will require a site area of approximately 2.5 km^2, together with an access road for construction and ongoing maintenance. There will also be a low voltage (12 kV) overhead distribution line connection between the ground electrode site and the converter station. The low voltage line will be supported on guyed single wood poles or guyed steel structures and in the south, routed along existing RoW.

Aspects of a buried ring ground electrode that have the potential to impact the aquatic environment are related to sites where the electrode will bisect a watercourse and would include:

- Clearing of vegetation on stream banks and increased erosion and sedimentation;
- Open-cut or isolation installation of ground electrode rod at watercourse crossings resulting in impacts to the stream bank and streambed;
- Contamination of a watercourse from an accidental spill of the embedded petroleum coke, or leaching of metals or PAHs (polycyclic aromatic hydrocarbons) into watercourses from coke;
- Improper construction practices causing loss of riparian zones, erosion, and sedimentation at stream crossings;
- Accidental spills and leaks of substances harmful to the aquatic environment (e.g., fuels and lubricants);
- Workforce presence and improved access to sensitive habitat;
- Improper use of herbicides during right-of-way maintenance resulting in herbicides entering waterways; and
- Effects of stray electrical current through ground potential rise on aquatic biota.

4.3 Converter Station

The new Keewatinoow Converter Station will be located approximately 5 km southwest of the Conawapa GS site on the Nelson River. The principal components of the converter station are staffing facilities, converter building, a high-voltage alternate current (AC) switchyard and a high voltage direct (DC) switchyard. The converter station site is estimated to require an area of approximately 500 x 600 m area or 24.5 hectares.

Construction activities for the converter station development will typically involve site preparation (e.g., removal of existing vegetation and organic topsoil from the site, addition and compaction of inorganic fill material, installation of station surface material) and initial infrastructure development (e.g., installation of station access roads and associated drainage,

followed by installation of perimeter fencing and gates). Once general site improvements have been completed, other necessary civil works and systems will be installed (e.g., foundations for building and equipment, grounding arrangements, water supply, oil spill containment, site services and buildings). Station apparatus and equipment installation will follow, including filling of equipment with insulating oil, construction clean-up and commissioning.

Aggregate and concrete batch plant wash water will be treated through settling and to reduce pH. If required, it will then be discharged to the surrounding area. The recycling of wash water will reduce the discharge volume. Due to the expected small volume and treatment methods, no effects to the aquatic environment are expected and this project component will not be further assessed.

Aspects of the converter station that may impact the aquatic environment include:

- Infilling of a watercourse that lies within the converter station site resulting in the potential loss and/or alteration of fish habitat;
- Sedimentation of reaches downstream of the channel infill/re-alignment section during construction activities;
- Improper construction practices near watercourses causing loss of riparian zones, erosion, and sedimentation of adjacent streams;
- Accidental spills and leaks of substances harmful to the aquatic environment (e.g., fuels and lubricants);
- Improper use of herbicides during RoW and site maintenance resulting in herbicides entering waterways; and
- Waste water disposal from staff use and station operation.

4.4 Construction Camp

A temporary startup construction camp will be established at the future Conawapa GS site to house workers involved in the construction of the construction camp required to support full development of the Keewatinoow Converter Station and ancillary facilities. This larger camp will be sized to accommodate between 230 workers and a peak work force of approximately 500. The camp location has been selected to facilitate its potential subsequent use for construction of the future Conawapa GS. Both the location and the design will be the subject of extensive consultation with the Fox Lake Cree Nation.

Construction power for the construction camp will be provided by extending the existing 138 kV transmission line, running from Kelsey GS to the Limestone construction power substation, approximately 31 km to a new construction power substation located near the Keewatinoow Converter Station site.

The main camp will consist of skid-mounted trailer units attached horizontally or stacked vertically. Depending on site selection and detailed soil investigations, the trailer units may require screw pile foundations to avoid differential settlement or heaving arising from poor soil conditions or permafrost activity. A two cell sewage lagoon will be constructed as part of the camp and waste water discharged to a nearby natural watercourse.

Primary issues of concern with regard to camp construction and impact to aquatic environments include:

- Improper disposal of water and waste systems into the surrounding aquatic environment;
- Accidental spills and leaks of substances harmful to the aquatic environment (e.g., fuels and lubricants);
- Construction practices near watercourses causing loss of riparian zones, erosion, and sedimentation of adjacent streams;
- Contamination and/or habitat loss from structure foundations and installations;
- Runoff from the access roads, camp site, work areas and other cleared lands (e.g., borrow sites), including potential inputs via groundwater; and
- Waste water disposal from staff use.

4.5 Borrow

Aggregates required for use in construction of the project components will generally be transported from established and appropriately licensed sources off-site. Suitable material for backfill of excavated organic soils may be hauled from newly developed borrow areas along the RoW. Currently borrow sites have been identified in the Keewatinoow area (Maps 7a and 7b) for granular, impervious, and Precambrian rock aggregates. Aggregates will be placed and stock piled in discrete excavated material placement areas (approximately 143 ha in total area). Berms will surround the placement areas to prevent erosion. The majority of drainage water will be reabsorbed within the immediate area and runoff will naturally flow towards the Nelson River.

Potential impacts to the aquatic environment from borrow sites and placement areas include:

- Encroachment on streams and degradation of fish habitat;
- Changes to groundwater discharge to streams;
- Lowering of water tables;
- Pollution of groundwater through fuel spills in borrow pit areas; and
- Sedimentation of streams from erosion of aggregates at placement areas.

5.0 EXISTING ENVIRONMENT

5.1 Information Sources

5.1.1 Major Sources

Data compiled for both physical and biological parameters included existing data and data gathered through field studies. Remote imagery data sources were used for all desktop components, including DOI (collected in 2009) and Red Hen video (collected in 2010) obtained for the preliminary PR by Manitoba Hydro, as well as Google Earth™ imagery. The FIHCS, published, and grey literature were used to identify fish species distributions as well as fish habitat features. Additional distribution information was obtained from Manitoba Conservation

Data Centre, provided by Manitoba Hydro as part of a data sharing agreement. Information gathered through field studies included both physical and biological data at specific sites.

5.1.2 Information Deficiencies

Red Hen imagery was not available for a significant number of the PR watercourse crossings (79 of 317 crossings). Red Hen imagery was also not available for the collector lines, construction power line, or northern ground electrode line watercourse crossings. For these crossings, DOI and Google Earth™ imagery was used but did not provide the same level of detail. Other information gaps included literature and FIHCS data failing to include many of the smaller watercourses in the study area, leaving gaps of biological and habitat information on a number of watercourses. These watercourses were assessed through the available imagery and professional knowledge of similar habitats.

Field studies were not conducted for collector lines, the construction power line, northern ground electrode line the southern ground electrode site, and adjusted segments of the PR due to the timing of final locations of these components. In addition, field studies were not conducted for certain PR crossings due to lack of private land access. These watercourses were assessed through the available desktop imagery and professional knowledge of similar habitats.

5.2 Existing Environment Description

A literature review of the existing environment within the 3 mile corridor of the proposed Bipole III was conducted and identified the environmental components, sensitive biophysical features, and major aquatic species that may be affected by the proposed project. An overview of aquatic environment components within the project study area was provided in support of the project EIS (Appendix 5). This included a review of water quality, lower trophic levels, fish and fish habitat, species at risk, invasive species, and resource use. This technical report focuses on the selected VECs.

5.2.1 Valued Environmental Components

Two VECs were chosen for the aquatic environment component of the proposed developments: surface water quality and fish habitat.

Surface water quality is considered a VEC in all waterbodies that are considered fish habitat or otherwise. Potential project-related effects on surface water quality include the introduction of sediments and other contaminants from RoW surface runoff or the release of contaminants from equipment or accidental spill. These effects can all be mitigated through implementation of the protection plans proposed to protect fish habitat. Since water quality protection is tied to fish habitat, it will be discussed conjointly as the fish habitat VEC. Provincial guidelines for surface water quality as it relates to humans and aquatic life (Manitoba Water Stewardship 2011) will be given consideration.

Fish habitat is considered a VEC and is generally used as a surrogate for measuring productive capacity. Section 35.1 of the *Fisheries Act* prohibits Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat. Maintaining fish habitats is best assured by minimizing short-term and avoiding long-term degradation of instream and riparian habitats.

5.2.1.1 Environmental Indicators

Fish habitat is defined by a variety of biophysical parameters, including hydrology, channel and flow characteristics, substrate, cover, water and sediment quality, aquatic macrophytes and periphyton, and benthic invertebrate communities. Benthic invertebrate communities represent a large and diverse food base for higher trophic levels such as fish populations and are also of indirect importance to fish populations through ecological importance to the overall structure and function of aquatic environments. Water quality parameters key to defining fish habitat characteristics include temperature, DO, total suspended solids (TSS), turbidity, and pH.

5.2.1.2 Measurable Parameters

The measurable parameters that were used to assess potential project and cumulative effects on fish habitat include:

- physical fish habitat (substrate composition, channel characteristics, cover composition, and habitat units);
- water quality (DO, TSS, and turbidity);
- hydrology (velocity and water depth); and
- riparian vegetation (riparian health and riparian vegetation composition).

5.2.2 Watershed Overview of the Study Area

Watersheds transected by the Bipole III PR corridor, collector lines, construction power line, and ground electrode line RoWs and the total number of stream crossings within each watershed are summarized in Table 1. In order from north to south, the Bipole III PR corridor crosses portions of five major watersheds (Nelson River, Saskatchewan River, Lake Manitoba, Assiniboine River, and Red River) and 18 sub-basins, (Map 1). Overall, the Nelson River basin comprises the largest proportion of the PR followed by the Lake Manitoba, Saskatchewan River, Assiniboine River, and Red River basins. The comparatively short collector and construction power line RoWs only cross the Nelson River watershed.

5.2.2.1 Nelson River Basin

The Nelson River basin begins in the west near Cranberry Portage and flows northeast ending at Hudson Bay. Within this watershed, the PR corridor intersects four sub-basins (Lower Nelson River, Burntwood River, Grass River, and upper Nelson River) and includes 155 watercourse crossings that extend from Goose Creek, a tributary of the lower Nelson River, to south of Wekusko Lake (Maps 100-01 to 100-07). The 43 watercourse crossings of the collector and construction power line RoWs are within the Nelson River basin, as are the 5 crossings of the northern ground electrode line (Maps 2a, 2b, 2c).

Within the lower Nelson River sub-basin, the PR runs from Split Lake north-eastward to the proposed Conawapa GS (Sites 1-63; Maps 100-01, 100-02, 100-03). The collector and construction power RoWs also intersect this sub-basin (Sites 1-43) along the Nelson River between the proposed Conawapa GS and the Long Spruce GS (Maps 2a, 2b, 2c). The northern ground electrode line is within this area as well (Sites G_E 1-5). The sub-basin includes the Nelson River mainstem and Split Lake as well as numerous headwater lakes and tributaries of these waterbodies. The eastern portion of the lower Nelson River sub-basin lies within the

Hudson Bay coastal plain and is notable for a number of small to medium sized tributaries of the Nelson River mainstem.

The Burntwood River sub-basin is the largest sub-basin contributing drainage along the proposed corridor and includes 15 stream crossings (Sites 64 - 78) in the vicinity of Orr Lake (Maps 100-03, 100-04). The sub-basin begins approximately at Rat Lake, flows southeast to Wuskwatim Lake, and then flows northeast joining the Nelson River at Split Lake. The predominant watercourse in the Burntwood River sub-basin is the Churchill River Diversion (CRD), which enters from the north via the Rat River. Diversion flows extend down the Burntwood River through Wuskwatim, Opegano, Birch Tree, and Apussigamasi lakes before converging with the Nelson River at Split Lake.

The Grass River sub-basin lies south of the Burntwood River sub-basin and includes 63 crossings (Sites 79-128; and 143-155) (Maps 100-04, 100-05, 100-07). The basin begins in the west near Cranberry Portage and, similar to the Burntwood River sub-basin, flows northeast converging with the Nelson River at Split Lake. Waterbodies in this sub-basin include numerous lakes and rivers; notably, the Grass, Missipisew, and Wuskatasko rivers and Wekusko, Herblet, Snow, and Tramping lakes.

The PR intersects the upper Nelson River sub-basin, and includes 14 crossings (Sites 129 - 142) near Clarke and Conlin lakes east of Snow Lake (Maps 100-05, 100-06). The sub-basin flows into east and west Cross Lake in Manitoba, after which it empties into Hudson Bay by way of the Nelson River.

5.2.2.2 Saskatchewan River Basin

The Saskatchewan River basin originates near Flin Flon along the Saskatchewan border and flows southeast to Cedar Lake. The proposed RoW intersects two sub-basins (Clearwater Lake/Moose Lake and Cedar Lake) and includes 30 watercourse crossings that extend from Cedar Lake, south of The Pas, to near North Moose Lake. The Clearwater Lake/Moose Lake sub-basin (Sites 156 - 176) includes tributaries such as Frog Creek and Little Frog Creek, and the majority of crossing sites in this basin are located on unnamed tributaries of Little Frog Creek (Map 100-08). The Cedar Lake sub-basin (Sites 177 - 185) includes the Saskatchewan River, which flows eastward across Saskatchewan and Manitoba and empties into Lake Winnipeg. The sub-basin also includes significant feeder streams such as Rall's and Iskwayanikakespeetik creeks which the proposed RoW intersects in the vicinity of The Pas, Manitoba (Map 100-09).

5.2.2.3 Lake Manitoba Basin

The Lake Manitoba basin extends from the Lake Winnipegosis sub-basin in the north, south through the escarpment region of Manitoba to the Whitemud River sub-basin. Within the Lake Manitoba basin, the Bipole III RoW corridor intersects five sub-basins (Lake Winnipegosis, Swan Lake, Duck Mountain, Lake Manitoba West, and Whitemud River) and includes a total of 93 watercourse crossings. The RoW extends north of Red Deer Lake to southwest of Portage La Prairie and parallels both Lake Winnipegosis and Lake Manitoba (Map 1).

The northern portion of the Lake Winnipegosis sub-basin is characterized by the Overflowing River, Red Deer Lake, and Red Deer River. Further south, the small lakes and streams on top of the Porcupine Mountains flow northeast to Lake Winnipegosis through the Bell and Steeprock rivers and Cork Cliff Creek (Sites 186 - 210 and 252 - 258) (Maps 100-10, 100-11, 100-13).

The Swan Lake sub-basin, which includes 22 stream crossings, collects water from the southern portion of the Porcupine Mountain through the Woody River (Sites 211 - 232) (Map 100-11). The Duck Mountain sub-basin (in association with the Valley River and Turtle River basins) collects water from the eastern sides of the Duck and Riding mountains and enter Lake Winnipegosis either directly or via Dauphin Lake and the Mossy River (Sites 233 - 251) (Maps 100-12, 100-13). The Lake Manitoba West sub-basin, which includes nine stream crossings (Sites 259 - 267), captures water from the southeastern slopes of Riding Mountain before flowing through the low gradient landscape adjacent to Lake Manitoba and east of McCreary, Manitoba (Maps 100-13, 100-14). Characteristic of the escarpment, streams in the three sub-basins have elevated water velocity and coarse stream substrate. Once on the lowland areas adjacent to lakes Winnipegosis, Swan, and Manitoba, water velocity slows and substrates shift to fine silts and organics. Shoreline vegetation is generally a combination of birch, dogwood, grass/sedge, poplar, or willow.

The Whitemud River sub-basin system (Sites 268 - 278) includes the Whitemud River, a small highly meandering river in southwest Manitoba (Maps 100-15, 100-16). The basin tributary begins at the junction of Stony Creek and Boggy Creek near Neepawa and then flows east through the communities of Gladstone and Westbourne, and empties into Lake Manitoba. The watercourse crossings in this sub-basin intersect the Whitemud River, Squirrel Creek, Westbourne Drain, Bagot Creek, and Rat River; all eastward flowing headwater tributaries.

5.2.2.4 Assiniboine River Basin

The Assiniboine River watershed begins with the Shell River and Lake of the Prairies sub-basins in the northwest, flows southwest including the south-western drainages of the Duck and Riding mountains in the Little Saskatchewan River and Birdtail Creek sub-basins, and then flows west through the sand hills region of Spruce Woods before joining the Red River at Winnipeg. Within the Assiniboine River catchment, the RoW crosses one sub-basin (Central Assiniboine) in the area north-east of Treherne, Manitoba (Map 100-16). The Central Assiniboine River watershed, which includes three watercourse crossings (Sites 279 - 281), is composed of inflows from the Assiniboine River, Fetterly Creek, and unnamed intermittent tributaries that drain into the Assiniboine River.

5.2.2.5 Red River Basin

The Red River drainage basin largely surrounds Winnipeg and is characterized by a low gradient landscape dominated by row-crop agriculture where many of the smaller watercourses have been severely altered or eliminated. Within the Red River basin, the RoW intersects six sub-basins (La Salle River, Morris River, Red River South, Rat River, Seine River, and Cooks Creek/Devils Creek) and includes a total of 36 watercourse crossings that originate at St. Claude, flow east towards Steinbach, and then north, passing near Landmark, Manitoba (Maps 100-16, 100-17). Watercourses in the La Salle River (Sites 282, 289, 290, and 293 - 297) and Morris River (Sites 283 - 288, 291, and 292) sub-basins are characterized primarily by diverted drainage channels along the agricultural landscape. The Red River South drainage basin includes two crossings (Sites 298 - 299), and the Seine River sub-basin includes 12 crossings (Sites 304 - 315), such as Tourond Creek, Fish Creek, and the Seine River. Other sub-drainage basins include the Rat River (Sites 300-303) and the Cooks Creek/Devils Creek basin (Sites 316 and 317).

5.2.3 Environmentally Sensitive Sites

The following sections provide a description of environmental components of aquatic ecosystems within the Bipole III study area, and identifies specific aspects of importance in terms of fish habitat and environmental legislation.

5.2.3.1 Transmission Line

5.2.3.1.1 Preferred Route

Stream Crossings

The PR for the Bipole III transmission line has a total of 317 watercourse crossings, including various rivers, creeks, drains, lakes, and ponds. All watercourse crossings were assessed for fish habitat quality and habitat sensitivity to disturbance as described in Section 3.5. A summary of all watercourse crossings can be found in Table 2, and detailed assessments of each crossing can be found in the watercourse crossings assessment booklets in Appendix 6.

Based on the assessments, 54 watercourse crossings were considered to provide No Fish Habitat. These crossings included very small streams and drains with small channel size and very little water. They were often headwater streams, with poor connectivity to larger downstream watercourses. These also included isolated ponds and wetlands. Watercourse crossings considered Marginal fish habitat included 185 of the crossings. These were often smaller streams and drains, all with connection to larger waterbodies. Where applicable, these watercourses had DFO Fish Habitat ratings of either E (indirect fish habitat), D, or C (simple or complex fish habitat with no indicator species present). Watercourses considered Important fish habitat included 78 of the crossings. These often were major rivers with perennial flow and, where applicable, these waterbodies usually had DFO Fish Habitat ratings of A or B (complex or simple fish habitat with indicator species present). No crossings were considered to have Critical habitat.

One hundred and seventy-two watercourse crossings were considered to have Low habitat sensitivity to disturbance. These crossings had stable banks, no soft floodplain, and little canopy cover. All sites with No Fish Habitat were considered to have Low habitat sensitivity, regardless of crossing conditions. Crossings considered to have Moderate habitat sensitivity to disturbance included 137 of the watercourses. These crossings often had soft floodplains in the northern portion of the PR (Nelson River basin), and some degree of bank instability in the southern portion. Crossings considered to have High habitat sensitivity to disturbance included eight of the watercourses. These crossings all had highly unstable banks, often with slumping or erosion occurring, and all were classified as Important fish habitat.

The eight sites with High habitat sensitivity and Important fish habitat included the Burntwood, Mitishto, Steeprock, Woody, North Duck, Assiniboine, Red, and Rat rivers (crossings 77, 145, 199, 220, 233, 281, 299, and 302). All crossings had highly unstable banks, with the Assiniboine River having an actively eroding bank, and the North Duck River having eroding cutbanks. In addition, the North Duck and Steeprock rivers had high habitat diversity (riffle and run habitat), and the Woody River had a large amount of canopy cover.

RoW Riparian Buffer

The Bipole III PR had 57 waterbodies within the 50 m distance from the RoW, a summary of which can be found in Table 3. Of these, most (39) were assessed as No Fish Habitat. These usually were isolated wetland or pond habitat, or extreme headwaters of streams. Fifteen waterbodies were assessed as Marginal fish habitat, and consisted mostly of tributaries with weak connections to other watercourses, and lower water levels. Three waterbodies were assessed as Important fish habitat. These consisted of a northern unnamed lake, a tributary of the Clay River, and Cooks Creek. No waterbodies were assessed as containing Critical fish habitat.

Twenty-one of the waterbodies were considered to have ephemeral flow regimes. Most of these waterbodies consisted of small ponds or wetlands. Thirty-two waterbodies were considered to have intermittent flow regimes, also consisting mostly of ponds and wetlands. Only four waterbodies were considered to have perennial flow regimes. These consisted of an unnamed lake, an unnamed pond, Munigwari Creek, and Cooks Creek.

Construction Access Trail Stream Crossings

Of the 44 construction access trails, 25of the trails have waterbody crossings. There are a total of 125 waterbody crossings on these 25 trails, including crossings of small isolated ponds, headwater streams, small and medium sized streams such as 9 Mile Creek, Limestone River and North Pine River, and a crossing of one large river, the Grass River (Table 4).

5.2.3.1.2 Collector and Construction Power

Stream Crossings

The collector and construction power lines for the Bipole III project have a total of 43 watercourse crossings, consisting mostly of various tributaries of the Nelson River. All watercourse crossings were assessed for fish habitat quality and habitat sensitivity to disturbance as described in Section 3.5. A summary of all watercourse crossings can be found in Table 5, and detailed assessments of each crossing can be found in the collector and construction power line watercourse crossing assessment booklets in Appendix 7.

Based on the assessments four watercourse crossings were considered to provide No Fish Habitat. These crossings were of wetlands, with no connection to other waterbodies. Watercourse crossings considered Marginal fish habitat included 31 of the crossings. These crossings consisted of upstream habitat of tributaries, far from their confluence with the Nelson River. They were within bog/fen habitat, which likely support only forage fish. Watercourse crossings considered Important fish habitat included eight of the crossings. These crossings included major rivers such as the Nelson and Limestone rivers with known indicator and forage fish populations. They also included downstream habitat of tributaries, close to their confluence with the Nelson River. Crossings of tributaries with known indicator and forage fish populations were also considered Important, even if these crossings were within upstream bog/fen habitat, as indicator fish were likely to use this habitat to some extent. No crossings were considered to have Critical fish habitat.

Five watercourse crossings were considered to have Low habitat sensitivity to disturbance. Four of these crossings consisted of wetlands with No Fish Habitat, and one was a small tributary with no signs of instability. Crossings considered to have Moderate habitat sensitivity to disturbance included 38 of the crossings. Most of these crossings (34) consisted of tributaries with broad,

soft floodplains. Also, two tributaries had unknown bank conditions, and the Nelson and Limestone rivers had exposed soil banks, indicating potential instability. No crossings were considered to have High habitat sensitivity to disturbance.

RoW Riparian Buffer

The Bipole III collector and construction power lines contained only one waterbody within their 50 m buffer zone. This waterbody was a small unnamed pond within a larger wetland area, containing No Fish Habitat, and having an intermittent flow regime (Table 3).

5.2.3.1.3 Northern Ground Electrode Line

Stream Crossings

The northern ground electrode line for the Bipole III project has a total of five watercourse crossings, consisting mostly of various tributaries of the Nelson River (Map 2a). All watercourse crossings were assessed for fish habitat quality and habitat sensitivity to disturbance as described in Section 3.5. A summary of all watercourse crossings can be found in Table 6, and detailed assessments of each crossing can be found in the northern ground electrode line watercourse crossing assessment booklets in Appendix 8.

Based on the assessments three watercourse crossings were considered to provide Marginal fish habitat. These crossings were within bog/fen habitat and had weak connection to downstream habitat. They likely supported only forage fish. Watercourse crossings considered Important fish habitat included two of the crossings. These crossings included Swift and Goose Creek, both creeks with known indicator and forage fish populations.

RoW Riparian Buffer

The Bipole III northern ground electrode line contained only one waterbody within its 50 m buffer zone. This waterbody was a section of Swift Creek containing Important fish habitat, and having a perennial flow regime (Table 3).

5.2.3.2 Ground Electrode

Fish habitat at the ground electrode sites was assessed as described in Section 3.1.2. A summary of the assessment results is provided in Table 7, and detailed assessments for each site are in Appendix 9. At the time of the assessments for both northern and southern ground electrode sites, water levels were moderate to flood stage and many of the smaller watercourses would have been at maximum fish habitat potential due to high water.

5.2.3.2.1 Northern Ground Electrode

A desktop assessment of the 2 x 2 km study area of preferred ground electrode site NES6 was conducted using orthophotos and Google Earth™ imagery. An unnamed tributary of the Nelson River was identified within the southern portion of the site (Map 4). In June, 2011 field studies of this stream were conducted. An isolated pond was also identified in the central portion of the 2 x 2 km area (Map 4).

This small unnamed tributary is an ephemeral watercourse and lies within the ground electrode site approximately 587 m from the Nelson River (Map 4). Upstream of the Conawapa road (and within the ground electrode site), the watercourse breaks into braided channels within wetland habitat. Downstream of the Conawapa road, the creek has a defined channel and descends the

steep banks of the Nelson River. This steep descent to the river is believed to inhibit upstream fish movements. No fish were captured during sampling efforts.

This creek is rated as Marginal fish habitat and at the ground electrode site does not support fish directly. The creek provides indirect fish habitat in the form of water, nutrients, and food (lower trophic levels) to the Nelson River.

The isolated pond lies within a boreal wetland area and lacks connection to downstream waters. This pond is the deep water area of wetland, and is not considered fish habitat.

5.2.3.2.2 Southern Ground Electrode

A review of aerial imagery (from spring and late summer/early fall) indicated that no watercourses lie within site SES1c. However, two roadside ditches run south and north (SES1cS1) of the site (Map 5). These ditches provide Marginal habitat for forage fish only (DFO 2008). They are likely intermittent and flow into Cooks Creek.

A channelized section of Cooks Creek is found 0.82 km west of the site (SES1cS2). At this location the creek provides Important fish habitat for both indicator and forage fish species (DFO 2008).

5.2.3.3 Converter Station

5.2.3.3.1 Keewatinoow Converter Station

The proposed Keewatinoow converter site (NCS4) is located south of Goose Creek (Map 3). The site includes the saturated headwater area of an unnamed tributary, which has poor connectivity to the Nelson River (Appendix 9). No fish were captured during spring or summer sampling efforts (Appendix 9). The habitat type at transects 1 and 2 was pool habitat with organic substrate. This tributary is rated as Marginal fish habitat and does not support fish directly. It provides indirect fish habitat in the form of water, nutrients, and food (lower trophic levels) to the Nelson River. Considering the small size of this unnamed tributary and the large size of the Nelson River, the relative contribution of water, food, and nutrients to the Nelson River are negligible.

5.2.3.3.2 Riel Converter Station

No watercourses lie within the Riel Station site (Map 6). South Bibeau Drain, a channelized drain lies to the west of the site and has been classified as Type E (indirect) fish habitat by DFO (2008).

5.2.3.4 Construction Camp

The construction camp site is situated adjacent to four watercourses (Creek Fifteen, Creek Fourteen, an unnamed tributary to the Nelson River, and the Nelson River proper) but does not overlap or encroach on any. Fish habitat in these watercourses is briefly discussed below and detailed assessments can be found in Appendix 9.

5.2.3.4.1 Creek Fifteen

Creek Fifteen is a small tributary of the Nelson River approximately 15 km in length. Fish habitat in the creek is characterized by cascade-scour pool and riffle-scour pool in the lower 2

km and by bog/wetland habitat upstream of 2 km (Swanson and Kansas 1987). Fish reported within Creek Fifteen include brook stickleback, fathead minnow, longnose sucker, white sucker, brook trout, suckers, slimy sculpin, brook stickleback, longnose dace, pearl dace, finescale dace, and burbot (Johnson et al. 2005, Kroeker 1992, 1993). Cassin and MacDonell (2009) reported one location with ground water upwelling at 300 m downstream of the Conawapa road. This creek provides Important fish habitat, including nursery habitat for brook trout.

5.2.3.4.2 Creek Fourteen

Creek Fourteen originates in a low-lying saturated area, located approximately 100 m upstream of the Conawapa road crossing, and flows southeast to the Nelson River. The channel receives additional flows from roadside ditches located on either side of the Conawapa road. The stream channel is narrow and shallow (approximately 0.1 m). Riparian vegetation consists predominately of willow and grasses and there is a high level of instream vegetation (grasses) and significant stream cover from overhanging vegetation. The channel connection to the Nelson River is undefined. No fish were captured during sampling efforts.

This tributary is rated as Marginal fish habitat and does not support fish directly. It provides indirect fish habitat in the form of water, nutrients, and food (lower trophic levels) to the Nelson River. Considering the small size of this unnamed tributary and the large size of the Nelson River, the relative contribution of water, food, and nutrients to the Nelson River are negligible.

5.2.3.4.3 Nelson River

The Nelson River is a major river system that drains into the Hudson Bay. The river is a perennial watercourse that supports a diverse fish community, providing spawning, rearing, feeding, and overwintering habitat. Within the lower Nelson River mainstem, 40 species of fish have been documented including burbot, goldeye, lake cisco, lake chub, lake sturgeon, lake whitefish, longnose sucker, mooneye, northern pike, sauger, walleye, white sucker, yellow perch, brook trout, freshwater drum, and rainbow smelt (Bernhardt et al. 1991, Johnson and MacDonell 2004, Swanson et al. 1990).

5.2.3.4.4 Unnamed Tributary of Nelson River

This unnamed tributary of Nelson River is a small stream with a small watershed and minimal water levels. Few fish, if any, are anticipated to occur in this small stream. There is no to low overwintering potential for fish in this tributary and habitat is considered Marginal.

5.2.3.5 Borrow

5.2.3.5.1 Borrow Sites

The initial drawings of borrow site locations in the Keewatinoow area indicate five borrow sites overlapping waterbodies (Maps 7a and 7b). Three sites overlap Swift Creek (N-4, N-5, and N-6), and two sites overlap unnamed creeks (N-10-2 and N-8). In addition one site is near Goose Creek (N-9), and site N-6 is near two unnamed creeks. All other potential borrow pit areas are not near waterbodies (N-10-1, N-7 Area 1, N-7 Area II, N-3 Area II, B-5-1, B-5-3, Limestone Stockpile, and 'Mount Kumagai' Stockpile). The six borrow sites overlapping or near waterbodies are assessed below:

Borrow Sites N-4 and N-5 (Swift Creek)

Borrow area sites N-4 and N-5 overlap the banks of Swift Creek approximately 1.4 and 1.7 km upstream from the confluence with the Nelson River, respectively. Habitat in Swift Creek at these distances from the confluence consists mostly of riffle-pool-run habitat sequences with boulder substrates and some cobble. The creek is confined by a wooded boundary and the riparian vegetation is made up primarily of shrubs and coniferous trees. Instream cover is composed predominately of large woody debris along with overhanging vegetation and boulders (Swanson and Kansas 1987). Fish habitat in this section of Swift Creek was rated as Important with a high potential for forage fish use and moderate potential for large-bodied fish species. Two groundwater sites exist nearby where Site N-4 overlaps the banks of Swift Creek; one approximately 100 m upstream and another approximately 200 m downstream (Table 8). Another cluster of three groundwater sites is roughly 200 m away from the northeast inland edge of the borrow area boundary. There are no groundwater sites at the location where Site N-5 overlaps Swift Creek. However, three highly localized groundwater sites are within 100 m upstream from the south end of the borrow area inland boundary. In effect, these three sites are also within 200 m of the north-central inland boundary of Site N-4.

Borrow Site N-6 (Swift Creek)

Borrow area Site N-6 overlaps the banks of Swift Creek approximately 2.2 km upstream from the Conawapa access road crossing and 5.3 km upstream from the confluence with the Nelson River. Fish habitat in Swift Creek at this distance from the confluence consists of deep (1-2 m) run habitat with organic substrates. Confined by a wooded boundary, this section of creek supports abundant instream vegetation that provides significant cover for fish. Riparian vegetation is dominated by grasses/sedges and shrubs. No groundwater sites have been identified near this section of stream or elsewhere in Swift Creek upstream of the Conawapa access road crossing (Swanson and Kansas 1987). There is high fish habitat potential for forage fish upstream and downstream of this borrow area site overlap in regards to spawning, rearing, and overwintering. The habitat potential for large-bodied fish is low at, and upstream of, the site; therefore, overall habitat was rated as Marginal.

Borrow Site N-10-2 (Unnamed Tributary of Nelson River)

Borrow area site N-10-2 overlaps an intermittent unnamed tributary of the Nelson River approximately 208 m downstream from the Conawapa access road crossing and 895 m upstream from the confluence with the Nelson River. There appears to be an existing borrow pit area already excavated directly upstream of this site that surrounds the headwaters of the tributary. There is no existing information on fish habitat or groundwater for this tributary; however, based on a desktop assessment, the tributary appears as a faint channel, likely containing little to no water for most of the year. Therefore, only forage fish are expected to use this habitat, and the habitat was rated as Marginal.

Borrow Site N-8 (Unnamed Tributary of Nelson River)

Borrow area site N-8 overlaps an intermittent unnamed tributary of the Nelson River approximately 50 m downstream from the Conawapa access road crossing and 570 m upstream from the confluence with the Nelson River. There is no existing information on fish habitat or groundwater for the tributary; however, based on a desktop assessment, the tributary appears as a faint channel, likely containing little to no water for most of the year. Therefore, only forage fish are expected to use this habitat, and the habitat was rated as Marginal.

Borrow Sites N-9 (Goose Creek) and N-6 (Unnamed tributary of Nelson River, Unnamed tributary of Swift Creek)

Borrow site area N-9 is near Goose Creek, which was assessed as a perennial watercourse with Important fish habitat. Borrow site area N-6 is near two unnamed creeks, both of which were assessed as intermittent watercourses with Marginal fish habitat.

5.2.3.5.2 Excavated Material Placement Areas

The six excavated material placement areas do not overlap any waterbodies (Map 7a). The areas lie adjacent to a number of small streams and ponds and those within approximately 100 m of the sites include: Site 1A – Creek Eighteen and unnamed creek; Site 1B – three unnamed creeks; Site 1C – unnamed creek and Creek Fifteen; Site 1D – unnamed creek and unnamed tributary of Goose Creek; Site 1E – Tiny Creek; 1F – Tiny Creek and unnamed creek.

In the small streams and in areas upstream of the Conawapa access road, habitat consists primarily of headwater boreal wetland with undefined channel development, abundant pools, and vegetation and undergo restricted periods of flow (i.e., spring only). These sites generally support Marginal fish habitat and fish use is limited to species such as brook stickleback and fathead minnow, if any. Creek Eighteen and the unnamed creeks would be considered Marginal fish habitat. Habitat in Creek Fifteen, Goose Creek, and Tiny Creek is considered Important.

6.0 ENVIRONMENTAL EFFECTS ASSESSMENT

This section identifies the potential impacts of the project on the aquatic environment, mitigation measures to prevent or minimize impact, and the residual and cumulative effects following mitigation.

6.1 Environmental Effects Assessment

Environmental effects were identified based on the project description for each component of the project, review of available literature, and habitat assessment results. Project components likely to affect aquatic habitats are discussed in Section 4.0. Potential effects identified from the literature and study results are discussed, followed by mitigation measures and then an assessment of residual effects (Table 9).

6.1.1 Literature Review

6.1.1.1 Transmission Lines

The loss of riparian vegetation, erosion causing sedimentation of watercourses, and the introduction of deleterious substances to watercourses are considered the greatest potential effects from the construction and operation of an overhead transmission line (BC EAO 2011, SaskPower 2009, DOE and DEQ 2008). These, and other, potential effects are discussed below.

6.1.1.1.1 Erosion and Sedimentation of Streams due to improper construction practices

Vegetation removal and improper construction practices near watercourses can result in increased erosion leading to sedimentation of streams. Clearing streamside vegetation for transmission line crossings may result in decreased bank stability and exposure of bare soils that are prone to erosion. Machinery and equipment working in or near watercourses can cause rutting and erosion of floodplains, streambeds and channel banks. Increased levels of suspended

sediment and deposited sediment can have multiple negative effects on the aquatic environment, including impacts to the primary producers, invertebrates, and fish.

Decreased light penetration due to higher turbidity (suspended sediment) can result in decreased photosynthesis by primary producers. Since primary producers form the base of the food chain, reductions in productivity can impact higher trophic levels, such as invertebrates and fish. Further, large influxes of sediment can bury aquatic invertebrates, an important food item for many fish species, resulting in reductions in invertebrate species diversity and abundances. Deposition of fine streambed materials over larger substrates may create unsuitable habitat for invertebrate species that anchor to coarse substrates.

Sedimentation may result in the loss of spawning habitats and/or decreased spawning success for some fish species. Fine sediment deposition may bury existing coarse or rocky substrates creating unsuitable spawning habitat. Deposited eggs can be smothered by sediments and larval emergence from spawning substrates may be inhibited by infilling of interstitial spaces (Kondolf 2000).

Short- and long-term increases in turbidity from suspended sediments can decrease feeding success by visual feeders (Berg and Northcote 1985, Gardner 1981). Suspended sediment can also be harmful to fish by clogging their gills, decreasing oxygen exchange and reducing growth rates (Wood and Armitage 1997).

6.1.1.1.2 Loss of Riparian Vegetation due to improper construction practices

In addition to contributing to bank stability and erosion protection, riparian vegetation contributes nutrients to streams and lakes through litter and terrestrial insect drop. The removal of riparian vegetation can result in the reduction of nutrient inputs into aquatic food webs. In many streams, terrestrial insects contribute a significant portion to the diet of fish. Leaf litter and other organic matter are consumed by aquatic invertebrates, another important food source for many fish species, including salmonids (Allan et al. 2003).

Riparian losses can result in increased water temperatures due to loss of shading by canopy species. Further, increases in plant growth can also occur due to increased light exposure. The loss of low, overhanging vegetation represents a loss of cover for fish.

6.1.1.1.3 Habitat Loss from Structure Foundations and Installations

Habitat loss and degradation due to structure foundations and installations may result in decreased productivity and fish population declines. Loss of migration routes may limit access to critical habitats, such as spawning areas. Impacts to spawning and nursery areas may decrease fish abundances.

Loss of riparian habitats due to placement of structures may result in the reduction of allochthonous inputs (e.g., terrestrial litter and insects) and shading/ cover for fish (as discussed in Section 6.1.1.1.2).

6.1.1.1.4 Contamination from Structure Foundations and Installations

Construction of cast in place concrete structures (e.g., foundations) near watercourses may result in accidental releases of concrete or concrete wash water into watercourses. Uncured or partly cured concrete and other lime containing materials (e.g., Portland cement, mortar and grout) have a high pH and are extremely toxic to many aquatic animals, including fish. Releases into

aquatic environments can cause increases in pH of the water resulting in damage to fish tissue. Also, elevated pH levels may increase toxicity of other substance in the water, such as ammonia.

Concrete and concrete wash water also contain sediments. Discharges of these materials into waterways may result in increased turbidity and sedimentation. These effects are described in Section 6.1.1.1.1.

6.1.1.2 Construction Access Trails

Potential effects to fish habitat from temporary construction access trail stream crossings is similar to that of transmission line stream crossings. The main effects relate to stream bank and bed damage, erosion and sedimentation of waterbodies and the introduction of deleterious substances to waterbodies as discussed in section 6.1.1.1.

6.1.1.3 Ground Electrodes

6.1.1.3.1 Clearing of Vegetation on Stream Banks and Increased Erosion and Sedimentation

The potential effects of clearing riparian vegetation and the erosion and sedimentation due to construction activities near streams are discussed in Section 6.1.1.1.1 and 6.1.1.1.2.

6.1.1.3.2 Open Cut or Isolation Installation of Ground Electrode at Watercourse Crossings Resulting in Impacts to the Stream Bank and Streambed

Improper construction practices (e.g., poor design and installation of stream diversions) or inadequate site restoration may result in bank and channel erosion. This could potentially lead to increased turbidity and sediment deposition in the watercourse and associated effects (discussed in Section 6.1.1.1.1).

Improper restoration of the streambed with materials less suitable for fish spawning and rearing could lead to a decrease in fish abundance.

6.1.1.3.3 Blockage or Alteration of Flow

Installing the ground electrodes could entail isolating the construction area while maintaining downstream flows (method used if there is flowing water in the watercourse at the time of construction). However, such an isolation would be a short duration blockage to fish passage.

6.1.1.3.4 Fish Stranding

Isolation construction methods require segregation of a stream section by placement of impervious upstream and downstream barriers, and de-watering of the channel between these barriers. For the duration of construction, water is re-routed around the site by means of flumes or pumps. Isolation and de-watering of a stream section often causes fish stranding if the stream is fish-bearing, and these fish must be removed and released to the stream (i.e., rescued) before completion of de-watering.

6.1.1.3.5 Contamination of a Watercourse from Leaching of Embedded Coke

Petroleum coke is a solid, carbonaceous material that is placed around the ground electrode rod to increase its conducting surface. The rod along with the coke is located approximately 3 m under the ground. The coke has the potential to leach various hazardous substances, such as metals and PAHs (polycyclic aromatic hydrocarbons).

Information on general coke leachate was gathered from research articles and other documents investigating the use of coke in oil sand wetland remediation. In these studies, the use of coke as a 'buffer' layer between a tailings and a peat layer was examined to block any contaminants that may leach from the tailings layer. These studies found that coke leachate can potentially contain levels of cobalt, copper, manganese, vanadium, nickel, cadmium, zinc, and molybdenum exceeding Canadian Water Quality guidelines for the protection of aquatic life (Squires 2005). Coke leachate was also found to decrease survival and reproduction of an invertebrate (*Ceriodaphnia dubia*) within the lab (Puttaswamy and Liber 2007). However, within *in-situ* experiments, metal concentrations were often not found to be significantly elevated, likely due to the metals being taken up by organic and inorganic constituents (peat, naphthenic acids, and other dissolved organic carbon species) (Squires 2005, Baker et al. 2007, Baker et al. 2008), and minute to no levels of PAHs were found in coke leachate (Squires 2005). It should be noted that these studies looked at the effects of an entire layer of coke under a wetland, as opposed to the relatively discrete use of coke in ground electrodes.

Coke leachate from ground electrodes may enter surface waters through introduction to groundwater or subsurface water (in saturated soil conditions) and subsequent transfer to surface waters. Coke may also directly enter surface waters from accidental spills during ground electrode construction. No acute effects to aquatic organisms are expected from coke, and overall it is considered to have a low potential to cause adverse effects on the aquatic environment (US EPA 2008).

6.1.1.3.6 Ground Potential Rise and Effects of Stray Current on Fish

A lack of information exists relating the effects of stray electrical currents from ground electrodes to fish. Brouard et al. (1996) examined effects of stray voltage on hatchery raised rainbow trout and highlighted the potential for impacts to embryonic development, growth rate, and survival. Potential effects from stray electrical currents can be gleaned from literature evaluating the impacts to fish subjected to electrical currents within a waterbody, notably through electroshocking. Similar to those reported by Brouard et al. (1996), effects include spinal injuries, stunted growth, and decreased survival (Ainslie et al. 1998, Dalbey et al. 1996). Stray electrical currents from ground electrodes could therefore result in detrimental effects to fish development, growth, anatomy, and survival.

6.1.1.4 Converter Station and Construction Camp

6.1.1.4.1 Infilling of Fish Habitat

Infilling a waterbody would represent a loss of fish habitat and potentially block fish migration routes. During construction, sediment might also be introduced outside of the infilling location through improper erosion controls (as discussed in Section 6.1.1.1.1).

6.1.1.4.2 Waste Water Effluent (from Converter Station Staff Facilities and Construction Camp)

The discharge of waste water into the aquatic environment could result in changes to water quality, including TSS levels, DO levels, nutrient concentrations (nitrogen and phosphorus), pH levels, and the introduction of bacteria and parasites. Such changes could alter fish health and habitat.

6.1.1.5 Borrow

Potential impacts to fish and fish habitat from borrow pit activities include changes to groundwater discharge patterns to stream, changes on groundwater quality, and dewatered water tables. In addition, the pollution of groundwater through fuel spills in borrow pit areas, which serve as groundwater recharge areas, could contaminate stream water supplies for a considerable period of time (Swanson et al. 1988). Other effects include increased erosion and sedimentation of streams from vegetation removal near streams and from erosion and run off from excavated material placement areas (as discussed in Section 6.1.1.1.1).

6.1.1.6 General

6.1.1.6.1 Workforce Presence and Improved Access to Sensitive Habitat

The construction of access roads and clearing of the RoW may provide improved access to sensitive habitats by both work crews and the public. This may lead to increased fishing pressure in lakes and streams along the alignment, and motorized vehicles (trucks, ATVs) used to access these areas may cause physical disturbances (e.g., disturb riparian vegetation and stream banks, which could cause erosion and sedimentation).

In southern areas of the project there is potential for increased access to streams and rivers by livestock via the RoW. Livestock trampling along stream banks may cause soil compaction, bank erosion, and sedimentation of watercourses. Browsing livestock can reduce riparian cover and limit regrowth. Livestock waste may also increase nutrient inputs to streams, altering water quality.

6.1.1.6.2 Accidental Spills and Leaks of Substances Harmful to the Aquatic Environment

Hydrocarbons such as oil, fuel, gasoline, lubricants, or hydraulic fluids can enter surface waters from machinery used for instream construction, or from maintenance and fuelling activities that are conducted too close to a watercourse. Hydrocarbons are considered deleterious substances may kill fish or other aquatic biota directly, or may result in impaired health, vigor, or productive capacity. Polycyclic aromatic hydrocarbons (PAHs) can persist in stream sediments resulting in chronic exposure through direct contact or indirectly through food chain interaction (Collier et al. 2002). Effects of PAHs to fish include fin erosion, liver abnormalities, cataracts, and compromised immune systems (Fabacher et al. 1991, Weeks and Warinner 1984, 1986, O'Conner and Huggett 1988). In benthic invertebrates, PAH exposure can inhibit reproduction, delay emergence, and cause sediment avoidance and mortality.

6.1.1.6.3 Improper Use of Herbicides during RoW, Ground Electrode and Converter Site Maintenance

The main pathways of herbicide entry into streams are leaching, surface run-off, and drain flow (Carter 2000). Entry is dependent on soil and herbicide properties, hydrology, application practices, and climate conditions. Many herbicides are toxic and releases of these chemicals into streams may have lethal and/or sublethal effects on aquatic organisms, including fish. Herbicides may also reduce the abundance of aquatic plants.

6.1.2 Study Results

6.1.2.1 Transmission Line

6.1.2.1.1 Preferred Route

Stream Crossings

Based on the NHN watercourse mapping dataset of the transmission line route, 317 stream crossings were identified. None of the crossings sites were considered Critical fish habitat. Seventy-eight were assessed as Important fish habitat. The remaining were either Marginal (185 sites) or No Fish Habitat (54 sites) (Table 2; Appendix 6).

Eight sites were assessed as having High sensitivity to disturbance based on evidence of bank instabilities, such as slumping and undercutting, and presence of high canopy cover (Table 2; Appendix 6). The High sensitivity sites included:

- Burntwood River;
- Mitishto River (Site 145);
- Steeprock River;
- Woody River;
- North Duck River;
- Assiniboine River;
- Red River; and
- Rat River.

These eight sites were all classified as Important fish habitat and would be susceptible to bank erosion from construction vehicles and machinery. Excessive removal of streamside vegetation could also decrease bank stability at these sites. However, as part of the construction plan, RoW clearing will leave ground cover and low woody vegetation within riparian areas to maintain stability. Additional site specific precautionary protection measures, with respect to erosion protection and RoW clearing and maintenance at sensitive sites, will also be adopted.

RoW Riparian Buffer

Fifty-seven waterbodies were found within the 50 m buffer zone surrounding the PR RoW. None of these were assessed as Critical fish habitat. Three were assessed as Important fish habitat, while the rest were considered Marginal (15), or No Fish Habitat (39) (Table 3). The three waterbodies assessed as Important fish habitat consisted of an unnamed lake, an unnamed tributary of the Clay River, and Cooks Creek.

Four of the waterbodies within the buffer zone were considered to have Perennial flow regimes, with the rest considered as Intermittent (32), or Ephemeral (21). The four waterbodies assessed as Perennial consisted of an unnamed lake, an unnamed pond, Munigwari Creek, and Cooks Creek. Based on these characterizations, each waterbody was assigned an RMA size. The riparian guidelines prescribe mitigation methods to protect vegetation and prevent erosion within

the RMAs (Manitoba Conservation and Manitoba Water Stewardship 2008) that will be adopted during project construction.

6.1.2.1.2 Collector Lines and Construction Power Line

Stream Crossings

Based on the NHN watercourse mapping dataset, the collector and construction power line routes cross 43 streams. None of the crossing sites were considered Critical fish habitat, twelve were assessed as Important fish habitat, and the remaining were either Marginal (31) or provided No Fish Habitat (4) (Table 5; Appendix 7).

No sites were assessed as having High sensitivity to disturbance, 38 were assessed as Moderately sensitive, and five were assessed as having Low habitat sensitivity. Within the Moderately sensitive sites, most (34) had broad soft floodplains that would be sensitive to disturbance, two had potentially unstable banks, and two had unknown bank stability. Additional site-specific precautionary protection measures (e.g., erosion control) will be required at these sites.

Transmission line construction will not involve the placement of any structures below the ordinary high water mark. Riparian zones are the most sensitive to this type of construction; however, disturbance to these areas will be minimized through the application of best management practices. Transmission line construction is expected to have no residual impact provided that the DFO (2007c) Operational Statement(OS) for overhead line construction is adhered to.

These transmission lines share a 310 m RoW for most of their line length. Considering this RoW width, the most detrimental effect would be clearing of riparian forest. However, at most of the watercourse crossings, the riparian area is sedge and shrub with canopy forest further back from, and not overhanging, the stream. These type of riparian areas would not be effected by clearing of trees as there would be no consequence to fish habitat in the stream.

RoW Riparian Buffer

Only one waterbody was found within the collector and construction power line buffer zones (Table 3). This waterbody contained No Fish Habitat and had an intermittent flow regime.

6.1.2.1.3 Northern Ground Electrode Line

Stream Crossings

Based on the NHN watercourse mapping dataset, the northern ground electrode line route crosses five streams. None of the crossing sites were considered Critical fish habitat, two were assessed as Important fish habitat, and the remaining three sites were assessed as Marginal fish habitat (Table 6; Appendix 8).

All five sites were assessed as having Moderate sensitivity to disturbance. Three sites had broad soft floodplains that would be sensitive to disturbance, and the remaining two had unknown bank stability. Additional site specific precautionary protection measures (e.g., erosion control) will be required at these sites. Overall, transmission line construction is expected to have no residual impact provided that the DFO (2007c) OS for overhead line construction is adhered to.

RoW Riparian Buffer

Only one waterbody was found within the northern ground electrode line buffer zone (Table 3). This waterbody was a section of Swift Creek containing Important fish habitat and having a perennial flow regime.

6.1.2.1.4 Contamination and/or Habitat Loss from Structure Foundations

Habitat loss due to tower construction is not expected as structures will be placed above the high water mark and outside of riparian areas. Grouting used in tower construction has the potential to affect pH of surface waters if released into the environment. Since towers will be constructed away from watercourses the risk of entry is low and will be mitigated by the implementation of best management practices (e.g., neutralize pH of wash water). Further, in boggy terrains and on saturated floodplains, construction will take place under frozen conditions, preventing introduction of grout or similar materials to surface waters.

6.1.2.1.5 Other Impacts

Potential effects from accidental spills, leaks, herbicide use, and workforce presence are expected to be circumvented through the application of mitigation and best management practices.

6.1.2.2 Construction Access Trails

Based on the NHN watercourse mapping dataset, the construction access trails cross 125 waterbodies. These temporary trails occur on existing linear disturbance in most cases and where existing stream crossing structure are not in place, crossings will be made in adherence to DFO OS for “Temporary Stream Crossings” (DFO 2007d) or ”Ice Bridges and Snow Fills (DFO 2007f).

6.1.2.3 Ground Electrodes

Based on technical studies of candidate sites, a preferred site was selected for the northern and southern ground electrodes. Potential impacts to the aquatic environment, based on aquatic habitat assessments conducted at preferred and alternate sites, is discussed below.

6.1.2.3.1 Stream Crossings

Based on the habitat assessment results, construction of stream crossings by ground electrodes is expected to result in no impact to fish habitat. At sites where fish habitat is present, stream crossings can be constructed in adherence to DFO (2007a) OS for “Isolated or Dry Open-cut Stream Crossings” (Appendix 10). The OS outlines conditions and mitigation measures that are required to ensure that the project does not result in impacts to fish habitat. A summary of watercourses at ground electrode sites can be found in Table 7, and detailed assessments of these watercourses can be found in Appendix 9.

Northern Ground Electrode

One watercourse lies within the northern ground electrode site (NES6). The stream provides Marginal fish habitat and does not support fish directly. Its small size and lack of a defined channel within the site indicates that it freezes to the bottom in winter. These characteristics suggest that stream crossings by a shallow land electrode can be constructed in adherence to the DFO OS for “Isolated or Dry Open-Cut Stream Crossings” (DFO 2007a). A Low sensitivity

rating was assigned to this watercourse as there would be minimal immediate disturbance of fish by following the OS, and the natural recovery following construction would minimize the potential for residual impacts.

Southern Ground Electrode

No watercourses lie within the southern ground electrode site; therefore, no watercourse crossings will be required during installation of this ground electrode. However, two roadside ditches directly south and north of the site contain Marginal forage fish habitat (DFO 2008) and Cooks Creek, which is located 0.82 km west of the site, contains Important forage and indicator fish habitat. Erosion and sedimentation controls will be implemented as necessary during construction at SES1c to protect fish habitat in these watercourses.

6.1.2.3.2 Contamination from Leaching of Embedded Coke

Northern Ground Electrode

The potential of coke leachate to enter surface water depends on groundwater and surface water movements at the ground electrode site. Based on borehole logs near northern ground electrode site NES6, groundwater appears to be between 6 and 10 m below ground and overlain by clay at the site. It appears that surface water is the most likely source of water in the unnamed tributary of the Nelson River within the site. However perched groundwater tables and permafrost in the area are not well mapped out and it is possible that groundwater enters this tributary (N. Sidenko, Stantec, pers. comm.). Therefore it is conceivable that coke leachate could enter this tributary along with groundwater, but is not likely. The soil within the site is described as well-drained, and consequently coke leachate travelling from subsurface water (in saturated soil conditions) to surface water is also unlikely.

Southern Ground Electrode

The southern ground electrode site (SES1c) exhibits minimal upward groundwater flow, and groundwater likely contributes negligible amounts to surficial drainage (N. Sidenko, Stantec, pers. comm.). Therefore it is possible that coke leachate could enter the nearby roadside ditches along with groundwater, but this scenario is not likely. The soil within the site is expected to be well-drained, and therefore coke leachate travelling from subsurface water (in saturated soil conditions) to surface water is also unlikely.

6.1.2.3.3 Ground Potential Rise and Effects of Stray Current on Fish

The expected level of current stray (voltage) from ground electrodes was determined to be below the levels reported to cause effects in fish as outlined in Section 6.1.1.2.6 (B. Bailey, Exponent Engineering and Scientific Consulting, pers. comm., Exponent 2011). Therefore, effects resulting from ground potential rise to fish at the ground electrode sites is not expected to occur.

6.1.2.4 Converter Station

6.1.2.4.1 Footprint

The proposed converter station site includes saturated land that is directed to a ditch and through a culvert on the Conawapa Access Road. This area is the headwaters of a drainage that has limited connectivity to the Nelson River (through vegetation). Within the converter station footprint there is no channel development, limited water flow (would only flow during periods of

increased runoff, i.e., during the spring freshet and during rain events), the water is oxygen depleted for most of the year, and the saturated areas likely freeze to the substrate during winter. This waterbody provides indirect fish habitat in the form of water, nutrients, and food (lower trophic levels) to the Nelson River (Appendix 9).

Based on NHN, the approximate linear distance of the waterbody from the converter station site to the Nelson River is 1.5 km. Infilling of the converter station's footprint includes 622 m of this linear distance.

The area surrounding the converter station footprint is flat, saturated land that drains towards the Conawapa access road ditch similarly to the converter site's area, and is directed through the same culvert. The surrounding area also has similar substrate and vegetation as the footprint area. The infilling of the footprint's wetted area would be displaced proportionally to adjacent low-lying areas.

The sensitivity of aquatic habitat at the site is classified as Low and the scale of negative effect as High (Appendix 11). The loss of the wetted area within the footprint would be offset proportionally to adjacent areas; this is a headwater area and infilling will not impede fish movements upstream. Moreover, the potential for increased local and downstream suspended and streambed sediment burdens caused by construction can be effectively mitigated through proper control measures (e.g., silt fence barriers between footprint and adjacent areas and the prevention of silt laden waters pumped from the footprint to downstream areas).

The converter station site lies in close proximity to Goose Creek. No effects are expected in relation to construction and operation of the converter stations (other than facility sewage effluent discussed in 6.1.2.4.2) as the site will include a standard development setback from the stream.

Infilling and site construction will result in negligible impact to fish habitat.

6.1.2.4.2 Waste Water Effluent

It is proposed that Goose Creek near the converter site be used to receive the facility waste water discharge. Sewage will be treated to meet effluent criteria set by Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG). Specifically, effluent will be treated to achieve the following minimum standards: 200 faecal coliform bacteria per 100 mL, 25 mg/L biological oxygen demand (BOD), 25 mg/L TSS and 1 mg/L total phosphorous (TP) (Manitoba Water Stewardship 2011).

The effects of treated sewage effluent in Goose Creek are expected to have no measurable effect in the fully mixed condition; however, small, localized increases in TSS may occur near the effluent outfall. This was based on a screening of the effects of effluent discharge on water quality in Goose Creek presented in Appendix 1. The screening considered baseline Goose Creek water quality and discharge range, predicted facility effluent discharge rate and regime, and effluent quality to create mass-balance scenarios. Results of the mass-balance modeling indicated that MWQSOGs would be met for all parameters except for TP under the lowest flow regime, under which the TP narrative (0.05 mg/L) was slightly exceeded (0.06 mg/L).

Construction of an outlet that does not reduce the amount of fish habitat would be expected to represent a low risk of impact to fish habitat. In contrast a structure that results in the loss or degradation of fish habitat are more likely to impact to fish habitat. Following the "Practitioners

Guide to the Risk Management Framework for DFO Habitat Management Staff" (DFO 2010), several scenarios are presented in Appendix 1 with corresponding Scale of Negative Effects rating and the Sensitivity of Fish and Fish Habitat rating.

Two basic types of effluent outlets were assumed, an excavated channel that joins a receiving water and an outlet pipe at a receiving water. The outlet pipe configuration is assumed to be either a pipe terminating at the stream bank with no infill of the stream channel proper or a pipe that extends into the stream channel with a resulting infill of stream channel by the pipe or by infill material (see Appendix 1 for a schematic). Both the excavated channel and outlet pipe in the bank are rated as Low for the scale of negative effect and the outlet pipe located in the stream channel is rated as Moderate due to the expected infilling of streambed.

Selection of an outlet structure that is rated as Low for scale of negative effect would have a negligible effect to fish habitat as described in Appendix 1.

6.1.2.5 Construction Camp

6.1.2.5.1 Footprint

No waterbodies were found to be within the construction camp site. Four waterbodies were found adjacent or near the site. These waterbodies include the Nelson River (418 m from camp), Creek Fifteen (35 m), Creek Fourteen (31 m), and an unnamed tributary of the Nelson River (460 m). The construction camp waste water lagoon will require an area of 200 m x 500 m, which will be sited within the identified area (Map 3). This larger area overlaps the same three tributaries of the Nelson River listed above as well as an unnamed tributary of Goose Creek. The lagoon will be sited away from all natural watercourse.

6.1.2.5.2 Waste Water Effluent

It is proposed that Creek Fourteen be used to receive the camp waste water effluent. Similar to the converter station, sewage will be treated to meet effluent criteria set by MWQSOG. Specifically, effluent will be treated to achieve the following minimum standards: 200 faecal coliform bacteria per 100 mL, 25 mg/L BOD, 25 mg/L TSS, and 1 mg/L TP (Manitoba Water Stewardship 2011).

The screening of the effects of effluent discharge on water quality in Creek Fourteen is presented in Appendix 2. The screening considered baseline water quality (from the adjacent Creek Fifteen), discharge range, predicted facility effluent discharge rate and regime, and effluent quality to create mass-balance scenarios. Results of the mass-balance modeling indicate that discharge of sewage effluent to Creek Fourteen would not meet MWQSOGs protection of aquatic life (PAL) criteria for TSS and ammonia and the narrative guideline for TP under fully mixed conditions in the creek under most stream discharge scenarios.

Because Creek Fourteen is a small stream that does not support fish directly and habitat in the construction camp area consists of boreal wetland with heavy vegetation and undefined channel, he effects of treated sewage effluent on the Nelson River would be negligible in fully mixed conditions in the river.

6.1.2.6 Borrow

6.1.2.6.1 Borrow Sites

Six of the fourteen potential borrow pit sites were found to overlap or be near waterbodies. Three of these (N-4, N-5, and N-6) were found to overlap Swift Creek. Sites N-4 and N-5 overlapped Important fish habitat within Swift Creek, and had groundwater sites near them. Groundwater sites near N-4 were 100 m upstream and 200 m downstream of the site overlap with the creek, and 200 m from the northeast edge of the site (Table 8). Site N-6 overlapped Marginal fish habitat within Swift Creek, and no groundwater sites were identified in proximity to the stream.

Sites N-8 and N-10-2 were found to overlap intermittent unnamed tributaries of the Nelson River. These sites overlapped Marginal fish habitat, and did not have any identified groundwater sites near them. Potential impacts to fish and fish habitat within these overlapped watercourses from borrow site activities can be negated through proper mitigation measures.

Site N-9 was found to be near Goose Creek, which was assessed as a perennial watercourse with Important fish habitat. Site N-6 was found to be near two unnamed creeks, both assessed as intermittent watercourses with Marginal fish habitat. Mitigation measures can negate any potential negative impacts to fish and fish habitat from borrow site activities.

6.1.2.6.2 Excavated Material Placement Areas

Nine watercourses lie within 100 m of the excavated material placement areas. Of these, three support Important fish habitat. Erosion of stock piled aggregate following rain events may result in sediment-laden runoff from entering adjacent watercourses. Mitigation measures can negate the potential negative impacts to fish and fish habitat at the excavated material placement areas.

6.1.3 Environmental Protection Measures

To minimize potential effects of the project, aquatic resource and habitat information has been considered in project planning and the selection of the preferred transmission line route. Critical habitats have been avoided. To ensure that project-related impacts are minimal, applicable legislation, regulations, and guidelines will be adhered to.

In general, construction and maintenance of the project will have the least effect on the aquatic environment when ground conditions are hard (frozen) and water levels are low (i.e., during winter, dry summer months, and early fall), especially in terrains such as bogs. Construction near waterbodies in undesirable conditions (i.e., unfrozen) will only be conducted if the environmental effects can be avoided or reduced through mitigation. Measures to mitigate or minimize the effects of project-related impacts are discussed below and summarized in Appendix 12.

6.1.3.1 General

6.1.3.1.1 Hazardous Materials/Deleterious Substances

- Construction crews will be adequately trained in spill prevention and clean up procedures.
- Harmful substances, such as fuels, chemicals and herbicides will be stored greater than 100 m from the ordinary high water mark (HWM) of streams.

- Emergency spill clean-up kits will be on site at all times.
- Only clean construction materials and equipment will be used.

6.1.3.1.2 Construction Vehicles and Machinery

- All vehicles, machinery, and construction materials will arrive on site clean and free of leaks.
- Equipment refuelling and maintenance will be conducted greater than 100 m from the stream's HWM.
- Machinery will remain above the HWM, unless fording is required to transport equipment across the watercourse and only in accordance with DFO OS.
- Temporary crossings will be constructed to ensure that construction vehicles and machinery remain out of watercourses and will be done in accordance with the DFO OS.

6.1.3.2 Transmission Lines

The construction, operation, and maintenance of overhead transmission lines pose a low risk to negatively affect fish habitat at watercourse crossings. To this end, DFO has developed an OS that describes mitigation measures to prevent impacts to fish and fish habitat during the construction of overhead lines (DFO 2007c, Appendix 10). Specific mitigation to be implemented at watercourse crossings are described in the following sections.

6.1.3.2.1 Construction

- Where possible, installation of lines over watercourses and poorly drained habitats such as bogs and fens will be conducted under frozen conditions or aerially.
- Where possible, transmission line approaches and crossings will be perpendicular to the watercourse and will avoid unstable features such as meander bends, braided streams, and active floodplains.
- All structures (temporary and permanent) will be placed above the HWM.

<u>Vegetation Removal</u>

- Removal of riparian vegetation will be limited to select plants within the RoW required to accommodate overhead lines and uprooting of plants will be minimized).
- Vegetation will be retained for as long as possible prior to construction.
- A machine free zone (MFZ) of 7 m will be established from the HWM of all waterbodies where harvesting or clearing machinery will not enter other than to cross the stream.
- A riparian buffer (RB) of 7, 15 or 30 m (depending on fish habitat quality) will be established at all waterbodies where ground disturbance is minimized, all shrub and herbaceous vegetation is retained and all trees that do not violate Manitoba Hydro vegetation clearance requirements are retained.
- Clearing limits and sensitive areas will be clearly marked prior to vegetation removal.

- Clearing will be conducted under favourable weather conditions. Operations will be postponed under adverse weather (i.e., storm events) to minimize potential sediment introduction into the aquatic environment.
- Slash/debris piles will be adequately stabilized and stored well above the HWM.

Erosion and Sediment Control

- Disturbed areas will be re-vegetated following completion of works.
- Appropriate erosion and sediment control measures will be implemented to prevent sediment introduction into watercourses.

Stream Crossings

Existing stream crossings will be used whenever possible during construction of the transmission line including access trails. Where an existing crossing does not exist and/or is not practical for use a temporary stream crossing may be used. DFO's OS for "Temporary Stream Crossings" (DFO 2007d) and, if appropriate conditions exist, for "Ice Bridges and Snow Fills" (DFO 2007f) should be adhered to including:

- Temporary stream crossings will be constructed only where existing crossings do not exist or are not practical for use.
- Temporary stream crossings consist of bridges, dry streambed fords, or a one-time ford (over and back) in flowing waters.
- Whenever possible, existing trails, roads, and cut lines will be used as access routes.
- Crossings will be constructed on a straight section of the watercourse, perpendicular to the channel.
- Clean materials will be used in the construction of temporary crossings. All materials will be removed upon project completion or prior to freshet (whichever occurs first).
- One-time fording (over and back) of flowing streams and temporary bridge construction will only occur where the channel width is less than 5 m (from HWM to HWM).
- Fording in flowing waters will occur within appropriate fisheries timing windows, as outlined in DFO's "Manitoba In-water Construction Timing Windows for the Protection of Fish and Fish Habitat" (DFO 2007e; Appendix 10).
- Fording will occur under low flow and favourable weather conditions and will avoid known fish spawning areas.
- Where necessary, measures to protect the streambed and banks will be in place prior to fording (e.g., pads, swamp mats). Protection measures will not impede fish passage or constrict flows.
- If fording will likely result in erosion and degradation of the streambed and banks, a temporary bridge will be constructed.

Concrete Works

- Any uncured or partly cured concrete will be kept isolated from watercourses.

- Concrete wash water or water that has contacted uncured or partly cured concrete will be isolated from watercourses until it has reached a neutral pH.

Riparian Management Areas – RoW Riparian Buffer Zone

Potential effects of transmission line construction and maintenance on nearby waterbodies will be mitigated by the establishment of RMAs within the RoW. These areas will be structured using the guidelines set out in the Water Quality and Fish Habitat keys in the "Forest Management Guidelines For Riparian Management Areas" (Manitoba Conservation and Manitoba Water Stewardship 2008). Due to the nature of transmission line construction, some of the guidelines cannot be followed (no harvesting of vegetation, no mechanical disturbance). However the guidelines will be followed as closely as possible. This will include a Riparian Buffer (RB) where ground disturbance is minimized, all shrub and herbaceous vegetation is retained and all trees that do not violate Manitoba Hydro vegetation clearance requirements are retained.

The size of the RB will be dependent on the following:

- Flow regime:
    - Perennial waterbodies – 30 m; and
    - Ephemeral/intermittent waterbodies – 7 m.
- Fish Habitat:
    - Important fish habitat – 30 m;
    - Marginal fish habitat – 15 m; and
    - No Fish Habitat – 7 m.

The larger of the two RMAs that might be applicable to one waterbody was adopted. A list of RMAs sizes was determined for all sites and is summarized in Table 6.

6.1.3.2.2 Operation and Maintenance

Vegetation Management

During the operation of the project, riparian vegetation management within the RoW will adhere to DFO's OS for "Maintenance of Riparian Vegetation in Existing Rights-of-way" (DFO 2007b; Appendix 10) including the following measures:

- In riparian areas, vegetation will be maintained in a way that leaves root systems intact.
- Riparian vegetation maintenance within 30 m of the HWM will affect a maximum of 1/3 of woody vegetation (e.g., trees and shrubs) within the RoW.
- Riparian vegetation maintenance will be conducted by the method that minimizes stream bank disturbance. If rutting or erosion is likely, appropriate bank protection measures will be implemented prior to machinery use.
- All waste materials (slash) will be stabilized well above the HWM to mitigate entry into the watercourse.

- Application of herbicides will adhere to appropriate best management practices. All chemical applications will be conducted by a certified applicator.

Erosion and Sediment Control

- Disturbed areas will be stabilized through seeding, planting, mulching, or other appropriate materials to prevent erosion and sediment transport into the watercourse.
- Erosion and sedimentation control measures will be routinely inspected to ensure effectiveness.

Stream Crossing

Existing stream crossings will be used whenever possible during operations and maintenance. Where an existing crossing does not exist and/or is not practical for use a temporary stream crossing may be used. DFO's OS for "Temporary Stream Crossings" (DFO 2007d) and, if appropriate conditions exist, for "Ice Bridges and Snow Fills" (DFO 2007f) should be adhered to as described in Section 6.1.3.2.1.

6.1.3.3 Ground Electrode Sites

- Construction of the ground electrode sites will adhere to the mitigation measures outlined in DFO's OS for "Isolated or Dry Open-cut Stream Crossings" (DFO 2007a; Appendix 10).
- Where crossing a stream is necessary, fording or construction of temporary stream crossings will follow DFO's OS for "Temporary Stream Crossings" (DFO 2007d) and, if appropriate conditions exist, for "Ice Bridges and Snow Fills" (DFO 2007f).

6.1.3.3.1 Instream Work and Diversions

- All instream construction activities will be conducted during the appropriate fisheries timing window as outlined in DFO's OS for "Manitoba In-water Construction Timing Windows for the Protection of Fish and Fish Habitat" (DFO 2007e; Appendix 10) to protect spawning fish and developing eggs and fry.
- Instream work will be conducted during favourable weather conditions. Construction will be postponed under adverse weather (i.e., storm events) to minimize potential sediment introduction into the aquatic environment.
- All instream construction activities will be conducted in isolation of flowing water using a temporary diversion.
- Flow to downstream areas will be maintained at all times while diversions are in place.
- Turbid water generated from the isolated work site will be pumped away from the watercourse to a vegetated area, filter fabric dam, or other acceptable area that will provide filtration and/or settling time prior to entering watercourses.
- Diversions will be removed following completion of works. The site will be restored and all disturbed surfaces stabilized (i.e., re-vegetated).

Erosion and Sediment Control

- A standard development setback of 15 m will be established from the HWM of all adjacent waterbodies, where clearing of vegetation will be minimized.
- Disturbed areas will be re-vegetated following completion of works.
- Appropriate erosion and sediment control measures will be implemented to prevent sediment introduction into watercourses.

6.1.3.3.2 Contamination from Leaching of Embedded Coke

Coke leachate is not expected to have a significant effect on the aquatic environment due to the lack of groundwater or subsurface water flow into surface waters at the preferred ground electrodes sites. However, to ensure protection of waterbodies, coke will be rinsed or leached (aged) before used to remove any metals loosely bound to its surface (Alberta Environment 2008, Squires 2005).

To prevent an accidental spill of coke into the aquatic environment, coke materials will be stored greater than 100 m from the ordinary high water mark. Coke will be adequately contained and protected from wind and rain to prevent entry of fine particulates into streams through runoff or dust deposition.

6.1.3.4 Converter Station

The main concerns to fish habitat from construction/operation of the converter station are erosion of sediments into areas adjacent to the converter station site and waste water effluent discharge into fish bearing streams.

6.1.3.4.1 Erosion and Sediment Control

Erosion of sediments into wetted areas adjacent to construction site during construction and operation of the converter station will be mitigated using the following measures:

- A standard development setback of 15 m will be established from the HWM of all adjacent waterbodies, where clearing of vegetation will be minimized.
- Erosion and sedimentation control measures will be in place before construction commences and will be maintained throughout the construction phase.
- An erosion and sediment control plan will be created for this project.
- During spring runoff erosion and sediment control measures will be in place to ensure sediment laden water does not leave the site or enter nearby streams.
- Silt fencing will be used and installed correctly where there is the potential for erosion of exposed soils into adjacent waterbodies or wetlands. Damaged silt fencing will be immediately repaired.
- Long-term erosion control requirements will be developed and will follow the most recent best management practices of Manitoba.
- Surface erosion control measures such as tackifiers, hydroseeding, organic mulches, wood fibre, peat moss, wood chips/bark, brush matting, or the application of water may also be used at the discretion of the construction contractor.

- Water will be applied to exposed ground or soil during construction to reduce dust caused by wind and construction traffic.
- Erosion prone areas, such as steep slopes, erodible soils, wet areas, and areas adjacent to watercourses, will be monitored to ensure erosion is minimized.
- Erosion control measures will be used as required in the ditches to reduce surface erosion and the washing or blowing away of seed.
- Surface runoff will be directed into well vegetated areas or settling basins. Existing drainage systems will be used when possible.
- Contractors will ensure that sufficient erosion control materials are present on site (such as silt fencing, stakes, and geotextile fabric) to ensure timely response to erosion and sedimentation issues that arise during construction activities.
- The application of soil erosion control measures will be implemented when there is evidence of soil erosion (e.g., erosion of topsoil berms or piles, etc.) and immediately after grading is completed to stabilize the soil.

6.1.3.4.2 Waste Water Effluent

Sewage effluent will be discharged to Goose Creek and will meet the following standards:

- Sewage effluent will be treated to meet the Manitoba Water Quality Standard for municipal waste water effluents of 25 mg/L TSS prior to discharge.
- Sewage effluent will be treated to meet the Manitoba Water Quality Standard for municipal waste water effluents of 25 mg/L BOD prior to discharge.
- Sewage effluent will be treated, as required, to meet the MWQSOG for pH levels for the protection of aquatic life (6.5-9.0) prior to discharge.
- Sewage effluent will be treated to meet the Manitoba Water Quality Standard for municipal waste water effluents of 200 faecal coliform organisms/100 mL prior to discharge.
- Sewage effluent will be treated to meet the Manitoba Water Quality Standard for municipal waste water effluents of 1 mg/L TP prior to discharge.

The construction of the waste water outlet to Goose Creek will minimize riparian vegetation clearing and stream bank damage. Mitigation for instream works (Section 6.1.3.3.1) and erosion and sediment control (Section 6.1.3.4.1) will be implemented. Specific mitigation will be refined when construction details are finalized.

6.1.3.5 Construction Camp

6.1.3.5.1 Construction

Siting of the camp facilities will be such that a watercourse is not included in the footprint of the camp, avoiding any physical impact to fish habitat. A standard development setback of 15 m will be established from the HWM of all adjacent waterbodies, where clearing of vegetation will be minimized.

6.1.3.5.2 Waste Water Effluent

Sewage effluent will be discharged to Creek Fourteen and meet the same standards outlined for the converter stations (Section 6.1.3.4.2). The construction of the waste water outlet to Creek Fourteen will minimize riparian vegetation clearing and stream bank damage. Mitigation for instream works (Section 6.1.3.3.1) and erosion and sediment control (Section 6.1.3.4.1) will be implemented. Specific mitigation will be refined when construction details are finalized.

6.1.3.6 Borrow

Siting of the borrow pit and excavated material placement areas away from waterbodies is preferable to avoid potential effects of borrow pit activity on fish and fish habitat. Other mitigation measures are described below.

6.1.3.6.1 Borrow Sites

- No excavating below the water table.
- No refueling in borrow areas which could result in fuel spillage in groundwater recharge areas.
- No dumping oil or other machinery lubricants in borrow and/or groundwater areas.
- A standard development setback of 15 m will be established from the HWM of all adjacent waterbodies, where clearing of vegetation will be minimized.

6.1.3.6.2 Excavated Material Placement Areas

- Construct berms surrounding all placement areas to prevent runoff.
- A standard development setback of 15 m will be established from the HWM of all adjacent waterbodies, where clearing of vegetation will be minimized.

6.2 Residual Effects

6.2.1 Approach

The significance approach framework is guided by the "Reference Guide for the *Canadian Environmental Assessment Act*" (CEAA 1994) and includes the identification of adverse environmental effects, followed by the determination of the significance and likelihood of the residual adverse effects. The effects assessment was applied to each project component and specific activities that have the potential to effect the selected VECs.

Because a significant residual adverse effect to fish habitat (a VEC) may constitute a violation of the *Fisheries Act*, the "Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff" (DFO 2010) was considered in the effects assessment. Within this framework, DFO has developed OSs for certain lower risk projects/activities. DFO OSs outline specific conditions and mitigation measures that must be followed to avoid a HADD.

Where an OS is in place for a specific activity (e.g., Overhead Line Construction), the OS's specific mitigation must be adhered to and is considered sufficient to offset any significant residual adverse effect to fish habitat and is therefore in compliance with the *Fisheries Act*.

In cases where the implementation of appropriate mitigation may not offset effects, the significance of resulting residual effects was evaluated. The characterization of the significance of residual effects was based on habitat quality and sensitivity, the effectiveness of mitigation measures described in Sections 6.1.3 and the criteria outlined in Table 9. A project-related residual effect was considered Probable if there was a high likelihood that the productive capacity of fish habitat (a VEC) could be negatively affected after implementation of mitigation measures. An evaluation of confidence in the assessment of residual effects was also made based on the certainty of the scientific information. A residual effect that was High in probability and scientific certainty was considered to be a significant residual effect. A summary of the residual effects assessment is presented in Table 10.

6.2.2 Transmission Lines

The construction and operation of overhead transmission lines poses a low risk to fish habitat as indicated in DFO's OS for "Overhead Line Construction" (DFO 2007c). The two main potential effects to fish habitat from construction and operation of overhead transmission lines are loss of riparian habitat and instream sedimentation. With appropriate mitigation measures implemented, the residual effects from the construction and operation of the PR and collector and construction power lines is expected to have no measurable effect.

6.2.3 Construction Access Trails

Construction access trails will occur on existing linear disturbances and use existing waterbody crossing structures where available. Where crossing structures are not present, crossing will be made in adherence to DFO's OS for "Temporary Stream Crossings (DFO 2007d) or "Ice Bridges and Snow Fills" (DFO 2007f). With adherence to these OS' the construction access trails are expected to have no measure effect.

6.2.4 Ground Electrodes

The construction of the ground electrodes at NES6 and SES1c pose low risk to fish habitat. There is no watercourse at SES1c. Two roadside ditches directly south and north of the SES1c and Cooks Creek (west of the site) will be protected during construction; erosion and sedimentation controls will be implemented as necessary. Construction of the ground electrode at NES6 would include isolated or dry open-cut stream crossing construction. Potential effects from construction include riparian clearing, erosion and sedimentation, improper streambed restoration, alteration of stream flow, and fish stranding. These effects can all be mitigated through the implementation of DFO's OS for "Isolated or Dry Open-Cut Stream Crossings" (DFO 2007a), thereby eliminating adverse residual effect.

6.2.4.1 Embedded Coke

Coke leachate is not predicted to enter surface water at either of the ground electrode sites. In addition if leachate did enter a waterbody, it may or may not have a measureable effect on the aquatic environment. Similarly coke physically entering a watercourse through a spill is considered to have a low potential to cause adverse effects on the aquatic environment. Therefore, the residual effect of the placement and presence of coke on the aquatic environment is expected to have no measurable effect.

6.2.5 Keewatinoow Converter Station

The construction and operation of the converter station poses a low risk to fish habitat. The three main potential effects to fish habitat are the loss of habitat due to infilling, downstream sedimentation caused by construction, and the effects of waste water effluent from staff facilities on receiving waters. With appropriate mitigation measures implemented, the residual effects from the construction and operation of the converter station is expected to have no measurable effect.

Development of the converter station site will require the infilling of a portion of a small unnamed creek (NSC4). The creek is considered Marginal fish habitat of Low ecological importance since the infilling would result in the displacement of water from the site to similar habitat adjacent to the site that drains to the same channel downstream. The potential for increased local and downstream suspended and streambed sediment burdens caused by construction can be effectively mitigated through proper control measures.

The proposed waste water receiving water body, Goose Creek, supports Important fish habitat of High sensitivity. Through treatment of waste water to provincial guidelines prior to discharge and appropriate siting and construction of the waste water outlet, effects to fish habitat will be avoided. Therefore, the Keewatinoow Converter Station will have no significant residual effects.

6.2.6 Construction Camp

The Construction Camp footprint does not overlap any watercourses and siting of the waste water lagoons will also result in no overlap of watercourses. Therefore with appropriate riparian buffers, there will be no significant residual effects.

Construction Camp waste water effluent discharge to Creek Fourteen will require the construction of an outlet structure to the creek and the discharge of waste water effluent to the creek. Creek Fourteen is a small ephemeral creek with an undefined connection to the Nelson River. Flow ceases in the creek in summer and isolated stagnant pools are the only water in the creek. Creek Fourteen does not directly support fish, but provides water and nutrients to downstream areas. The mass-balance effluent modeling indicates that some MWQSOGs for PAL will be exceeded under some certain flow conditions. However, when considering the nature of fish habitat in the stream and the expectation of biota recovery between discharge events, discharge of camp waste water effluent to Creek Fourteen is not expected to result in a significant negative residual effect (Appendix 2).

6.2.7 Borrow

6.2.7.1 Borrow Sites

Potential borrow pit areas include 14 sites, six of which are situated near waterbodies. Borrow pit activities may have a negative effect on fish and fish habitat through erosion and sedimentation to streams, as well as pollution of and changes to groundwater flow. These effects can be negated through appropriate mitigation measures, including the establishment and maintenance of riparian setbacks, the restriction of excavation depth to avoid groundwater and prohibiting refueling within borrow pits. With these mitigation measures in place there will be no residual effects for borrow pits.

6.2.7.2 Excavated Material Placement Areas

The six excavated material placement areas do not overlap any water bodies but do lie adjacent to nine water bodies. Erosion and sediment laden runoff that enters an adjacent water body could negatively affect fish habitat. Mitigation measures can contain such runoff and negate the effects to fish habitat. Therefore, with prescribed mitigation measures in place there will be no residual effects for the excavated material placement areas.

6.3 Monitoring

6.3.1 Construction Monitoring

6.3.1.1 Drainage Patterns

Temporary and permanent facilities installed to maintain natural cross-flow drainage across the construction sites will be inspected on a regular basis to ensure that natural drainage is not being inhibited by the construction activities.

6.3.1.2 Surface Water Quality

Construction activities have the potential to introduce sediment or deleterious materials to waterbodies. Water quality monitoring will be implemented at construction sites where instream construction occurs under wetted conditions (i.e., not dry or frozen to the bottom) and an OS does not apply. This includes construction of the waste water outlet structures at Creek Fourteen and Goose Creek.

Prior to the start of construction, the normally occurring linear relationship between total suspended solids (TSS) concentration and turbidity in the watercourse will be determined. Watercourse monitoring will include regular turbidity measurements when potential release of sediments can occur during construction activities (e.g., installing stream isolation barriers). Measurement frequency and locations will depend on site condition/construction activity and type of watercourse, respectively. The measurements will be converted to TSS (mg/L). The maximum allowable increase in TSS will follow the Canadian Council of Ministers of the Environment guidelines (CCME 1999; updated to 2011).

The watercourse will be monitored during the remaining phases of construction for signs of malfunction. Monitoring will include turbidity measurements and visual observations along watercourse margins for detection of a TSS plume or ‘oil sheen’. The watercourse monitoring is essential to detect sediment release or spill of a deleterious substance into the watercourse. If a release is detected, mitigative actions will immediately be undertaken and will include a review and modifications, if appropriate, of the construction plan to prevent a subsequent similar release.

6.3.2 Follow-Up Monitoring

All stream crossing sites will be inspected following construction to document compliance with prescribed mitigation and recommend additional remediation where deemed necessary.

Where disturbance to streambed and stream banks has occurred, all disturbed bed and bank sites will be restored comparable to pre-disturbance conditions. Restoration efforts will be monitored as required by proponent personnel. Once restoration work is deemed acceptable, temporary erosion control structures will be removed.

6.3.3 Effluent Monitoring

Municipal and industrial waste water facilities operate under a *Manitoba Environment Act* license issued and are monitored by Manitoba Conservation. The license outlines requirements of proponents for effluent quality and monitoring.

Monitoring of surface water quality is recommended for Goose Creek as this creek supports Important fish habitat. Monitoring would be conducted for nutrients, DO, BOD, and TSS at a minimum of three sites (upstream, mixing zone, and fully mixed zone) and would occur during periods of discharge for three years.

6.4 Potential Cumulative Effects

Cumulative environmental effects can result when the environmental effects of a project combine with the effects of other past, present and future projects or activities. Cumulative effects typically occur over a large area that may cross spatial and temporal boundaries, and can act, at least, additively, and, at most, synergistically. A series of seemingly insignificant environmental effects over space and time, for example, may ultimately result in a significant effect when an ecological or legal threshold is exceeded.

The cumulative effects assessment (CEA) is carried out using residual environmental effects of other projects or activities within the Bipole III study area and proximate vicinity, emphasizing the use of the same environmental indicators and measurable parameters or variables as the Bipole III Project environmental effects (Table 11).

The proposed Bipole III transmission project is a very large, complex project with many components including transmission lines, converter stations, ground electrode facilities, construction camps, marshaling yards, etc. Each project component may have environmental effects that may act cumulatively with the effects of other components as well as the effects of other projects and activities in the assessment area.

A review of existing and future projects (next 20 years) was conducted with either the reported or anticipated residual effect to the aquatic VECs summarized (Table 12).

6.4.1 Transmission Lines

Several existing overhead line transmission projects exist within the study area and surrounding areas. These include:

- Wuskwatim transmission project;
- AC collectors in lower Nelson River;
- US tie-line;
- Dorsey-Portage - 500 kV;
- South loop-Dorsey to Riel - 230 kV; and
- Letellier/St. Vital.

In addition to changes in riparian vegetation and associated effects, portions of the Wuskwatim Transmission Project parallel the Bipole III Project and are therefore in close proximity on some of the same watercourses.

Future transmission projects include:

- Keeyask collector lines; and
- Conawapa collector lines.

Overhead transmission lines pose a small risk to water quality and fish habitat. Effects to water quality and fish habitat occur primarily through erosion and sedimentation of streams and the loss of riparian vegetation and associated function. However, the residual effects of construction and operation of overhead transmission lines are considered negligible. Where a number of transmission line RoW occur in close proximity or the RoW becomes large, the potential significant residual effects from the loss of riparian vegetation becomes more likely. Such is the case in the lower Nelson River area, specifically with the increasing number of collector lines. However, riparian vegetation bordering the majority of streams in this area consist of low growth plants (sedge, willow) within a saturated floodplain (and not canopy trees shading the stream). Considering the growth, form, and function of riparian vegetation is this area, the cumulative effect of multiple RoW is expected to be negligible.

6.4.2 Hydroelectric Generation Stations

Several existing GS projects exist within the study area and surrounding areas. These include:

- Long Spruce Generating Station; and
- Limestone Generating Station.

Future GS projects in the study area include:

- Conawapa Generating Station; and
- Keeyask Generating Station.

The main residual effect resulting from the construction and operation of hydroelectric generating stations is the inundation of the lower reaches of tributaries. This results in change in water levels and flow regime and, therefore, fish habitat in a portion of some tributaries.

The effects from the Bipole III project in this area will include the infilling of an unnamed tributary, discharge of waste water effluent to Goose Creek and Creek Fourteen, ground electrode crossing on an unnamed creek, and effects from overhead transmission lines. However, due to the low level of the residual effect from the Bipole III Project, the cumulative effect when combined with generating stations is considered not significant.

6.4.3 Forestry

Forestry activities currently exist within the Bipole III project study area, including:

- Tolko operations; and
- Louisiana Pacific operations.

With the implementation of riparian management guidelines, forestry has little effects of water quality and fish habitat in adjacent streams. The development of access roads has the potential to effect water quality and fish habitat at stream crossings through infilling of fish habitat and the introduction of sediments and nutrients. Therefore, the cumulative effect when combined with forestry is considered not significant.

6.4.4 Roads

Past and future road developments have the potential to effect water quality and fish habitat in streams that are crossed. Effects include the direct loss of fish habitat through the placement of crossing structures in the stream (e.g., culvert, bridge abutments), the introduction of sediment during construction, and ongoing introduction of sediments by way of erosion and the loss of riparian vegetation along the RoW. There are numerous roads throughout the study area that include stream crossings. However, in contrast to permanent road crossings, the Bipole III transmission line stream crossings have a negligible effect.

6.4.5 Agriculture

Agricultural developments and practices in the study area have affected and continue to affect water quality and fish habitat. Previous straightening and channelization of smaller streams have simplified fish habitat and have generally reduced fish habitat quality. Channelization is generally an action from the past. Current effects to watercourses include the loss of riparian vegetation, damage to stream banks, and erosion and sedimentation of stream through livestock where pastures include watercourses. In comparison, the Bipole III project will have negligible effects to watercourses. The additive of effect of Bipole on current and future agricultural effects will be negligible.

6.4.6 Climate Change

The effects of climate change are predicted to result in earlier, wetter springs, warmer, drier summers and shorter, milder winters in Manitoba (MMM 2011). Extreme weather events, such as flood and severe droughts will become more frequent and although there will be an increase in total precipitation, water scarcity will likely be the single most critical climate change result. The predicted increase in precipitation will be offset by higher temperatures and increased evaporation and plant transpiration resulting in a net reduction in available water. It is conceivable that increased flood events may result in increased erosion and sedimentation of water courses, affecting both surface water quality and fish habitat. Perhaps more important from a fish habitat perspective is the potential reduction in summer and wintering fish habitat resulting from reduced surface water levels.

Most Bipole III project components have insignificant effects to the aquatic environment following the implementation of mitigation measures that avoid direct and indirect impacts to surface water quality and fish habitat (e.g., riparian management, no instream works, and avoidance of sensitive habitats). Therefore, any changes to surface water levels or quality resulting from climate change will not have a compounding effect to that of most Bipole III project components. One project component where climate change effects may result in a cumulative or enhanced effect of the project is the Keewatinoow Converter Station waste water discharge.

The discharge of waste water to surface waters relies on surface water flow to dilute effluent in order to achieve surface water quality within provincial guidelines. A reduction in surface water would therefore have a direct effect on the dilution potential; the potential for this is greatest at Goose Creek, the receiving water for waste water effluent from the Keewatinoow Converter Station.

The mass-balance model applied to the waste water discharge to Goose Creek indicated that under the lowest flow scenario Total Phosphorous (TP) in the creek would marginally exceed the provincial guideline. If summer and fall water flows are reduced due to climate change, the TP level in Goose Creek would be expected to exceed guideline by a greater margin and under higher percentile flows. Adjustments to the discharge regime could mitigate such changes in surface water flow to allow receiving water quality to remain within guideline. It should be noted that climate change effects are predicted over the long-term (up to the year 2100), and such predicted effects may not be realized during the life of the Bipole III project.

6.4.7 Other

Both past and future natural events, such as forest fires have potential adverse effects on water quality and fish habitat through effects to riparian vegetation, nutrient loading, erosion and sedimentation. The unpredictable nature of such events makes the assessment of cumulative effects challenging.

Expansion of the Red River Floodway resulted in effects to fish habitat ion the channel proper as well as associated floodway infrastructure. Fish habitat effected was variable in its quality and the impacts In the general area, effects from the Bipole III project are limited to the overhead transmission line stream crossing effects – and they will have a negligible cumulative effect in addition to other natural and anthropogenic effects.

6.4.8 Evaluation of Significance

Residual effects on the aquatic VECs from the Bipole III project were assessed as negligible and not significant. Where effects from other projects, known or anticipated, were identified the cumulative effect when considered with Bipole III residual effects are considered not significant. This is due to the negligible level of the Bipole III residual effect on the Bipole III aquatic VECs.

7.0 CONCLUSIONS

7.1 Transmission Lines

The transmission line PR crosses a total of 317 watercourses. Of these, 54 were classified as No Fish Habitat, 185 as Marginal, 78 as Important, and none had Critical fish habitat. The sensitivity of watercourse crossing sites to disturbance was rated as Low for 172 sites, Moderate for 137 and High for eight sites. The eight sites with High habitat sensitivity and Important fish habitat included the Burntwood, Mitishto, Steeprock, Woody, North Duck, Assiniboine, Red, and Rat rivers.

There are 43 watercourse crossings within the RoW of the five collector lines and one construction power line. The majority of the watercourses along the route were small headwater streams and isolated wetlands. Four had No Fish Habitat, 31 were Marginal, and eight were classified as Important (e.g., Limestone and Nelson rivers, Goose and Wilson creeks). Most crossing sites (38) were rated as Moderate respective to their sensitivity to disturbance. The smaller watercourses tended to have soft floodplains susceptible to rutting and the larger watercourses had banks with instability. Five crossing sites have Low sensitivity to disturbance ratings.

The northern ground electrode line crosses five watercourses. Of these, three were classified as Marginal fish habitat, and the remaining two as Important fish habitat. No crossings had Critical fish habitat. The sensitivity of watercourse crossing sites to disturbance was rated as Moderate for all five sites due to the presence of soft floodplains or unknown bank stabilities.

The construction and operation of overhead transmission lines pose a low risk to fish habitat as indicated in DFO's OS for "Overhead Line Construction (DFO 2007c). The two main potential effects to fish habitat from construction and operation of overhead transmission lines are loss of riparian habitat and instream sedimentation. With appropriate mitigation measures implemented, the residual effects from the construction and operation of the PR and collector and construction power lines is expected to have no measurable effect.

The Bipole III PR has 57 waterbodies within the 50 m buffer zone from the RoW that would require mitigation under riparian management guidelines. Of these, 39 were assessed as No Fish Habitat, 15 as Marginal, and three as Important. No waterbodies were assessed as Critical. Twenty-one of these waterbodies had ephemeral flow regimes, 32 waterbodies had intermittent, and four had perennial flow regimes. Perennial waterbodies or waterbodies with Important fish habitat were assigned a 30 m RB, ones with Marginal fish habitat were assigned 15 m RBs, and ephemeral, intermittent, or streams with No Fish Habitat were assigned 7 m RBs. The larger of the two RMAs that might be applicable to one waterbody was adopted.

The collector and construction power lines contained only one waterbody within the 50 m buffer zone. This waterbody was a small unnamed pond within a larger wetland area that contained No Fish Habitat and had an intermittent flow regime. It was assigned a 7 m RB.

The northern ground electrode line contained only one waterbody within the 50m buffer zone. This waterbody was a section of Swift Creek that contained Important fish habitat and had a perennial flow regime. It was assigned a 30 m RB.

Construction monitoring will be employed to ensure the integrity of mitigative measures utilized for transmission lines. All disturbed bed and bank sites will be restored comparable to pre-

disturbance conditions. Restoration efforts will be monitored as required by proponent personnel. Once reclamation success is deemed acceptable, temporary erosion control structures will be removed.

7.2 Construction Access Trails

Twenty five of the 44 construction access trails will require crossings of waterbodies. There are 125 waterbody crossings on the construction access trails, ranging from isolated ponds, headwater streams and small and large creeks and rivers. All access trails occur on existing linear disturbances with some existing crossing structures in place. Where existing crossing structures are not present, temporary crossings in adherence to DFO's OS will be made (DFO 2007d, 2007f). With mitigation applied, the construction access trails are expected to have no measurable effect.

7.3 Ground Electrodes

The northern electrode site (NES6) contains an unnamed tributary of the Nelson River, which was rated as providing Marginal fish habitat. A Low sensitivity rating was assigned to this watercourse. The southern ground electrode site (SES1c) contains no waterbodies, but is adjacent to two roadside ditches and to Cooks Creek that were rated as Marginal and Important fish habitat, respectively.

The construction of the ground electrodes pose low risk to fish habitat. There is no watercourse at SES1c. The two roadside ditches directly south and north of the SES1c will be protected via erosion and sedimentation controls implemented during construction as necessary. Construction of the ground electrode at NES6 will include isolated or dry open-cut stream crossing construction. Effects from construction include riparian clearing, erosion and sedimentation, streambed disturbance, alteration of stream flow, and fish standing. These effects can all be mitigated through the implementation of applicable DFO OSs, eliminating adverse residual effects.

Coke leachate is not expected to have a significant effect on the aquatic environment due to the lack of groundwater or subsurface water flow into surface waters at the ground electrodes sites. To prevent an accidental spill of coke into the aquatic environment, coke materials will be stored greater than 100 m from the ordinary high water mark. Coke will be adequately contained and will be protected from wind and rain to prevent entry of fine particulates into streams through runoff or dust deposition.

Monitoring will be employed to ensure the integrity of mitigative measures utilized for ground electrode construction. Temporary and permanent facilities installed to maintain natural cross-flow drainage across the construction sites will be inspected on a regular basis to ensure that natural drainage is not being inhibited by the construction activities. Water quality monitoring will be implemented at crossing sites where there is potential for sediment introduction into surface waters (e.g., stream bed disturbance during stream isolations). All disturbed bed and bank sites will be restored comparable to pre-disturbance conditions. Reclamation efforts will be monitored as required by proponent personnel. Once reclamation success is deemed acceptable, temporary erosion control structures will be removed.

7.4 Converter Station

The proposed Keewatinoow Converter Station site includes headwaters (saturated land) of a drainage that has limited connectivity to the Nelson River (through vegetation). This waterbody conservatively provides Marginal fish habitat, but does not support fish directly.

The three main potential effects to fish habitat are the loss of habitat due to infilling, downstream sedimentation caused by construction, and the effects of waste water effluent from staff facilities on receiving waters. The area surrounding the converter station footprint is flat, saturated land that drains towards the Conawapa access road ditch similarly to the converter site's area, and is directed through the same culvert. The surrounding area also has similar substrate and vegetation as the footprint area. The infilling of the footprint's wetted area would be displaced proportionally to adjacent low-lying areas. The potential for increased local and downstream suspended and streambed sediment burdens caused by construction will be effectively mitigated through proper control measures and best management practices. Therefore, the construction and operation of the converter station poses a low risk to fish habitat and no residual effects are expected.

It is proposed that Goose Creek near the converter site be used to receive the facility waste water discharge. Sewage will be treated to meet MWQSOG effluent criteria. Based on baseline conditions, Goose Creek water quality and discharge range, predicted facility effluent discharge rate and regime, and effluent quality, the effects of treated sewage effluent in Goose Creek are expected to have no measurable effect in the fully mixed condition; however, small, localized increases in TSS may occur near the effluent outfall.

Waste water treatment will also require the construction of an outlet structure to the creek. Construction of an outlet that does not reduce the amount of fish habitat would be expected to represent a low risk of impacts to fish habitat, and is recommended for this project. Effluent carried to receiving waters via an excavated channel or an outlet pipe on the bank are examples of structures rated as Low for scale of negative effect that would have a negligible effect on fish habitat. Mitigation to control erosion and sediment, minimize riparian vegetation clearing, and stabilize stream banks would be implemented during outlet structure construction.

Monitoring will be employed to ensure the integrity of mitigative measures utilized during the construction and operation of the converter station. Temporary and permanent facilities installed to maintain natural cross-flow drainage across the construction sites will be inspected on a regular basis to ensure that natural drainage is not being inhibited by the construction activities. Water quality monitoring will be implemented at Goose Creek where there is potential for sediment introduction into surface waters (e.g., during waste water outlet construction). Reclamation efforts will be monitored as required by proponent personnel. Once reclamation success is deemed acceptable, temporary erosion control structures will be removed.

Municipal and industrial waste water facilities operate under a *Manitoba Environment Act* license issued and monitored by Manitoba Conservation. The license requirements will be followed by the proponent for effluent quality and monitoring.

7.5 Construction Camp

The construction camp footprint does not overlap any waterbodies and, with appropriate riparian setbacks, there will be no effect on fish habitat, and, therefore, no residual effects. However, one

watercourse (Creek Fourteen) adjacent to the camp site is a candidate for camp sewage effluent discharge.

Creek Fourteen was classified as Marginal fish habitat with Low sensitivity to disturbance. Creek Fourteen is small ephemeral creek with an undefined connection to the Nelson River. Exceedences of MWQSOGs for PAL are expected to occur during periods of effluent discharge (twice annually). Due to recovery of the aquatic biota between discharge events and the lack of quality fish habitat in Creek Fourteen, the effect to fish habitat from waste water effluent is predicted to have no measurable effect. The effects of treated sewage effluent once it reaches the lower Nelson River are also expected to have no measurable effect in the fully mixed condition.

Waste water treatment will also require the construction of an outlet structure to the creek. Construction of an outlet that does not reduce the amount of fish habitat is expected to represent a low risk of impacts to fish habitat, and is recommended for this project. Effluent carried to receiving waters via an excavated channel or an outlet pipe on the bank are examples of structures rated as Low for scale of negative effect that would have a negligible effect to fish habitat. Mitigation to control erosion and sediment, minimize riparian vegetation clearing, and stabilize stream banks would be implemented during outlet structure construction.

Monitoring will be employed to ensure the integrity of mitigative measures utilized during the construction and operation of the construction camp. Temporary and permanent facilities installed to maintain natural cross-flow drainage across the construction sites will be inspected on a regular basis to ensure that natural drainage is not being inhibited by the construction activities. Water quality monitoring will be implemented at Creek Fourteen where there is potential for sediment introduction into surface waters (e.g., during waste water outlet construction). Reclamation efforts will be monitored as required by proponent personnel. Once reclamation success is deemed acceptable, temporary erosion control structures will be removed.

Municipal and industrial waste water facilities operate under a *Manitoba Environment Act* license issued and monitored by Manitoba Conservation. The license requirements will be followed by the proponent for effluent quality and monitoring.

7.6 Borrow

Six of the Keewatinoow borrow sites are near waterbodies. Three sites overlap Swift Creek (i.e., borrow site N-4, N-5, and N-6) and two sites overlap unnamed creeks (N-8 and N-10-2). Sites N-4 and N-5 overlap Important fish habitat and have groundwater sites near them. Site N-6 overlaps Marginal fish habitat within Swift Creek and do not have any identified groundwater sites near it. Sites N-8 and N-10-2 were found to overlap intermittent unnamed tributaries of the Nelson River that were Marginal fish habitat and do not have any identified groundwater sites near them. Site N-9 was found to be near Goose Creek, which supports Important fish habitat, and site N-6 was found to be near two unnamed creeks, both assessed as intermittent watercourses with Marginal fish habitat. None of the excavated material placement areas overlap or encroach on waterbodies.

Borrow pit and material placement area activities may have a negative effect on fish and fish habitat through erosion and sedimentation to streams, as well as pollution of and changes to groundwater flow. Siting of the borrow pit and material placement areas away from waterbodies and establishing setbacks is proposed to avoid potential effects of borrow activity on fish and fish habitat. Other mitigation measures include not excavating below the water table, not

refueling in borrow areas, which could result in fuel spillage in groundwater recharge areas, not dumping oil or other machinery lubricants in borrow and/or groundwater areas, and the construction of berms surrounding material placement areas. Appropriate mitigation measures will result in no residual effects for borrow pits.

7.7 Cumulative Effects

Residual effects on the aquatic VECs from the Bipole III project were assessed as negligible and not significant. Where effects from other projects, known or anticipated, were identified the cumulative effect when considered with Bipole III residual effects are considered not significant. This is due to the negligible level of the Bipole III residual effect on the Bipole III aquatic VECs.

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TABLES

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Table 1. Summary of major watershed basins and sub-basins transected by the BP III preferred route corridor, collector, construction power lines and ground electrode line right-of-ways, including watercourse crossings.

Major Basin	Sub-Drainage Basin	Site IDs (Watercourse)
Nelson River	Lower Nelson River	1-63, C_C 1-43[1], G_E 1-5[2]
	Burntwood River	64-77
	Grass River	79-128, 143-155
	Upper Nelson River	129–142
Saskatchewan River	Clearwater Lake/Moose Lake	156-176
	Cedar Lake	177-185
Lake Manitoba	Lake Winnipegosis	186-210, 252-258
	Swan Lake	211-232
	Duck Mountain	232-251
	Lake Manitoba West	259-267
	Whitemud River	268-278
Assiniboine River	Central Assiniboine	279-281
Red River	La Salle River	282, 289, 290, 293-297
	Morris River	283-288, 291, 292
	Red River South	298, 299
	Rat River	300-303
	Seine River	304-315
	Cooks Creek/Devils Creek	316,317

[1] C_C denotes collector and construction power line watercourse crossings

[2]G_E denotes northern ground electrode line watercourse crossings

Table 2. Summary of watercourse crossings on the Bipole III Transmission Line preferred route.

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
1	Unnamed Tributary of Goose Creek	814094	6291412	5.5	Goose Creek	Marginal	N/A	Moderate
2	Unnamed Tributary of Goose Creek	813861	6291596	2.4	Goose Creek	Marginal	N/A	Moderate
3	Unnamed Tributary of Goose Creek	812398	6292558	1.7	Goose Creek	Marginal	N/A	Moderate
4	Unnamed Tributary of Goose Creek	811177	6292776	1.0	Goose Creek	Marginal	N/A	Moderate
5	Unnamed Tributary of Goose Creek	810400	6292915	0.5	Goose Creek	Marginal	N/A	Moderate
6	Unnamed Tributary of Tiny Creek	808477	6293259	0.8	Tiny Creek	Marginal	N/A	Moderate
7	Unnamed wetland	808089	6293329	-	-	No Fish Habitat	N/A	Low
8	Unnamed Tributary of Goose Creek	805864	6293726	4.1	Goose Creek	Marginal	N/A	Moderate
9	Unnamed Tributary of Goose Creek	803579	6294135	1.4	Goose Creek	Marginal	N/A	Moderate
10	Goose Creek	799341	6294065	44.9	Nelson River	Marginal	N/A	Low
11	Unnamed Tributary of Weir River	792745	6293177	1.1	Weir River	No Fish Habitat	N/A	Low
12	Unnamed Tributary of Weir River	790685	6292900	2.9	Weir River	No Fish Habitat	N/A	Low
13	9-Mile Creek	787107	6292418	4.9	Limestone River	Marginal	N/A	Low
14	9-Mile Creek	787054	6292411	5.0	Limestone River	Marginal	N/A	Low
15	9-Mile Creek	786825	6292380	5.1	Limestone River	Marginal	N/A	Low
16	9-Mile Creek	786558	6292344	5.3	Limestone River	Marginal	N/A	Low
17	9-Mile Creek	785839	6292247	13.3	Limestone River	Marginal	N/A	Low
18	Unnamed Tributary of McMillan Creek	783392	6291918	0.2	McMillan Creek	No Fish Habitat	N/A	Low
19	Unnamed Tributary of McMillan Creek	781481	6291660	1.3	McMillan Creek	No Fish Habitat	N/A	Low
20	Unnamed Tributary of McMillan Creek	779210	6291354	30.9	McMillan Creek	Marginal	N/A	Moderate
21	Unnamed Tributary of McMillan Creek	773472	6290582	9.0	McMillan Creek	Marginal	N/A	Moderate
22	McMillan Creek	770214	6290143	343.3	Limestone River	Important	N/A	Low
23	Unnamed Tributary of McMillan Creek	768847	6289959	1.2	McMillan Creek	No Fish Habitat	N/A	Low
24	Unnamed Tributary of McMillan Creek	768709	6289940	2.7	McMillan Creek	No Fish Habitat	N/A	Low
25	Unnamed Tributary of McMillan Creek	759726	6283711	0.3	McMillan Creek	No Fish Habitat	N/A	Low

ID	Name	UTM (Zone 14, NAD83)		Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
		Easting	Northing					
26	Unnamed Tributary of Limestone River	755973	6281452	1.8	Limestone River	No Fish Habitat	N/A	Low
27	Limestone River	754292	6280478	2012.4	Nelson River	Important	N/A	Low
28	Limestone River	745068	6278994	1893.6	Nelson River	Important	N/A	Low
29	Unnamed Tributary of Limestone River	739918	6279251	3.2	Limestone River	Marginal	N/A	Moderate
30	Unnamed Tributary of Limestone River	735678	6279272	1.8	Limestone River	Marginal	N/A	Low
31	Unnamed Tributary of Limestone River	733302	6278553	2.0	Limestone River	Marginal	N/A	Moderate
32	Unnamed Tributary of Unnamed Lake	731827	6278106	1.7	Unnamed Lake	Marginal	N/A	Low
33	Limestone River	728333	6276594	1763.9	Nelson River	Important	N/A	Moderate
34	Unnamed Tributary of Limestone River	727632	6276049	0.6	Limestone River	Marginal	N/A	Low
35	North Moswakot River	714765	6267856	170.7	Stephens Lake	Important	N/A	Low
36	Unnamed tributary of South Moswakot River	713755	6264884	0.9	South Moswakot River	Marginal	N/A	Moderate
37	Unnamed tributary of South Moswakot River	713965	6262983	90.3	South Moswakot River	Important	N/A	Moderate
38	South Moswakot River	714113	6261651	171.2	Stephens Lake	Important	N/A	Moderate
39	Unnamed tributary of South Moswakot River	713868	6259786	11.9	South Moswakot River	Marginal	N/A	Moderate
40	Unnamed tributary of South Moswakot River	712814	6258294	6.3	South Moswakot River	Marginal	N/A	Moderate
41	Unnamed tributary of Stephens Lake	706977	6254164	4.5	Stephens Lake	Marginal	N/A	Moderate
42	Unnamed tributary of Assean River	690229	6252641	1.8	Assean River	Marginal	N/A	Moderate
43	Unnamed tributary of Assean River	688781	6252726	9.2	Assean River	Marginal	N/A	Moderate
44	Unnamed tributary of Apetowachakamasik Lake	685019	6252948	0.0	Apetowachakamasik Lake	Marginal	N/A	Moderate
45	Unnamed Tributary of Apetowachakamasik Lake	684293	6252815	1.1	Apetowachakamasik Lake	Marginal	N/A	Low
46	Unnamed Tributary of Apetowachakamasik Lake	682418	6251649	1.5	Apetowachakamasik Lake	Marginal	N/A	Low
47	Unnamed Tributary of Assean River	678980	6250131	5.4	Assean River	Marginal	N/A	Moderate
48	Crying River	676613	6249674	1153.4	Stephens Lake	Important	N/A	Low
49	Unnamed Tributary of Hunting River	671345	6248509	4.4	Hunting River	Marginal	N/A	Low
50	Hunting River	670124	6248576	651.2	Assean River	Important	N/A	Low
51	Unnamed Tributary of Hunting River	668100	6248450	4.1	Hunting River	No Fish Habitat	N/A	Low
52	Awaweyaykamak Creek	665103	6247104	42.9	Hunting River	Marginal	N/A	Moderate

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
53	Unnamed Tributary of Hunting River	657552	6243713	3.3	Hunting River	Marginal	N/A	Low
54	Unnamed Tributary of Hunting River	656411	6243250	15.3	Hunting River	Marginal	N/A	Moderate
55	Missewaitay River	650348	6240910	432.7	Hunting River	Important	N/A	Moderate
56	Unnamed Tributary of Hunting Lake	648304	6240528	0.0	Hunting Lake	Marginal	N/A	Low
57	Unnamed tributary of Hunting Lake	644166	6237928	0.2	Hunting Lake	Marginal	N/A	Moderate
58	Unnamed tributary of Hunting Lake	643421	6236939	8.8	Hunting Lake	Marginal	N/A	Moderate
59	Unnamed tributary of Assean Lake	643398	6234822	0.4	Assean Lake	Marginal	N/A	Low
60	Unnamed tributary of Assean Lake	643386	6233774	2.3	Assean Lake	Marginal	N/A	Moderate
61	Unnamed tributary of Clay River	643376	6232830	0.2	Clay River	Marginal	N/A	Moderate
62	Unnamed tributary of Clay River	643370	6232351	1.6	Clay River	Important	N/A	Moderate
63	Clay River	643357	6231167	260.1	Assean Lake	Important	N/A	Moderate
64	Unnamed tributary of Burntwood River	641963	6227980	1.1	Burntwood River	Marginal	N/A	Moderate
65	Unnamed tributary of Burntwood River	641825	6227902	1.2	Burntwood River	Marginal	N/A	Moderate
66	Unnamed tributary of Burntwood River	635356	6223851	4.8	Burntwood River	Marginal	N/A	Moderate
67	Unnamed tributary of Burntwood River	632129	6221631	1.3	Burntwood River	Marginal	N/A	Moderate
68	Unnamed tributary of Orr Creek	629889	6220190	0.0	Orr Creek	Marginal	N/A	Moderate
69	Orr Creek	629264	6219788	236.7	Burntwood River	Important	N/A	Moderate
70	Unnamed tributary of Orr Creek	628746	6219456	0.0	Orr Creek	Marginal	N/A	Moderate
71	Unnamed tributary of Burntwood River	621924	6215068	8.8	Burntwood River	Marginal	N/A	Moderate
72	Odei River	620228	6212911	6259.7	Burntwood River	Important	N/A	Low
73	Unnamed Tributary of Odei River	619439	6211546	1.0	Odei River	Marginal	N/A	Low
74	Unnamed Tributary of Burntwood River	618229	6209674	0.3	Burntwood River	Marginal	N/A	Moderate
75	Unnamed Tributary of Burntwood River	617598	6208747	0.5	Burntwood River	Marginal	N/A	Low
76	Unnamed Tributary of Burntwood River	617392	6208452	0.2	Burntwood River	No Fish Habitat	N/A	Low
77	Burntwood River	616211	6206771	19103.2	Nelson River	Important	N/A	High
78	Tributary of Burntwood River	613794	6201861	6.8	Burntwood River	Marginal	N/A	Moderate
79	Ponded area within wetland	612275	6199694	n/a	n/a	No Fish Habitat	N/A	Low
80	Tributary of Brannigan Creek	609670	6196994	5.1	Brannigan Creek	Marginal	N/A	Low

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
81	Tributary of Brannigan Creek	607525	6195647	2.0	Brannigan Creek	Marginal	N/A	Low
82	Brannigan Creek	607318	6195517	11.4	Brannigan Lake	Marginal	N/A	Moderate
83	Unnamed stream	603314	6193001	n/a	n/a	Marginal	N/A	Low
84	Unnamed stream	603199	6192929	n/a	n/a	Marginal	N/A	Low
85	Small, unnamed lake	600543	6191260	n/a	Isbister Creek	Marginal	N/A	Low
86	Tributary of Isbister Creek	599839	6190817	7.3	Isbister Creek	Marginal	N/A	Moderate
87	Tributary of Isbister Creek	598731	6190121	13.2	Isbister Creek	Marginal	N/A	Moderate
88	Tributary of Isbister Creek	596605	6187282	1.7	Isbister Creek	Marginal	N/A	Moderate
89	Isbister Creek	596653	6185774	24.6	Isbister Lake	Marginal	N/A	Moderate
90	Tributary of Isbister Creek	596631	6183081	2.1	Isbister Creek	Marginal	N/A	Moderate
91	Tributary of Partridge Crop Lake	595145	6179083	0.1	Partridge Crop Lake	No Fish Habitat	N/A	Low
92	Tributary of Partridge Crop Lake	595069	6178880	0.2	Partridge Crop Lake	Marginal	N/A	Low
93	Unnamed Tributary of Partridge Crop Lake	594469	6177266	2.2	Partridge Crop Lake	Marginal	N/A	Moderate
94	Tributary of Partridge Crop Lake	594220	6174610	0.0	Partridge Crop Lake	Marginal	N/A	Low
95	Tributary of Partridge Crop Lake	594113	6172023	0.5	Partridge Crop Lake	Marginal	N/A	Low
96	Tributary of Partridge Crop Lake	594062	6170794	0.2	Partridge Crop Lake	No Fish Habitat	N/A	Low
97	Tributary of Partridge Crop Lake	594046	6170413	1.0	Partridge Crop Lake	Marginal	N/A	Moderate
98	Partridge Crop Lake	593719	6167671	4.1	Nelson River	Important	N/A	Moderate
99	Partridge Crop Lake	593115	6163661	12764.1	Nelson River	Important	N/A	Low
100	Unnamed Tributary into Partridge Crop Lake	592983	6162918	0.2	Partridge Crop Lake	Marginal	N/A	Low
101	Unnamed Tributary into Partridge Crop Lake	592552	6161442	0.2	Partridge Crop Lake	No Fish Habitat	N/A	Low
102	Unnamed Tributary into Partridge Crop Lake	594062	6170794	n/a	Partridge Crop Lake	Marginal	N/A	Low
103	Unnamed Pond	591937	6159336	n/a	n/a	No Fish Habitat	N/A	Low
104	Unnamed Tributary into Partridge Crop Lake	591822	6158940	0.1	Partridge Crop Lake	Marginal	N/A	Low
105	Unnamed Tributary into Partridge Crop Lake	591693	6158498	n/a	Partridge Crop Lake	Marginal	N/A	Moderate
106	Unnamed Tributary into Partridge Crop Lake	591527	6157930	0.7	Partridge Crop Lake	Marginal	N/A	Low
107	Unnamed Tributary into Partridge Crop	591129	6156698	0.9	Partridge Crop Lake	Marginal	N/A	Moderate

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
	Lake							
108	Unnamed Tributary into Partridge Crop Lake	589219	6153875	4.0	Partridge Crop Lake	Marginal	N/A	Moderate
109	Unnamed Tributary into Partridge Crop Lake	583153	6149524	0.8	Partridge Crop Lake	Marginal	N/A	Low
110	Unnamed Tributary into Partridge Crop Lake	582835	6149296	n/a	Partridge Crop Lake	Marginal	N/A	Moderate
111	Unnamed Tributary into Partridge Crop Lake	581555	6148411	0.1	Partridge Crop Lake	Marginal	N/A	Moderate
112	Unnamed Tributary into Partridge Crop Lake	579961	6147362	n/a	Partridge Crop Lake	Marginal	N/A	Moderate
113	Unnamed Tributary into Partridge Crop Lake	578892	6146658	n/a	Partridge Crop Lake	Marginal	N/A	Moderate
114	Unnamed Tributary into Partridge Crop Lake	577301	6145610	8.0	Partridge Crop Lake	Important	N/A	Moderate
115	Unnamed Tributary into Partridge Crop Lake	574802	6143965	0.7	Partridge Crop Lake	Marginal	N/A	Moderate
116	Unnamed Tributary into Teardrop Lake	571920	6141885	4.7	Teardrop Lake	Marginal	N/A	Moderate
117	Unnamed Tributary connecting Gordon Brown Lake and Wintering Lake	570089	6140201	26.5	Wintering Lake	Marginal	N/A	Moderate
118	Unnamed Tributary of Wintering Lake	569354	6139525	20.9	Wintering Lake	Important	N/A	Low
119	Unnamed Tributary into Gordon Brown Lake	568747	6138967	1.3	Gordon Brown Lake	Marginal	N/A	Moderate
120	Unnamed Tributary into Wintering Lake	562136	6132887	6.5	Wintering Lake	Marginal	N/A	Moderate
121	Unnamed Tributary into Wintering Lake	561331	6132146	1.8	Wintering Lake	Marginal	N/A	Moderate
122	Unnamed Tributary into Wintering Lake	559194	6129706	1.4	Wintering Lake	Marginal	N/A	Moderate
123	Unnamed Tributary into Wintering Lake	558358	6128722	0.7	Wintering Lake	Marginal	N/A	Low
124	Patrick Creek	554582	6124563	83.6	Halfway River	Important	N/A	Moderate
125	Halfway River	553547	6124051	272.3	Halfway Lake	Important	N/A	Low
126	Halfway River	552970	6123685	270.1	Halfway Lake	Important	N/A	Low
127	Unnamed tributary of Patrick Lake	548641	6116350	-	Patrick Lake	No Fish Habitat	N/A	Low
128	Unnamed pond	547521	6112843	-	-	No Fish Habitat	N/A	Low
129	Unnamed tributary of Tooth lake	546114	6107319	1.0	Tooth Lake	Marginal	N/A	Moderate
130	Unnamed tributary of Rocky Lake	546383	6105516	13.1	Rocky Lake	Important	N/A	Moderate

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131	Unnamed tributary of Monty lake	545255	6101623	15.9	Monty Lake	Marginal	N/A	Moderate
132	Unnamed tributary of Leech Lake	544730	6100255	1.9	Leech Lake	Marginal	N/A	Moderate
133	Unnamed tributary of Sipiwesk Lake	541948	6094805	160.6	Sipiwesk Lake	Important	N/A	Moderate
134	Lumgair Creek	538325	6090109	9.3	Sipiwesk Lake	Marginal	N/A	Moderate
135	Thicket Creek	536586	6086988	8.7	Sipiwesk Lake	Marginal	N/A	Moderate
136	Unnamed tributary of Thicket Creek	536286	6086379	3.2	Thicket Creek	Marginal	N/A	Moderate
137	Unnamed tributary of Clarke Creek	532224	6078132	25.0	Clarke Creek	Important	N/A	Moderate
138	Unnamed tributary of Clarke Creek	531588	6076841	11.1	Clarke Creek	Marginal	N/A	Moderate
139	Unnamed tributary of Clarke Creek	529772	6073154	2.9	Clarke Creek	Marginal	N/A	Moderate
140	Unnamed tributary of Clarke Creek	529551	6072705	3.2	Clarke Creek	Marginal	N/A	Moderate
141	Clarke Creek	528149	6069859	284.8	Muhigan River	Important	N/A	Moderate
142	Unnamed tributary of Muningwari Creek	508621	6053368	3.5	Munigwari Creek	Marginal	N/A	Moderate
143	Unnamed Tributary into Mitishto River	487270	6054206	0.9	Mitishto River	Marginal	N/A	Moderate
144	Unnamed Tributary into Mitishto River	481655	6051487	1.3	Mitishto River	Marginal	N/A	Moderate
145	Mitishto River	479245	6050363	873.4	Grass River	Important	N/A	High
146	Mitishto River	479126	6050322	860.8	Grass River	Marginal	N/A	Moderate
147	Unnamed Tributary into Mitishto River	478743	6050191	3.9	Mitishto River	Marginal	N/A	Moderate
148	Unnamed Tributary into Mitishto River	476192	6049320	0.4	Mitishto River	Marginal	N/A	Low
149	Unnamed Tributary into Mitishto River	473894	6048590	0.8	Mitishto River	Marginal	N/A	Low
150	Unnamed Tributary into Mitishto River	470609	6047554	0.3	Mitishto River	Marginal	N/A	Low
151	Unnamed Tributary into Mitishto River	466453	6046243	1.1	Mitishto River	Marginal	N/A	Low
152	Unnamed Tributary into Mitishto River	462156	6044888	1.9	Mitishto River	Marginal	N/A	Low
153	Unnamed Tributary into Mitishto River	444794	6036784	0.1	Mitishto River	Marginal	N/A	Low
154	Mitishto River	435728	6032669	183.5	Grass River	Important	N/A	Moderate
155	Unnamed Tributary into Dyce Lake	431069	6029459	11.1	Dyce Lake	Marginal	N/A	Moderate
156	Unnamed Tributary of Frog Creek	404764	6006118	0.0	Frog Creek	Marginal	N/A	Moderate
157	Unnamed Tributary into Frog Creek	404107	6005786	1.2	Frog Creek	Marginal	N/A	Low
158	Frog Creek	399766	6003587	3293.2	North Moose Lake	Important	N/A	Moderate
159	Unnamed Headwater or Side Tributaries	397137	6002256	0.8	Frog Creek	No Fish Habitat	N/A	ow

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
	into Frog Creek							
160	Unnamed Headwater or Side Tributaries into Little Frog Creek	395929	6001644	0.6	Little Frog Creek	No Fish Habitat	N/A	Low
161	Unnamed Headwater or Side Tributaries into Little Frog Creek	395853	6001605	0.9	Little Frog Creek	No Fish Habitat	N/A	Low
162	Unnamed Headwater or Side Tributaries into Little Frog Creek	395519	6001436	0.4	Little Frog Creek	No Fish Habitat	N/A	Low
163	Unnamed Headwater or Side Tributaries into Little Frog Creek	395013	6001180	0.5	Little Frog Creek	No Fish Habitat	N/A	Low
164	Unnamed Headwater or Side Tributaries into Little Frog Creek	394081	6000708	1.5	Little Frog Creek	No Fish Habitat	N/A	Low
165	Unnamed Tributary into Little Frog Creek	391421	5999361	4.8	Little Frog Creek	No Fish Habitat	N/A	Low
166	Unnamed Tributary into Little Frog Creek	390995	5999145	5.7	Little Frog Creek	No Fish Habitat	N/A	Low
167	Unnamed Tributary of Unnamed Lake	384752	5993780	2.5	Unnamed Lake	No Fish Habitat	N/A	Low
168	Unnamed tributary of Little Frog Creek	372649	5979846	0.4	Little Frog Creek	Marginal	N/A	Moderate
169	Little Frog Creek	371988	5979313	132.7	Little Muddy Creek	Important	N/A	Moderate
170	Unnamed tributary of Little Frog Creek	369031	5976931	0.3	Little Frog Creek	No Fish Habitat	N/A	Low
171	Unnamed tributary of Little Frog Creek	368266	5976314	0.7	Little Frog Creek	No Fish Habitat	N/A	Low
172	Unnamed tributary of Little Frog Creek	368131	5976205	13.5	Little Frog Creek	Important	N/A	Moderate
173	Unnamed tributary of Little Frog Creek	367940	5976052	13.6	Little Frog Creek	No Fish Habitat	N/A	Low
174	Unnamed tributary of Little Frog Creek	367724	5975877	13.4	Little Frog Creek	No Fish Habitat	N/A	Low
175	Unnamed tributary of Little Frog Creek	366753	5975095	0.1	Little Frog Creek	No Fish Habitat	N/A	Low
176	Unnamed pond	364207	5972090	n/a	n/a	No Fish Habitat	N/A	Low
177	Saskatchewan River	363605	5970575	400031.7	Cedar Lake	Important	N/A	Moderate
178	Unnamed tributary of Saskatchewan River	363523	5967181	3.2	Saskatchewan River	Important	A	Moderate
179	Unnamed tributary of Saskatchewan River	363448	5964184	7.3	Saskatchewan River	Important	A	Moderate
180	Rall's Creek	363254	5962290	400084.9	Saskatchewan River	Important	N/A	Low
181	Unnamed pond	362532	5961911	n/a	n/a	No Fish Habitat	N/A	Low
182	Iskwayanikakespeetik Creek	357307	5942911	71.1	Kelsey Lake	Marginal	N/A	Moderate

ID	Name	UTM (Zone 14, NAD83)		Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
		Easting	Northing					
183	Iskwayanikakespeetik Creek	357350	5942608	70.6	Kelsey Lake	Marginal	N/A	Moderate
184	Iskwayanikakespeetik Creek	357434	5942024	68.4	Kelsey Lake	Marginal	N/A	Moderate
185	Unnamed tributary of Cedar Lake	359836	5925289	4.8	Cedar Lake	Marginal	N/A	Moderate
186	Unnamed drain	358992	5895706	57.2	Lake Winnipegosis	Important	N/A	Low
187	Overflowing River	356847	5892686	3044.5	Lake Winnipegosis	Important	N/A	Low
188	Unnamed tributary of Lake Winnipegosis	357091	5880464	27.8	Lake Winnipegosis	Important	N/A	Moderate
189	Red Deer River	363014	5861633	14505.1	Lake Winnipegosis	Important	N/A	Low
190	Unnamed tributary of Lake Winnipegosis	363128	5858786	0.2	Lake Winnipegosis	Marginal	N/A	Low
191	Unnamed tributary of Lake Winnipegosis	363011	5857254	0.0	Lake Winnipegosis	No Fish Habitat	N/A	Low
192	Unnamed tributary of Lake Winnipegosis	362965	5856655	0.0	Lake Winnipegosis	Marginal	N/A	Low
193	Unnamed tributary of Sucker Creek	360986	5851384	0.2	Sucker Creek	No Fish Habitat	N/A	Low
194	Unnamed tributary of Sucker Creek	360932	5851276	0.1	Sucker Creek	No Fish Habitat	N/A	Low
195	Unnamed tributary of Unnamed Lake	360394	5849294	3.4	Unnamed Lake	Marginal	C	Moderate
196	Unnamed tributary of Unnamed Lake	360387	5849249	3.4	Unnamed Lake	Marginal	C	Moderate
197	Unnamed tributary of Unnamed Lake	360365	5849086	3.3	Unnamed Lake	Marginal	C	Moderate
198	Unnamed tributary of Unnamed Lake	360287	5848515	3.0	Unnamed Lake	Marginal	E	Low
199	Steeprock River	360224	5846051	203.4	Lake Winnipegosis	Important	A	High
200	Unnamed tributary of Mafeking Creek	360847	5844747	0.7	Mafeking Creek	Marginal	E	Moderate
201	Mafeking Creek	361992	5842350	4.8	Steeprock River	Important	A	Moderate
202	Unnamed tributary of Moose Creek	363275	5839663	1.3	Moose Creek	Marginal	C	Moderate
203	Unnamed tributary of Moose Creek	363381	5839440	0.5	Moose Creek	Marginal	E	Moderate
204	Unnamed tributary of Moose Creek	363643	5838891	1.0	Moose Creek	Marginal	C	Moderate
205	Moose Creek	363836	5838488	8.5	Mafeking Creek	Marginal	C	Moderate
206	Moose Creek	363934	5838283	8.4	Mafeking Creek	Marginal	C	Moderate
207	Moose Creek	364006	5838131	8.6	Mafeking Creek	Marginal	C	Moderate
208	Unnamed tributary of Bell River	364424	5837257	12.2	Bell River	Marginal	C	Moderate
209	Bell River	366275	5833381	135.6	Lake Winnipegosis	Important	B	Low
210	Unnamed tributary of Bell River	366318	5833291	0.1	Bell River	No Fish Habitat	N/A	Low

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211	Unnamed agricultural drain	367407	5825703	0.0	Bell Creek	Marginal	E	Low
212	Bell Creek	368206	5824547	2.3	Swan Lake	Important	B	Low
213	Wawayanagan River	368102	5820698	4.7	Indian Birch River	Important	A	Moderate
214	Unnamed tributary of Indian Birch River	367905	5816290	16.8	Indian Birch River	No Fish Habitat	N/A	Low
215	Fishtown Creek	367842	5813787	33.6	Indian Birch River	Marginal	E	Low
216	Unnamed agricultural drain	367817	5812793	83.0	Swede Creek	Important	B	Low
217	Swede Creek	367784	5811514	119.3	Indian Birch River	Important	B	Low
218	Unnamed agricultural drain	367775	5811165	121.4	Woody River	Marginal	N/A	Low
219	Unnamed tributary of Woody River	368893	5807920	0.0	Woody River	Marginal	C	Low
220	Woody River	369424	5807905	2500.5	Swan Lake	Important	A	High
221	Tributary of Woody River	370908	5807864	9.7	Woody River	Marginal	C	Moderate
222	Tributary of Woody River	371353	5807851	9.7	Woody River	Marginal	C	Low
223	Poplar Creek	372274	5807826	1.6	Woody River	Marginal	N/A	Low
224	Poplar Creek	372517	5806740	0.2	Woody River	No Fish Habitat	N/A	Low
225	Poplar Creek	372514	5806603	0.2	Woody River	No Fish Habitat	N/A	Low
226	Poplar Creek	372507	5806370	0.3	Woody River	No Fish Habitat	N/A	Low
227	Oxbow lake/wetland of Swan River	372497	5805981	6132.7	N/A	Marginal	N/A	Low
228	Oxbow lake/wetland of Swan River	372480	5805372	n/a	N/A	No Fish Habitat	N/A	Low
229	Swan River	372476	5805226	6131.9	Swan Lake	Important	A	Moderate
230	Kitzul Drain	372435	5803753	0.7	Swan River	Marginal	E	Low
231	Unnamed agricultural drain	372286	5798024	1.7	Swan River	Marginal	D	Low
232	Unnamed agricultural drain	372358	5793158	9.1	Swan River	marginal	D	Low
233	North Duck River	398046	5761996	293.2	Lake Winnipegosis	Important	A	High
234	Unnamed tributary of North Duck River	400163	5758408	46.3	North Duck River	Important	B	Moderate
235	Sclater River	401048	5756908	176.6	Lake Winnipegosis	Important	A	Moderate
236	Unnamed tributar of Sclater River	403650	5752497	127.3	Sclater River	Important	A	Moderate
237	Unnamed tributary of North Pine River	405904	5748678	13.1	North Pine River	Marginal	C	Moderate

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238	North Pine River	406703	5747323	290.2	Pine River	Important	A	Moderate
239	North Pine River	406762	5747223	290.0	Pine River	Important	A	Moderate
240	North Pine River	406807	5747146	289.7	Pine River	Important	A	Moderate
241	South Pine River	407690	5745650	245.5	Pine River	Important	A	Moderate
242	Unnamed pond	408377	5744486	n/a	n/a	No Fish Habitat	N/A	Low
243	Unnamed tributary of Garland River	409569	5742466	11.1	Garland River	Marginal	C	Moderate
244	Garland River	410302	5741223	425.4	Pine River	Important	A	Moderate
245	Backwater of Garland River	410321	5741191	425.3	Pine River	Important	A	Moderate
246	Backwater of Garland River	410386	5741080	425.0	Pine River	Important	A	Moderate
247	Unnamed tributary of Wellburns Creek	412837	5736926	3.7	Wellburns Creek	Marginal	C	Moderate
248	Unnamed tributary of Wellburns Creek	413649	5735551	13.7	Wellburns Creek	Marginal	C	Low
249	Wellburns Creek	415123	5733053	25.0	Lake Winnipegosis	Important	A	Moderate
250	Unnamed small lake	431879	5719108	n/a	n/a	No Fish Habitat	N/A	Low
251	Mossy River	434153	5718021	9686.9	Lake Winnipegosis	Important	A	Low
252	Robinson Creek	435442	5717405	32.4	Lake Winnipegosis	Marginal	D	Low
253	Unnamed Tributary of Cork Cliff Creek	438543	5715923	3.8	Cork Cliff Creek	Marginal	D	Low
254	Cork Cliff Creek	439154	5715618	24.1	Lake Winnipegosis	Important	A	Moderate
255	Unnamed Tributary of Lake Winnipegosis	441017	5714153	0.1	Lake Winnipegosis	Marginal	A	Low
256	Unnamed Tributary of Lake Winnipegosis	441458	5713805	1.8	Lake Winnipegosis	Marginal	A	Low
257	German Creek	443998	5711807	15.3	Lake Winnipegosis	Important	A	Low
258	Unnamed pond	454017	5702214	n/a	n/a	No Fish Habitat	N/A	Low
259	Unnamed agricultural drain	460673	5697524	4.6	Lake Manitoba	Marginal	E	Low
260	Unnamed agricultural drain	464951	5694510	30.5	Lake Manitoba	Important	B	Low
261	Unnamed stream between Jarvies Lake and an unnamed lake	500796	5637779	14.3	Jarvies Lake	Marginal	N/A	Low
262	Garrioch Creek	503978	5626749	70.6	Lake Manitoba	Marginal	B	Low
263	Rocklan Drain	504265	5626110	31.7	Garrioch Creek	Marginal	B	Low
264	Small, unnamed lake	506762	5620536	n/a	n/a	Marginal	N/A	Low
265	Small, unnamed lake	506879	5620276	n/a	n/a	Marginal	N/A	Low

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
266	Small, unnamed lake	506989	5620016	n/a	n/a	No Fish Habitat	N/A	Low
267	Unnamed road ditch	507967	5617847	8.5	Harcus Drain	Marginal	E	Low
268	Whitemud River	521460	5555872	3554.5	Lake Manitoba	Important	A	Moderate
269	Squirrel Creek	521493	5553050	17.8	Whitemud River	Important	B	Low
270	New Beaudin Drain	523274	5549087	39.3	Whitemud River	Marginal	B	Low
271	Unnamed ditch	524864	5549095	0.2	Whitemud River	Marginal	N/A	Low
272	Unnamed road ditch	526502	5549103	0.5	Whitemud River	Marginal	B	Low
273	Westbourne Draine	531424	5549129	118.2	Whitemud River	Important	B	Low
274	Unnamed, small lake	532311	5543610	n/a	n/a	No Fish Habitat	N/A	Low
275	Unnamed tributary of Rat Creek	529963	5530879	0.8	Rat Creek	No Fish Habitat	N/A	Low
276	Bagot Creek	529975	5529162	80.5	Rat Creek	Important	A	Moderate
277	Rat Creek	529993	5526617	102.2	Whitemud River	Important	A	Moderate
278	Unnamed wetland	529812	5523967	n/a	n/a	No Fish Habitat	N/A	Low
279	Fetterly Creek	529844	5517873	13.2	Assiniboine River	Marginal	E	Low
280	Unnamed tributary of Assiniboine River	529869	5514591	0.2	Assiniboine River	Marginal	E	Low
281	Assiniboine River	532328	5512298	160985.3	Red River	Important	A	High
282	Unnamed small wetland area	539813	5500668	n/a	n/a	No Fish Habitat	N/A	Low
283	Unnamed small lake	567492	5497740	n/a	n/a	No Fish Habitat	N/A	Low
284	Unnamed agricultural drain	583634	5497172	114.2	11-A Drain	Marginal	E	Low
285	11-A Drain	601591	5497029	327.4	Morris River	Marginal	D	Low
286	11-A Drain	595038	5497289	348.5	Morris River	Marginal	D	Low
287	11-A Drain	601591	5497029	442.7	Morris River	Marginal	D	Low
288	Unnamed agricultural drain	603924	5497067	3.0	Morris River	Marginal	E	Low
289	Parker Drain	610026	5496771	8.5	Barnland Drain	Marginal	E	Low
290	Parker Drain	611298	5495205	4.1	Barnland Drain	Marginal	D	Low
291	Garber Drain	611557	5490221	7.0	Blackhurst Drain	Marginal	E	Low
292	Garber Drain	611395	5490534	8.0	Blackhurst Drain	Marginal	E	Low
293	Unnamed agricultural drain	616907	5490334	8.0	Manness Drain	Marginal	E	Low

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area (km^2)	Receiving Waterbody	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
294	Unnamed road ditch	618051	5490358	17.0	Manness Drain	Marginal	E	Low
295	Manness Drain	620520	5490417	0.4	La Salle River	Marginal	E	Low
296	Domain Drain	623842	5490469	3.5	La Salle River	Marginal	D	Low
297	Unnamed agricultural drain	626326	5490548	2.9	La Pointe Coulee	Marginal	E	Low
298	La Pointe Coulee	628399	5490441	4.8	Red River	Marginal	E	Low
299	Red River	630070	5489841	115344.8	Lake Winnipeg	Important	A	High
300	Unnamed tributary of Marsh River	633750	5489058	8.4	Marsh River	Marginal	N/A	Low
301	Marsh River	634072	5489067	409.4	Rat River	Important	A	Moderate
302	Rat River	635429	5489101	1576.7	Red River	Important	A	High
303	Unnamed agricultural drain	635973	5489115	2.5	Rat River	Marginal	D	Low
304	Tourond Creek	637881	5491117	261.4	Red River	Important	A	Moderate
305	Old South Lateral Drain	652663	5491561	5.6	Manning Canal	Marginal	D	Low
306	South Lateral Drain	654236	5491969	165.2	Manning Canal	Marginal	D	Low
307	Chorlitz Drain	657894	5492021	19.0	Manning Canal	Marginal	D	Low
308	Manning Canal	659523	5494468	209.2	Seine River Diversion	Important	A	Moderate
309	Youville Drain	659460	5500727	31.7	Seine River Diversion	Important	B	Low
310	Seine River Diversion	659279	5505793	85.7	Red River	Important	B	Low
311	Seine River	665050	5507082	722.2	Red River	Important	A	Moderate
312	Unnamed ditch/drain connected to Seine River	666926	5508551	23.2	Seine River	Marginal	D	Low
313	Unnamed ditch/drain connected to Seine River	667083	5508717	67.8	Seine River	Marginal	D	Low
314	Fish Creek	667638	5512024	41.7	Seine River	Marginal	C	Low
315	Unnamed lake	667540	5516242	n/a	n/a	No Fish Habitat	N/A	Low
316	Unnamed ditch/drain	662489	5524097	n/a	Cooks Creek	No Fish Habitat	N/A	Low
317	Swede Drain	659918	5525149	1.5	Cooks Creek	Marginal	E	Low

Table 3. Summary of watercourses falling within the riparian buffer of the Bipole III preferred route, collector, and construction power line, and northern ground electrode line RoWs and the prescribed riparian management area (RMA) width.

ID	UTM (Zone 14, NAD83) Easting	Northing	Name	Flow Regime	Fish Habitat Rating	RMA Width (m)[1]
1	801399	6294227	Unnamed pond	INT	No Fish Habitat	7
2	753257	6279964	Unnamed pond	EPH	No Fish Habitat	7
3	728161	6276547	Unnamed wetland	INT	No Fish Habitat	7
4	775591	6290942	Headwaters of unnamed tributary of McMillan Creek	EPH	No Fish Habitat	7
5	730409	6277842	Unnamed pond	INT	No Fish Habitat	7
6	713900	6259941	Unnamed pond	INT	No Fish Habitat	7
7	713844	6259976	Unnamed Pond	EPH	No Fish Habitat	7
9	693549	6254058	Unnamed Pond	INT	No Fish Habitat	7
10	675589	6249941	Unnamed Lake	PER	Important	30
11	678608	6249923	Unnamed pond	PER	Marginal	30
13	635460	6223861	Unnamed tributary of Burntwood River	INT	Marginal	15
14	590958	6156063	Unnamed tributary of Partridge Crop Lake	INT	Marginal	15
15	581120	6148200	Unnamed Tributary of Partridge Crop Lake	EPH	Marginal	15
16	582565	6149035	Unnamed pond	EPH	No Fish Habitat	7
17	592186	6160063	Unnamed wetland/floodplain	EPH	No Fish Habitat	7
18	573623	6143296	Unnamed pond	INT	No Fish Habitat	7
20	594049	6173733	Unnamed tributary of Partridge Crop Lake	INT	No Fish Habitat	7
21	548345	6115539	Unnamed wetland	EPH	No Fish Habitat	7
22	548464	6115554	Unnamed wetland	EPH	No Fish Habitat	7
23	556022	6126157	Unnamed tributary of Halfway River	INT	No Fish Habitat	7

ID	UTM (Zone 14, NAD83) Easting	Northing	Name	Flow Regime	Fish Habitat Rating	RMA Width (m)[1]
24	557068	6127291	Unnamed pond	INT	No Fish Habitat	7
25	48208	6052174	Unnamed pond	INT	No Fish Habitat	7
26	373379	5980614	Unnamed pond	INT	No Fish Habitat	7
29	362412	5961772	Unnamed pond/wetland	INT	No Fish Habitat	7
31	363223	5901387	Unnamed pond	INT	No Fish Habitat	7
32	364831	5909505	Unnamed pond	INT	No Fish Habitat	7
35	363069	5862331	Unnamed pond	INT	No Fish Habitat	7
36	376688	5785636	Unnamed pond	INT	No Fish Habitat	7
37	448546	5706807	Unnamed wetland	EPH	No Fish Habitat	7
38	454038	5702130	Unnamed pond	INT	No Fish Habitat	7
40	433315	5718539	Unnamed wetland	EPH	No Fish Habitat	7
41	487312	5662215	Unnamed wetland	INT	No Fish Habitat	7
45	542692	5497519	Unnamed pond	INT	No Fish Habitat	7
50	541772	5497747	Unnamed pond	EPH	No Fish Habitat	7
52	562790	5497413	Unnamed pond	EPH	No Fish Habitat	7
56	667526	5519088	Unnamed pond	EPH	No Fish Habitat	7
57	635585	5488634	Oxbow lake of Rat River	INT	Marginal	15
58	667580	5510676	Unnamed wetland	EPH	No Fish Habitat	7
61	536392	6086497	Unnamed tributary of Thicket Creek	INT	Marginal	15
62	540073	6092339	Unnamed pond	INT	No Fish Habitat	7
63	505903	6051103	Munigwari Creek	PER	Marginal	30
64	811594	6292245	Unnamed tributary of Goose Creek	INT	Marginal	15
65	643055	6232255	Unnamed tributary of Clay River	INT	Important	30
66	714599	6267810	Unnamed tributary of North Moswakot River	EPH	Marginal	15
68	324356	6253554	Unnamed tributary of South Moswakot River	INT	Marginal	15
69	614752	6203713	Unnamed tributary of Burntwood River	INT	Marginal	15
70	639904	6226759	Unnamed tributary of Burntwood River	INT	Marginal	15
71	591634	6158521	Unnamed tributary of Partridge Crop	EPH	Marginal	15

ID	UTM (Zone 14, NAD83) Easting	Northing	Name	Flow Regime	Fish Habitat Rating	RMA Width (m)[1]
			Lake			
			Unnamed tributary of Partridge Crop			
72	593583	6166209	Lake	INT	Marginal	15
73	363572	5969176	Unnamed agricultural drain	INT	No Fish Habitat	7
75	367725	5809636	Unnamed agricultural drain	EPH	No Fish Habitat	7
77	398126	5761930	Unnamed stream	EPH	No Fish Habitat	7
79	532316	5540433	Unnamed agricultural drain	EPH	No Fish Habitat	7
80	531532	5512975	Unnamed tributary of Assiniboine River	INT	Marginal	15
81	585785	5497130	Unnamed agricultural drain	EPH	No Fish Habitat	7
82	611421	5491622	Unnamed agricultural drain	EPH	No Fish Habitat	7
83	664612	5522123	Cooks Creek	PER	Important	30
C_C[2] 84	799091	6265166	Unnamed pond	INT	No Fish Habitat	7
G_E[3]85			Swift Creek	PER	Important	30

[1]Riparian Management Area Widths areas precribed in the "Forest Management Guidelines for Riparian Areas" (Manitoba Conservation and Manitoba Water Stewardship 2008). A Riparian Buffer (7, 15 or 30 m), where ground distrubance will be minimized and all shrub and herbaceous vegetation will be retained and all trees that do not violate Manitoba Hydro vegetation clearance requirements will be retained.

[2]C_C denotes collector and construction power line watercourse crossings.

[3]G_E denotes northern ground electrode line watercourse crossings.

Table 4. Summary of watercourse crossings on construction access trails.

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	UTM NAD83/ Zone 14 Northing	Existing RoW	RoW Type	Existing Crossing
2	02-1	Unnamed tributary of Twelve Mile Creek	772860	6272549	Y	T-line	N
2	02-2	Unnamed Pond	772999	6276067	Y	T-line	N
2	02-3	Unnamed tributary of Twelve Mile Creek	773006	6276259	Y	T-line	N
2	02-4	Twelve Mile Creek	773059	6277603	Y	T-line	N
2	02-5	Unnamed tributary of the Limestone River	773213	6281506	Y	T-line	N
2	02-6	Limestone River	773282	6283249	Y	T-line	N
2	02-7	Oxbow lake of the Limestone River	773306	6283847	Y	T-line	N
2	02-8	Unnamed Tributary of McMillan Creek	773440	6287237	Y	T-line	N
2	02-9	McMillan Creek	773613	6289211	Y	T-line	N
2	02-10	McMillan Creek	773628	6289315	Y	T-line	N
2	02-11	McMillan Creek	773634	6289356	Y	T-line	N
10	10-1	Unnamed tributary of the Burntwood River	641589	6226041	Y	Linear Disturbance	N
10	10-2	Unnamed tributary of the Burntwood River	641599	6226051	Y	Linear Disturbance	N
10	10-3	Unnamed tributary of the Burntwood River	641833	6226345	Y	Linear Disturbance	N
10	10-4	Unnamed tributary of the Burntwood River	641796	6227716	Y	Linear Disturbance	N
13	13-1	Moak Creek	599135	6204433	Y	Winter Road/T-line	N
13	13-2	Unnamed Tributary into Moak Creek	601294	6204082	Y	Winter Road/T-line	N
13	13-3	Unnamed Tributary of the Burntwood River	606629	6203145	Y	Winter Road/T-line	N
13	13-4	Unnamed Tributary of the Burntwood River	608155	6204084	Y	Winter Road/T-line	N
13	13-5	Unnamed Tributary of the Burntwood River	610675	6205778	Y	Winter Road/T-line	N
13	13-6	Unnamed Tributary of the Burntwood River	611197	6205974	Y	Winter Road/T-line	N
13	13-7	Unnamed Tributary of the Burntwood	613825	6206504	Y	Winter Road/T-line	N

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	Northing	Existing RoW	RoW Type	Existing Crossing
		River					
13	13-8	Unnamed Tributary of the Burntwood River	615580	6206846	Y	Winter Road/T-line	N
13	13-9	Unnamed Tributary of the Burntwood River	616039	6206935	Y	Winter Road/T-line	N
14	14-1	Unnamed Lake	578516	6176354	Y	Forestry Road/T-line	?/N
14	14-2	Unnamed Tributary of Apussigamasi Lake	580974	6175231	Y	Forestry Road/T-line	?/N
14	14-3	Unnamed Tributary of Apussigamasi Lake	582009	6173172	Y	Forestry Road/T-line	?/N
14	14-4	Unnamed Tributary of Apussigamasi Lake	582207	6173117	Y	Forestry Road/T-line	?/N
14	14-5	Unnamed Tributary of Apussigamasi Lake	583184	6174099	Y	Forestry Road/T-line	?/N
14	14-6	Unnamed Tributary of Apussigamasi Lake	583403	6174319	Y	Forestry Road/T-line	?/N
14	14-7	Unnamed Tributary of Apussigamasi Lake	584193	6175112	Y	Forestry Road/T-line	?/N
14	14-8	Unnamed Tributary of Apussigamasi Lake	585970	6176897	Y	Forestry Road/T-line	?/N
14	14-9	Unnamed Tributary of Apussigamasi Lake	585986	6176913	Y	Forestry Road/T-line	?/N
14	14-10	Unnamed Tributary of Apussigamasi Lake	586524	6177454	Y	Forestry Road/T-line	?/N
14	14-11	Unnamed Tributary of Apussigamasi Lake	587619	6178515	Y	Forestry Road/T-line	?/N
14	14-12	Unnamed Tributary of Apussigamasi Lake	590800	6181341	Y	Forestry Road/T-line	?/N
15	15-1	Unnamed Tributary of Owl Lake	570960	6170615	Y	Forestry Road	?
15	15-2	Unnamed Tributary of Unnamed Lake	572663	6170384	Y	Forestry Road	?
15	15-3	Unnamed Tributary of Unnamed Lake	574057	6169806	Y	Forestry Road	?
15	15-4	Unnamed Tributary into Thompson Creek	576082	6168960	Y	Forestry Road	?
15	15-5	Thompson Creek	577433	6168189	Y	Forestry Road	?
15	15-6	Unnamed Tributary into Thompson Creek	579687	6168456	Y	Forestry Road	?

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	UTM NAD83/ Zone 14 Northing	Existing RoW	RoW Type	Existing Crossing
15	15-7	Unnamed Tributary into Thompson Creek	580302	6168340	Y	Forestry Road	?
15	15-8	Unnamed Tributary into the Grass River	582506	6164418	Y	Forestry Road	?
15	15-9	Unnamed Tributary into the Grass River	583930	6162776	Y	Forestry Road	?
15	15-10	Unnamed Tributary into the Grass River	584316	6162645	Y	Forestry Road	?
15	15-11	Unnamed Tributary of the Grass River	586675	6162620	Y	Forestry Road	?
15	15-12	Unnamed Pond	588087	6163935	Y	Forestry Road	?
15	15-13	Unnamed Tributary into the Grass River	588137	6163983	Y	Forestry Road	?
15	15-14	Unnamed Tributary into the Grass River	588611	6164443	Y	Forestry Road	?
15	15-15	Unnamed Pond	589548	6165403	Y	Forestry Road	?
15	15-16	Unnamed Tributary of Partridge Crop Lake	591973	6167006	Y	Forestry Road	?
15	15-17	Unnamed Tributary of Partridge Crop Lake	592022	6166972	Y	Forestry Road	?
15	15-18	Unnamed Tributary of Partridge Crop Lake	592078	6166967	Y	Forestry Road	?
15	15-19	Unnamed Tributary of Partridge Crop Lake	592236	6166991	Y	Forestry Road	?
15	15-20	Partridge Crop Lake	592978	6167225	Y	Forestry Road	?
15	15-21	Partridge Crop Lake	593619	6167650	Y	Forestry Road	?
15b	15b-1	Unnamed Pond	584885	6162704	Y	Forestry Road	?
15b	15b-2	Unnamed Tributary into the Grass River	586113	6163850	Y	Forestry Road	?
15b	15b-3	Unnamed Tributary into the Grass River	588362	6167083	Y	Forestry Road	?
15b	15b-4	Unnamed Tributary into the Grass River	589738	6169997	Y	Forestry Road	?
15b	15b-5	Unnamed Tributary into the Grass River	590040	6171103	Y	Forestry Road	?
15b	15b-6	Unnamed Tributary into the Grass River	590696	6172526	Y	Forestry Road	?
15b	15b-7	Unnamed Tributary of Partridge Crop Lake	591123	6173650	Y	Forestry Road	?
15c	15c-1	Unnamed Tributary into the Grass River	582805	6162037	Y	Forestry Road	?
15c	15c-2	Grass River	581513	6161423	Y	Forestry Road	?
15c	15c-3	Unnamed Tributary into Unnamed Lake	580237	6156723	Y	Forestry Road	?
15c	15c-4	Unnamed Tributary into Unnamed Lake	580659	6155320	Y	Forestry Road	?

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	UTM NAD83/ Zone 14 Northing	Existing RoW	RoW Type	Existing Crossing
15c	15c-5	Unnamed Tributary into Unnamed Lake	581028	6154737	Y	Forestry Road	?
15c	15c-6	Unnamed Tributary into the Grass River	580176	6152247	Y	Forestry Road	?
15c	15c-7	Unnamed Tributary into the Grass River	580156	6152014	Y	Forestry Road	?
15c	15c-8	Unnamed Tributary into the Grass River	579701	6151404	Y	Forestry Road	?
15c	15c-9	Unnamed Tributary into the Grass River	575962	6146535	Y	Forestry Road	?
15c	15c-10	Unnamed Tributary into the Grass River	576215	6146191	Y	Forestry Road	?
15c	15c-11	Unnamed Tributary into the Grass River	577298	6145789	Y	Forestry Road	?
15d	15d-1	Unnamed Tributary into Wintering Lake	558921	6129815	Y	Forestry Road	?
15d	15d-2	Unnamed Tributary into Wintering Lake	561735	6132234	Y	Forestry Road	?
15d	15d-3	Unnamed Tributary into Wintering Lake	562185	6132823	Y	Forestry Road	?
15d	15d-4	Unnamed Tributary into Wintering Lake	563794	6134099	Y	Forestry Road	?
15d	15d-5	Unnamed tributary of Paint Lake	571722	6144039	Y	Forestry Road	?
16	16-1	Unnamed tributary of Brostrom Lake	536299	6107854	Y	Forestry Road	?
16	16-2	Halfway River	542226	6111932	Y	Forestry Road	?
16	16-3	Unnamed tributary of Halfway River	547226	6116816	Y	Forestry Road	?
16	16-4	Patrick Creek	554596	6124513	Y	Forestry Road	?
18	18-1	Unnamed tributary of Clarke Creek	528207	6073204	Y	Road	Y
18b	18b-1	Clarke Creek	528191	6069809	Y	Forestry Road	?
19	19-1	Clarke Creek	523990	6068826	Y	Forestry Road	?
20	20-1	Liquid Waste Pond	510377	6060754	Y	Forestry Road	?
20	20-2	Liquid Waste Pond	510780	6060588	Y	Forestry Road	?
20	20-3	Unnamed tributary of Clarke Lake	511967	6059430	Y	Forestry Road	?
20	20-4	Unnamed tributary of Clarke Lake	511513	6058852	Y	Forestry Road	?
20	20-5	Unnamed tributary of Clarke Lake	510745	6056585	Y	Forestry Road	?
21	21-1	Unnamed tributary into Mitishto River	499713	6060706	Y	T-line	N
21	21-2	Gormley Lake	502789	6059271	Y	T-line	N
21	21-3	Unnamed tributary of Clarke Lake	510193	6055843	Y	T-line	N

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	UTM NAD83/ Zone 14 Northing	Existing RoW	RoW Type	Existing Crossing
24	24-1	Hayward Creek	431743	6051344	Y	T-line	N
24	24-2	Unnamed tributary of Patiarche Lake	429355	6040397	Y	T-line	N
25	25-1	Air Force Bay	395486	6010108	Y	Forestry Road	?
25	25-2	Unnamed tributary of Little Cormorant Lake	399202	6011839	Y	Forestry Road	?
25	25-3	Pickerel Creek	403146	6010574	Y	Forestry Road	?
28	28-1	Intermittently wetted drain	363231	5971164	Y	Forestry Road	?
35	35-1	Unnamed Pond	359748	5895237	Y	Road/Trail	?
35	35-2	Unnamed drain	359455	5895579	Y	Road/Trail	?
37	37-1	Unnamed tributary of Lake Winnipegosis	356493	5885802	Y	Forestry Road	?
38	38-1	Unnamed tributary of Lake Winnipegosis	357599	5880338	Y	Road	?
47	47-1	Unnamed agricultural drain	370847	5794875	Y	Road	Y
48	48-1	Unnamed tributary of Swan River	367720	5788481	Y	Road	Y
48	48-2	Unnamed tributary of Swan River	369349	5788441	Y	Road	Y
48	48-3	Unnamed tributary of Swan River	369453	5788438	Y	Road	Y
48	48-4	Unnamed agricultural drain	370656	5788393	Y	Road	Y
49	49-1	Cox Drain	370418	5778691	Y	Road	Y
49	49-2	Unnamed agricultural drain	370507	5778689	Y	Road	Y
49	49-3	Sinclair River	371683	5778662	Y	Road	Y
49	49-4	Sinclair River	373681	5778607	Y	Road	Y
49	49-5	Jarosz Drain	373936	5778655	Y	Road	Y
49	49-6	Sinclair River	376933	5778522	Y	Road	Y
49	49-7	Sinclair River	377881	5778421	Y	Road	Y
49	49-8	Sinclair River	377890	5778415	Y	Road	Y
49	49-9	Sinclair River	378524	5778035	Y	Road	Y
49	49-10	Sinclair River	379511	5778472	Y	Road	Y
50	50-1	North Duck River	397742	5761916	Y	Road	Y
51	51-1	South Pine River	405657	5740421	Y	Road	Y

Access Route	Watercourse Crossing	Name	UTM NAD83/ Zone 14 Easting	UTM NAD83/ Zone 14 Northing	Existing RoW	RoW Type	Existing Crossing
51	51-2	Unnamed tributary of South Pine River	405712	5743193	Y	Road	Y
51	51-3	North Pine River	405766	5746110	Y	Road	Y
51	51-4	Unnamed tributary of North Pine River	405821	5748656	Y	Road	Y

Table 5. Summary of watercourse crossings on the Bipole III collector lines and construction power line.

ID	Name	UTM (Zone 14, NAD83)		Upstream Drainage Area km^2	Receiving Water	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
		Easting	Northing					
1	Unnamed tributary of Nelson River	815112	6293739	0.44	Nelson River	Marginal	N/A	Moderate
2	Goose Creek	813821	6292281	111.07	Nelson River	Important	N/A	Moderate
3	Unnamed tributary of Goose Creek	813618	6292052	1.46	Goose Creek	Marginal	N/A	Moderate
4	Unnamed tributary of Goose Creek	813405	6291810	2.05	Goose Creek	Marginal	N/A	Moderate
5	Unnamed tributary of Goose Creek	813242	6291626	0.22	Goose Creek	Marginal	N/A	Moderate
6	Unnamed Tributary of Goose Creek	813225	6291355	4.76	Goose Creek	Marginal	N/A	Moderate
7	Unnamed Tributary of Goose Creek	812745	6291254	4.76	Goose Creek	Marginal	N/A	Moderate
8	Unnamed Tributary of Tiny Creek	812427	6290895	8.13	Tiny Creek	Marginal	N/A	Moderate
9	Tiny Creek	812072	6290494	5.52	Nelson River	Important	N/A	Moderate
10	Unnamed Tributary of Nelson River	811038	6289326	0.32	Nelson River	Marginal	N/A	Moderate
11	Unnamed Tributary of Swift Creek	810705	6288950	0.10	Swift Creek	Marginal	N/A	Moderate
12	Unnamed Tributary of Swift Creek	810526	6288747	0.36	Swift Creek	Marginal	N/A	Moderate
13	Unnamed Tributary of Swift Creek	809910	6288052	6.29	Swift Creek	Marginal	N/A	Moderate
14	Unnamed Tributary of Swift Creek	809300	6287363	2.13	Swift Creek	Marginal	N/A	Moderate
15	Unnamed Tributary of Swift Creek	808560	6286527	18.92	Swift Creek	Marginal	N/A	Moderate
16	Unnamed Tributary of Swift Creek	807854	6285729	1.11	Swift Creek	Marginal	N/A	Moderate
17	Unnamed Tributary of Swift Creek	807537	6285370	0.72	Swift Creek	Marginal	N/A	Moderate
18	Swift Creek	807085	6284860	3.21	Nelson River	Important	N/A	Moderate
19	Unnamed Tributary of Swift Creek	806710	6284436	15.80	Swift Creek	Important	N/A	Moderate
20	Unnamed tributary of Beaver Creek	805699	6283294	6.15	Beaver Creek	Marginal	N/A	Moderate
21	Beaver Creek	804383	6281807	6.56	Nelson River	Marginal	N/A	Moderate
22	Unnamed Tributary of Sundance Creek	803110	6280369	5.00	Sundance Creek	Marginal	N/A	Moderate
23	Sundance Creek	801693	6278712	31.47	Nelson River	Important	N/A	Moderate
24	Unnamed Tributary of Unnamed Creek	800391	6277183	8.56	Unnamed Creek	Marginal	N/A	Moderate
25	Unnamed Tributary of Unnamed Creek	799810	6276501	6.73	Unnamed Creek	Marginal	N/A	Moderate
26	Unnamed Creek	799446	6276074	9.04	Nelson River	Marginal	N/A	Moderate
27	Unnamed wetland	798940	6275480	-	-	No Fish Habitat	N/A	Low

ID	Name	UTM (Zone 14, NAD83)		Upstream Drainage Area km^2	Receiving Water	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
		Easting	Northing					
28	Unnamed wetland	798687	6274817	-	-	No Fish Habitat	N/A	Low
29	Limestone River	798868	6273724	3299.02	Nelson River	Important	N/A	Moderate
30	Unnamed wetland	798702	6269454	-		No Fish Habitat	N/A	Low
31	Unnamed Tributary of Nelson River	798472	6268354	6.03	Nelson River	Marginal	N/A	Moderate
32	Unnamed Tributary of Nelson River	798548	6268164	6.28	Nelson River	Marginal	N/A	Moderate
33	Nelson River	799079	6267683	1116804.3	Hudson Bay	Important	N/A	Moderate
34	Unnamed wetland	799266	6265649	-	-	No Fish Habitat	N/A	Low
35	Unnamed tributary of Nelson River	798900	6264452	9.58	Nelson River	Marginal	N/A	Moderate
36	Unnamed tributary of Nelson River	797843	6261837	29.43	Nelson River	Important	N/A	Moderate
37	Brooks Creek	797169	6261612	71.06	Nelson River	Important	N/A	Moderate
38	Unnamed tributary of Nelson River	793709	6260455	12.37	Nelson River	Marginal	N/A	Low
39	Unnamed tributary of Nelson River	790009	6259218	5.42	Nelson River	Marginal	N/A	Moderate
40	Unnamed tributary of Nelson River	787824	6258488	8.25	Nelson River	Marginal	N/A	Moderate
41	Wilson Creek	786619	6258876	266.65	Nelson River	Important	N/A	Moderate
42	Wilson Creek	786607	6258895	266.72	Nelson River	Important	N/A	Moderate
43	Wilson Creek	786559	6258966	266.72	Nelson River	Important	N/A	Moderate

Table 6. Summary of watercourse crossings on the Bipole III northern ground electrode line.

ID	Name	UTM (Zone 14, NAD83) Easting	UTM (Zone 14, NAD83) Northing	Upstream Drainage Area km^2	Receiving Water	Fish Habitat Rating	DFO Ag Watershed Class	Sensitivity
1	Tiny Creek	814329	6289981	16.42	Nelson River	Important	N/A	Moderate
2	Unnamed tributary of Nelson River	813955	6289508	2.42	Nelson River	Marginal	N/A	Moderate
3	Unnamed tributary of Swift Creek	813104	6287866	0.92	Swift Creek	Marginal	N/A	Moderate
4	Unnamed tributary of Swift Creek	812755	6287185	3.74	Swift Creek	Marginal	N/A	Moderate
5	Swift Creek	812365	6286421	73.84	Nelson River	Important	N/A	Moderate

Table 7. Summary of watercourses at ground electrode sites.

Ground Electrode Site	Watercourse Site	Name	UTM[2]NAD83/ Zone 14 Easting	UTM[2]NAD83/ Zone 14 Northing	Distance of Watercourse from Ground Electrode Site (km)	Upstream Drainage Area (km^2)	Receiving Water	Downstream Distance to Receiving Water(km)	Fish Present During Assessment	Fish Habitat Rating	DFO Ag Watershed Class
SES1c	SES1cS1	Unnamed agricultural ditches/drains	663041	5533296	Adjacent	-	Cooks Creek	0.82	-	Marginal	D
SES1c	SES1cS1	Unnamed agricultural ditches/drains	662998	5534916	Adjacent	-	Cooks Creek	0.82	-	Marginal	D
SES1c	SES1cS2	Cooks Creek	662186	5534085	0.82	287.5	Red River	33.3	-	Important	A
NES6	NES6	Unnamed Tributary of Nelson River	810071	6281874	Within	2.4	Nelson River	0.6	-	Marginal	N/A

Table 8. Groundwater seepage locations found near potential borrow sites.

Borrow Area Site	Groundwater Site Location(s)	UTM			Source(s)
		Zone	Easting	Northing	
N-4	100 m upstream of boundary overlap	14	814422	6287369	TetrES Consultants Inc. 2009
	200 m downstream of boundary overlap	14	814559	6287481	TetrES Consultants Inc. 2009
	200 m away from NE end of inland boundary (cluster of three groundwater sites)	14	814712	6287756	TetrES Consultants Inc. 2009; Lavergne and MacDonell 2010
N-5	Within 100 m of SW end of inland boundary; also within 200 m of north-central inland boundary of Site N-4	14	813959	6287274	Lavergne and MacDonell 2010
	Within 100 m of SW end of inland boundary; also within 200 m of north-central inland boundary of Site N-4	14	814023	6287260	Swanson et al. 1991
	Within 100 m of SW end of inland boundary; also within 200 m of north-central inland boundary of Site N-4	14	814127	6287217	Lavergne and MacDonell 2010

Table 9. Environmental effects assessment significance criteria definitions.

Criterion	Low	Moderate	High
Ecological Importance	Evidence of environmental effects by human activities. Effect results in minimal disruption of ecological functions and relationships in the impacted area	Relatively pristine area. Effect results in some disruption of non-critical ecological functions and relationship in the impacted area	Pristine area/not affected by human activity. Effect results in disruption of critical ecological functions and relationship in the impacted area
Societal Context	No designation or recognition by legislation, traditional, local or public knowledge	Designated or protected locally, regionally, or provincially and/or recognized by traditional knowledge	Designated or protected both nationally and internationally and recognized by traditional knowledge
Magnitude	Effect is evident only at, or nominally above, baseline conditions	Effect exceeds baseline conditions; however, is less than regulatory criteria or published guideline values	Effect exceeds regulatory criteria or published guidelines
Geographic Extent	Effect is limited to the project site/footprint	Effect extends into areas beyond the project site/footprint boundary	Effect is trans-boundary in nature
Frequency	Conditions or phenomena causing the effect occur infrequently (e.g., < once per year)	Conditions or phenomena causing the effect occur at regular intervals although infrequent intervals	Conditions or phenomena causing the effect occur at regular and frequent intervals (e.g., > once per month)

Criterion	Low	Moderate	High
		(e.g., < once per month)	
Duration	Effect is evident only during the construction phase of the project	Effect is evident during construction and/or the operational phase of the project	Effects will be evident beyond the operation life of the project
Reversibility	Effect is readily reversible over a short period of time (e.g., one growing season)	Effect is not readily reversible during the life of the project	Effect is permanent

Table 10. Summary of environmental effects on fish habitat from the Bipole III project.

Project Component	Activity	Effect	Mitigation Measures	Assessment
Transmission Line	RoW clearing	Erosion and sedimentation of adjacent streams from disturbed banks and RoW runoff.	Appropriate DFO Operational Statements will be followed (Overhead Line Construction (DFO 2007c), Temporary Stream Crossings (DFO 2007d), Ice Bridges and Snow Fills (DFO 2007f), Maintenance of Riparian Vegetation In Existing Rights-of-way (DFO 2007b)), as well as Manitoba Hydro's Generic Environmental Protection Plan for Transmission Line Construction and Maintenance (Kudzak 2008). Increased precautionary measures will be used at moderate and high sensitivity sites. Apply Riparian Management Areas (RMAs) to waterbodies within the buffer zone adjacent to the RoW.	All watercourses to be crossed by transmission lines and all watercourses within the buffer zone adjacent to the RoW were assessed for fish habitat and habitat sensitivity to disturbance. As part of the construction plan, RoW clearing will leave ground cover and low woody vegetation within riparian areas to maintain stability. Additional site specific precautionary protection measures, with respect to erosion protection and RoW clearing and maintenance at sensitive sites, will also be adopted. Transmission line construction will not involve the placement of any structures below the ordinary high water mark. Riparian zones are the most sensitive to this type of construction; however, disturbance to these areas will be minimized through the application of best management practices. All waterbodies within the buffer zone adjacent to the RoW will require mitigation measures in the form of RMAs, with the size of area prescribed dependent on fish habitat quality and flow regime. Transmission line construction is expected to have no residual impact provided that the DFO's operational statement for overhead line construction is adhered to.
		Loss of riparian vegetation along the extent of RoW at watercourses.		
	Construction of structure foundations	Contamination from structure foundations and installations.	Towers will be placed above the high water mark and outside of riparian areas; Construction will take place under frozen conditions, preventing introduction of contaminants to surface waters in boggy terrains and on saturated floodplains; application of best management practices.	
		Erosion and sedimentation of streams from disturbed banks.		
	Construction Access Trails	Erosion and sedimentation of adjacent streams from disturbed banks and streambed.	Appropriate DFO Operational Statements will be followed (Temporary Stream Crossings (DFO 2007d), Ice Bridges and Snow Fills (DFO 2007f).	

Project Component	Activity	Effect	Mitigation Measures	Assessment
Ground Electrode	Isolated or Dry Open cut installation of ground electrode at watercourse crossings	Erosion and sedimentation of adjacent streams from disturbed bed and banks, and RoW runoff.	Application of best management practices and appropriate DFO Operational Statements will be followed (Isolated or Dry Open-Cut Stream Crossings (DFO 2007a), Temporary Stream Crossings (DFO 2007d), Ice Bridges and Snow Fills (DFO 2007f), Maintenance of Riparian Vegetation In Existing Rights-of-way (DFO 2007b), and Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat (DFO and MNR 1996). Turbidity monitoring will be conducted during instream construction activities to monitor effectiveness of sedimentation mitigation measures.	One watercourse lies within the northern ground electrode site (NES6); no watercourses lie within the southern ground electrode site (SES1c). The NES6 stream provides Marginal fish habitat and is not expected to support fish directly. A Low sensitivity rating was assigned to this watercourse as there would be minimal immediate disturbance of fish following the Operational Statements, and the natural recovery following construction would minimize the potential for residual impacts.
		Blockage or alteration of flow.		For watercourses with water flow, isolation construction methods will maintain normal flow downstream by using best management practices and guidance from operational statements.
	Coke placed around the ground electrode rod to increase its conducting surface	Contamination of a watercourse from leaching of embedded coke.	Coke may be rinsed or leached (aged) before used to remove any metals loosely bound to its surface. Coke materials will be stored greater than 100 m from the ordinary high water mark and will be adequately contained/protected from wind and rain to prevent entry of into streams.	Has the potential to leach various hazardous substances to surface waters, such as metals and PAHs (polycyclic aromatic hydrocarbons). Coke may also directly enter surface waters from accidental spills during ground electrode construction. Due to the lack of groundwater or subsurface water flow into surface waters at the ground electrodes sites, as well as the inconclusive results of research articles on coke leachate, no acute effects to aquatic organisms are expected and it is considered to have a low potential to cause adverse effects on the aquatic environment.
Converter Station	Infilling of fish habitat	Loss of fish habitat and potential blockage of fish migration routes.	Where possible infilling will be conducted under dry or frozen conditions. When working under wetted conditions, infilling will occur in isolation and, prior to beginning the infilling, a fish salvage will be conducted. Is a headwater area and infilling will not impede fish movements upstream.	The proposed site includes headwater, saturated land that has limited connectivity to the Nelson River. This waterbody provides Marginal fish habitat for small bodied fish and is not expected to support migrations of larger fish. The sensitivity of aquatic habitat at the site is classified as Low; the loss of the wetted area within the footprint would be offset proportionally to adjacent areas; this is a headwater area and infilling will not impede fish movements upstream; and the potential for increased local and

Project Component	Activity	Effect	Mitigation Measures	Assessment
				downstream suspended and streambed sediment burdens caused by construction can be effectively mitigated through proper control measures. Stream adjacent to the converter station site will be buffered by appropriate riparian management areas to avoid loss of riparian vegetation, erosion and sedimentation. Construction of the waste water outlet structure at Goose Creek will adhere to instream work timing windows. Riparian vegetation clearing will be minimized .
	Station Site Clearing, waste water outlet structure installation	Erosion and sedimentation of adjacent streams from disturbed banks and RoW runoff.	Appropriate riparian management area buffers will be implemented and maintained. Waste water outlet structure will be constructed to avoid stream infilling and adhere to DFO Timing Windows (DFO 2007e).	
		Loss of riparian vegetation along the extent of RoW at watercourses.		
	Waste water effluent	Changes to water quality that could alter fish health and habitat.	Effluent will be treated according to Manitoba municipal waste water guidelines.	Goose Creek near the converter site will receive the facility waste water discharge. If the effluent meets Manitoba municipal waste water guidelines, mass-balance modeling indicates that discharge of sewage effluent would not result in exceedences of Manitoba PAL objectives or guidelines for ammonia, pH, or TSS or exceedences of the CCME interim PAL guideline for nitrate in a fully mixed condition under low or high Goose Creek water flows.
Construction Camp	Station Site Clearing, waste water outlet structure installation	Erosion and sedimentation of adjacent streams from disturbed banks and RoW runoff.	Appropriate riparian management area buffers will be implemented and maintained. Waste water outlet structure will be constructed to avoid stream infilling and adhere to DFO Timing Windows (DFO 2007e).	Stream adjacent to the converter station site will be buffered by appropriate riparian management areas to avoid loss of riparian vegetation, erosion and sedimentation. Construction of the waste water outlet structure at Creek Fourteen will adhere to instream work timing windows. Riparian vegetation clearing will be minimized . Creek Fourteen is a small ephemeral creek with an undefined connection to the Nelson River. Flow ceases in the creek in summer and isolated stagnant pools are the only water in the creek. Based on this, few fish species are expected and they would be limited to species tolerant of stagnant water with low DO, such as brook stickleback. Considering this, the
		Loss of riparian vegetation along the extent of RoW at watercourses.		

Project Component	Activity	Effect	Mitigation Measures	Assessment
				exceedance of MWQSOG's is not expected to result in a significant negative residual effect.
	Waste water effluent	Changes to water quality that could alter fish health and habitat.	Effluent will be treated according to Manitoba municipal waste water guidelines.	
General	Accidental spills and leaks of deleterious substances	Hydrocarbons such as oil, fuel, gasoline, lubricants or hydraulic fluids can enter surface waters from machinery used for instream construction, or from maintenance and fuelling activities that are conducted too close to a watercourse.	All fuels and lubricants will be stored at least 100m away from ordinary HWM in dedicated areas at work camps and marshalling yards with appropriate containment. Appropriate procedures will be implemented, such as ones under the Handling of Gasoline and Associated Products Regulation of the Manitoba *Environment Act*, and Manitoba Hydro's Generic Environmental Protection Plan for Transmission Line Construction and Maintenance (Kudzak 2008).	Mitigation measures would prevent adverse effects on the aquatic environment.
		Erosion and sedimentation of adjacent streams from chronic erosion.	Erosion and sedimentation control measures will be routinely inspected to ensure effectiveness.	Mitigation measures would prevent adverse effects on the aquatic environment.
	Maintenance of RoW, ground electrode, and converter sites	Improper use of herbicides. Releases of these chemicals into streams may have lethal and/or sublethal effects on aquatic organisms including plants, insects, and fish.	Herbicide storage, handling, and application will adhere to provincial and federal regulations and Manitoba Hydro's Generic Environmental Protection Plan for Transmission Line Construction and Maintenance (Kudzak 2008).	Mitigation measures would prevent adverse effects on the aquatic environment.

Notes: - the selection rationale for fish habitat as a VEC was Section 35 of the *Fisheries Act* that prohibits the Harmful Alteration, Disruption or Destruction of Fish Habitat (HADD)
- the environmental indicator of effects is the availability and quality of fish habitat within waterbodies affected

Table 11. Assessment of residual environmental effects on aquatic VECs.

VEC	Project Component	Phase	Residual Effect	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Surface Water Quality and Fish Habitat	HVdc Transmission Line and AC Collector Lines	Construction	Loss of riparian vegetation, stream bank damage, increase in TSS	Negative	Low-Medium	High	Small	Local Study Area	Short-term	Once	Reversible
		Operation		Negative	Low-Medium	High	Small	Local Study Area	Medium-term	Regular/ Continuous	Reversible
	Construction Access Trails	Construction	Stream bank damage, increase in TSS	Negative	Low-Medium	High	Small	Local Study Area	Short-term	Once	Reversible
		Operation		No project effect							
	Keewatinoow Converter Station	Construction	Infill, loss of riparian vegetation, stream bank alteration, increase in TSS	Negative	Low	High	Large	Local Study Area	Medium-term	Once	Reversible
		Operation	Changes to water quality	Negative	Medium	High	Small	Local Study Area	Medium-term	Regular/ Continuous	Reversible
	Construction Camp	Construction	Loss of riparian vegetation, stream bank alteration, increase in TSS	Negative	Low-Medium	High	Small	Project Site	Short-term	Once	Reversible
		Operation	Changes to water quality	Negative	Low	High	Small	Local Study Area	Medium-term	Regular/ Continuous	Reversible
	Riel Converter Station	Construction		No project effect							
		Operation		No project effect							
	Ground Electrodes and Lines	Construction	Loss of riparian vegetation,	Negative	Low-Medium	High	Small	Local Study Area	Short-term	Once	Reversible

VEC	Project Component	Phase	Residual Effect	Direction	Ecological Importance	Societal Importance	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
			stream bank damage, increase in TSS.								
		Operation	Loss of riparian vegetation, stream bank damage, increase in TSS	Negative	Low-Medium	High	Small	Local Study Area	Medium-term	Regular/ Continuous	Reversible
	Borrow Areas and Excavated Material Placement Areas	Construction	Increase in TSS	Negative	Low-Medium	High	Small	Local Study Area	Short-term	Once	Reversible
		Operation	Increase in TSS	Negative	Low-Medium	High	Small	Local Study Area	Medium-term	Regular/ Continuous	Reversible

Table 12. Cumulative effects assessment valued environmental component summary.

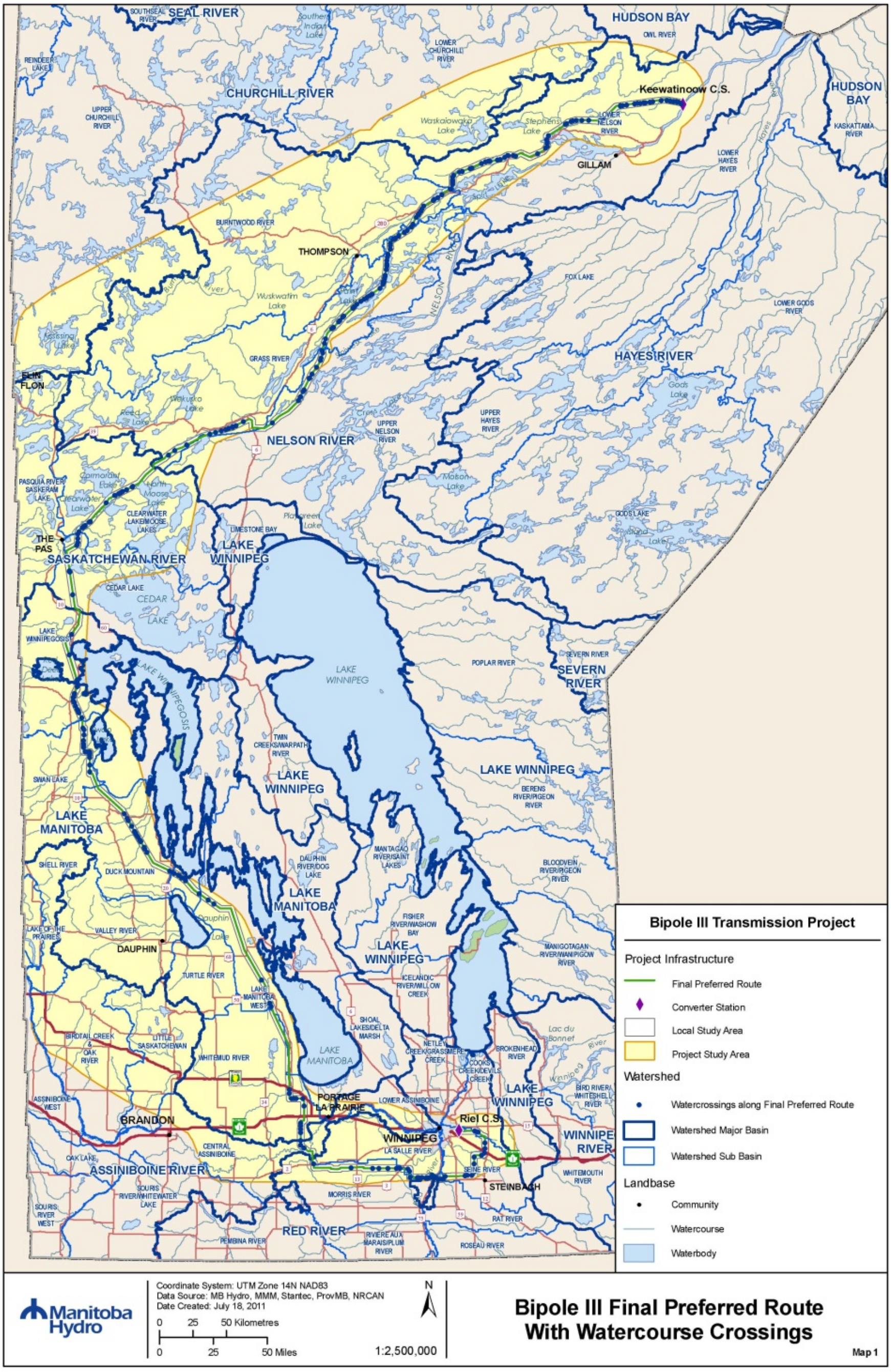
Valued Environmental Component	Environmental Indicator	Measurable Parameter/ Variable	Residual Environmental Effect	Comments
Surface Water Quality and Fish Habitat	Water Quality	TSS, DO, pH, TP	Potential short-term increase in TSS at stream crossings. Short-term periodic exceedence of MWQSOGs at Creek Fourteen from Keewatinoow Converter Station effluent.	Effects at stream crossings will be negligible. Absence of fish and marginal habitat result in negligible effect of waste water on Creek Fourteen.
Surface Water Quality and Fish Habitat	Fish Habitat	Area (m^2)	Loss of fish habitat in unnamed creek at Keewatinoow Converter Station site.	Absence of fish and marginal habitat result in negligible effect on fish habitat from infilling.
Surface Water Quality and Fish Habitat	Riparian Vegetation	Length of shoreline vegetation	Change in vegetation structure (i.e., removal of tall trees); maintenance of low vegetation, resulting in reduction of allocthanous inputs, shade and erosion protection.	Negligible residual effects due to mitigation.

Table 13. Summary of previous, present, and future projects that may have cumulative effects with the Bipole III project on the aquatic environment.

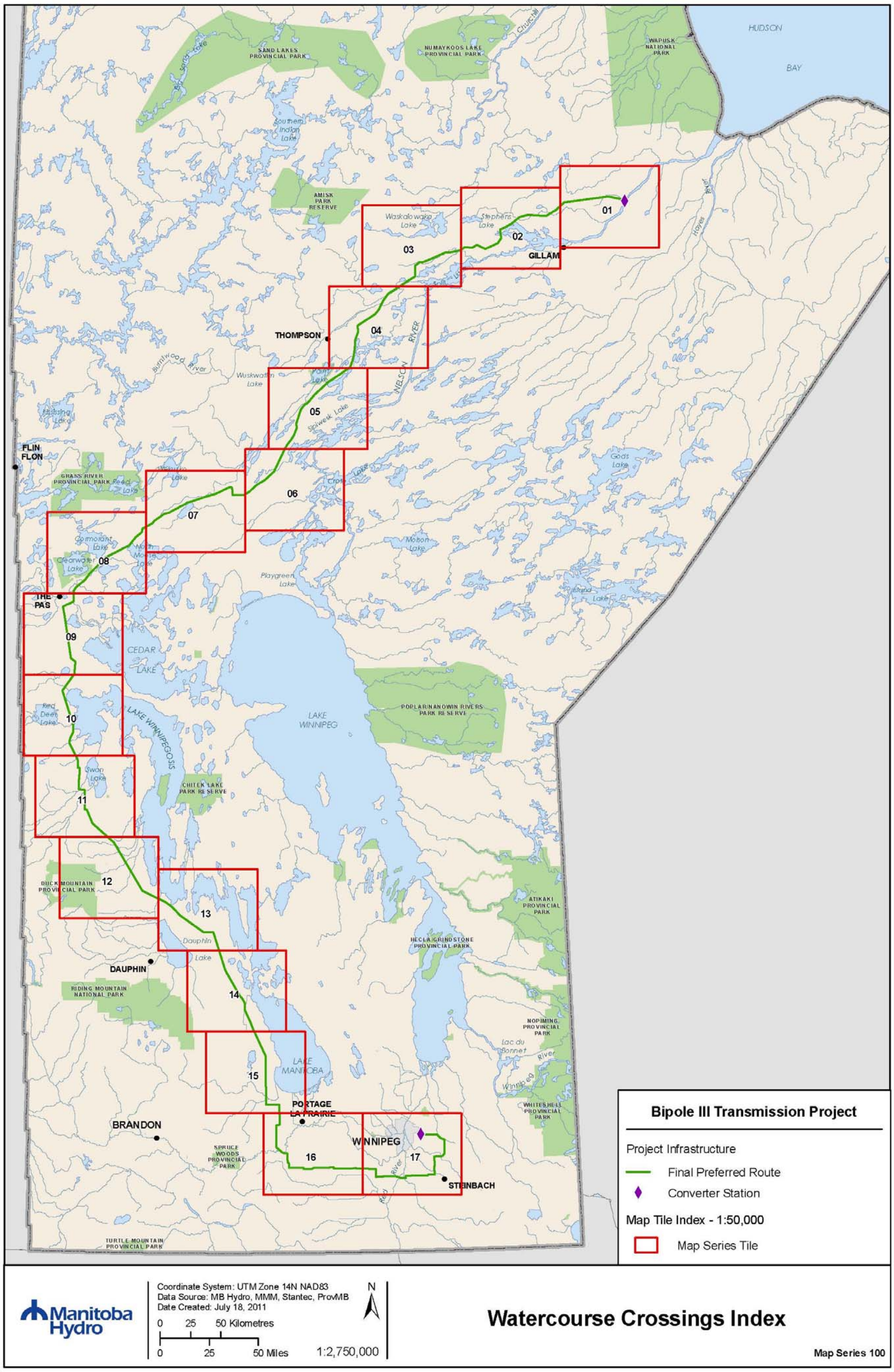
Category	Description	VEC	Measurable Parameter	Environmental Effects
Transmission Line	Wuskwatim Transmission Line	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Change in riparian vegetation structure. Temporary increase in TSS.
	Collectors in Lower Nelson	Fish Habitat	Water Quality and Fish Habitat	Change in riparian vegetation structure. Large RoW width. Temporary increase in TSS.
	US Tie-line	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Change in riparian vegetation structure. Temporary increase in TSS.
	Dorsey-Portage - 500 KV	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Change in riparian vegetation structure. Temporary increase in TSS.
	South Loop - Dorsey to Riel - 230 KV	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Change in riparian vegetation structure. Temporary increase in TSS.
	Letellier/St. Vital	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Change in riparian vegetation structure. Temporary increase in TSS.
Forestry	Louisiana Pacific	Fish Habitat, Water Quality	TSS	Erosion and sedimentation of watercourses with temporary increase in TSS.
	Tolko Access Roads	Fish Habitat, Water Quality	TSS, Nutrients	Nutrients, sedimentation, and potentially herbicides affecting water quality.
Agriculture	Livestock	Fish Habitat, Water Quality	Riparian, Banks, Instream, TSS.	Degradation of riparian zone and stream banks decreasing fish habitat quality and increasing TSS.
	Channelization	Fish Habitat	Area	Simplification of habitat (i.e., reduction of quality)
Hydroelectric GS	Limestone	Fish Habitat	Habitat Change	Inundation of lower reaches of tributaries (i.e., reduction in quality)
	Conawapa	Fish Habitat	Habitat Change	Inundation of lower reaches of tributaries (i.e., reduction in quality).
	Long Spruce	Fish Habitat	Habitat Change	Inundation of lower reaches of tributaries (i.e., reduction in quality)
	Keeyask	Fish Habitat	Habitat Change	Inundation of lower reaches of tributaries (i.e., reduction in quality)
Roads	Conawapa access road	Fish Habitat	Area	Infilling of fish habitat at stream crossings.
	Stream Crossings	Fish Habitat	Fish Habitat	Infilling of fish habitat at stream crossings.
Natural Events	Climate Change	Fish Habitat	Water Quantity	Change in flow regime/quantity of water changing amount and quality of fish habitat
	Forest Fire	Fish Habitat	Sedimentation	Increased sediment runoff and effects to TSS, fish, and habitat.
Other	Red River Floodway	Fish Habitat	Area	Alteration/destruction of fish habitat.

MAPS

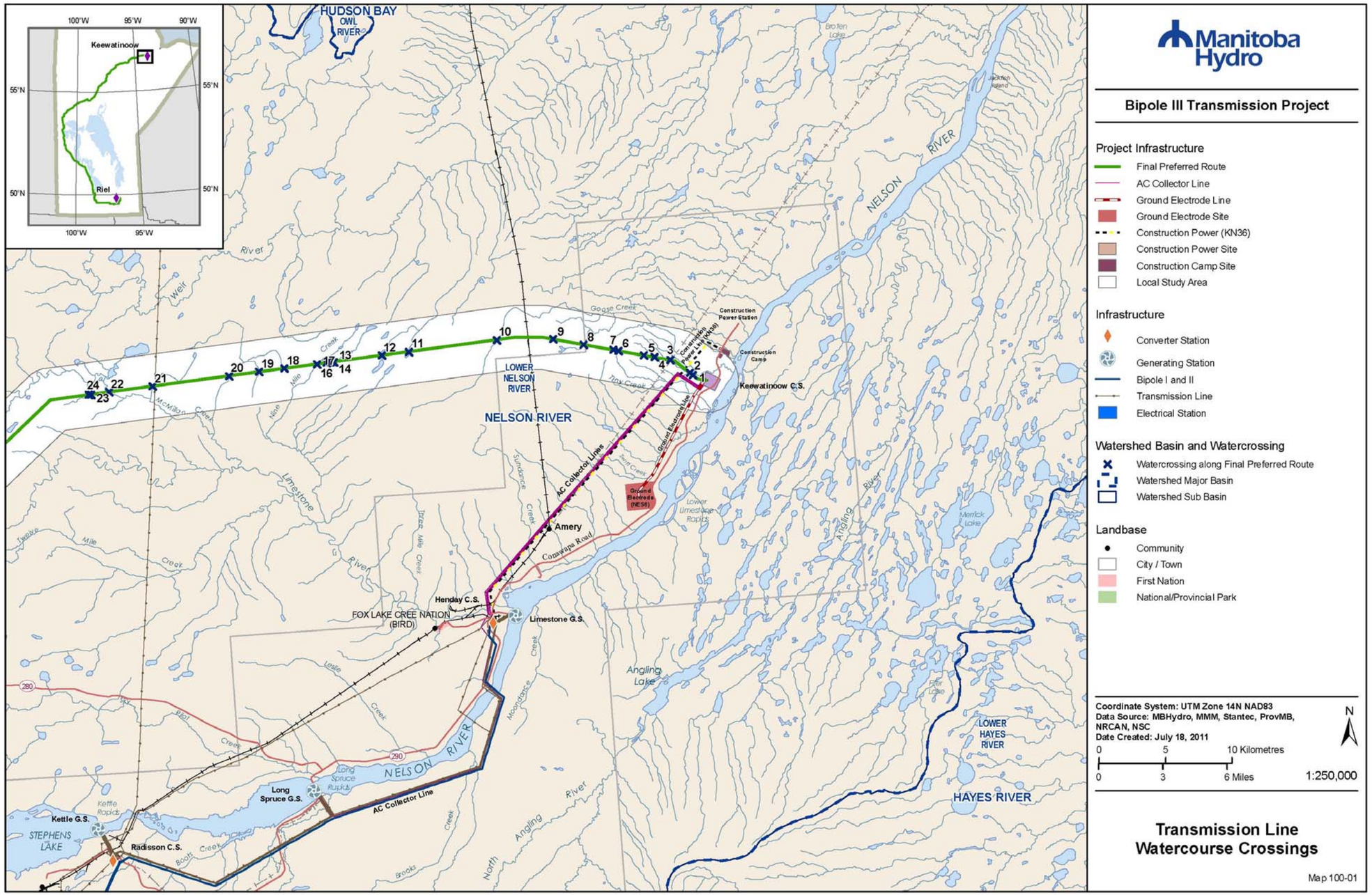
Page



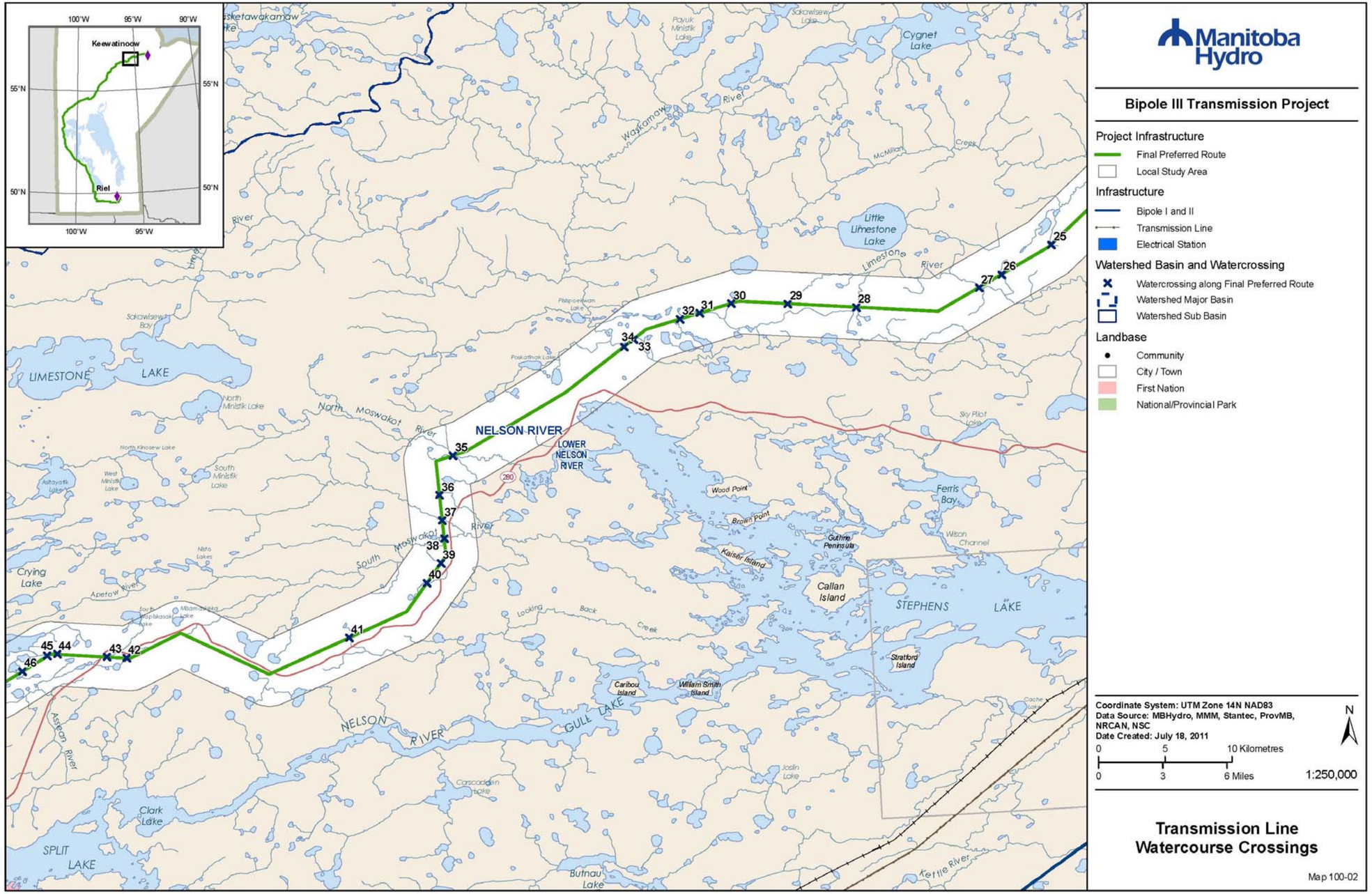
Map 1. Bipole III study area, watersheds, and preferred route (PR) with watercourse crossings.



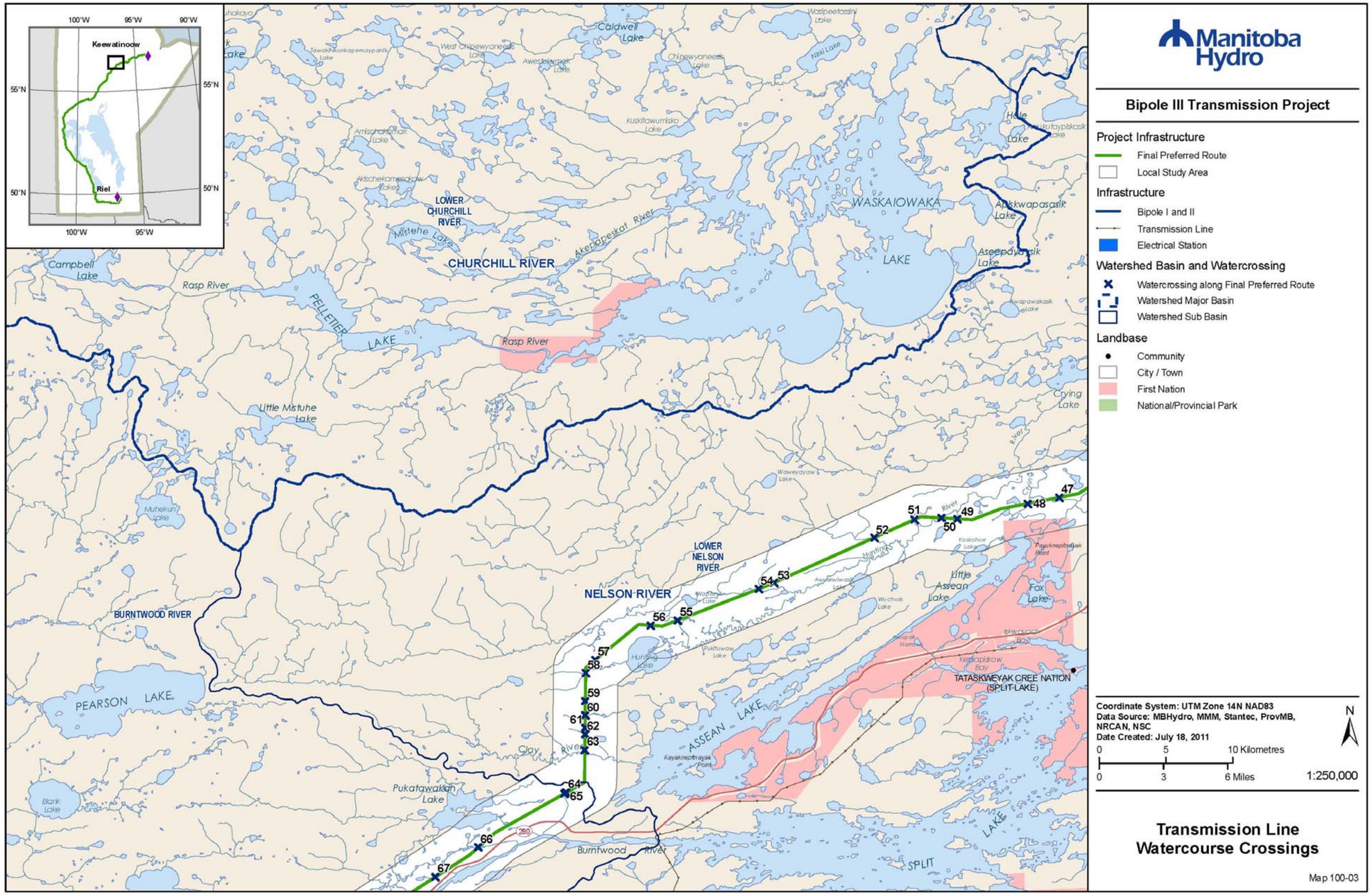
Map Series 100. Index map of Bipole III PR watercourse crossings.



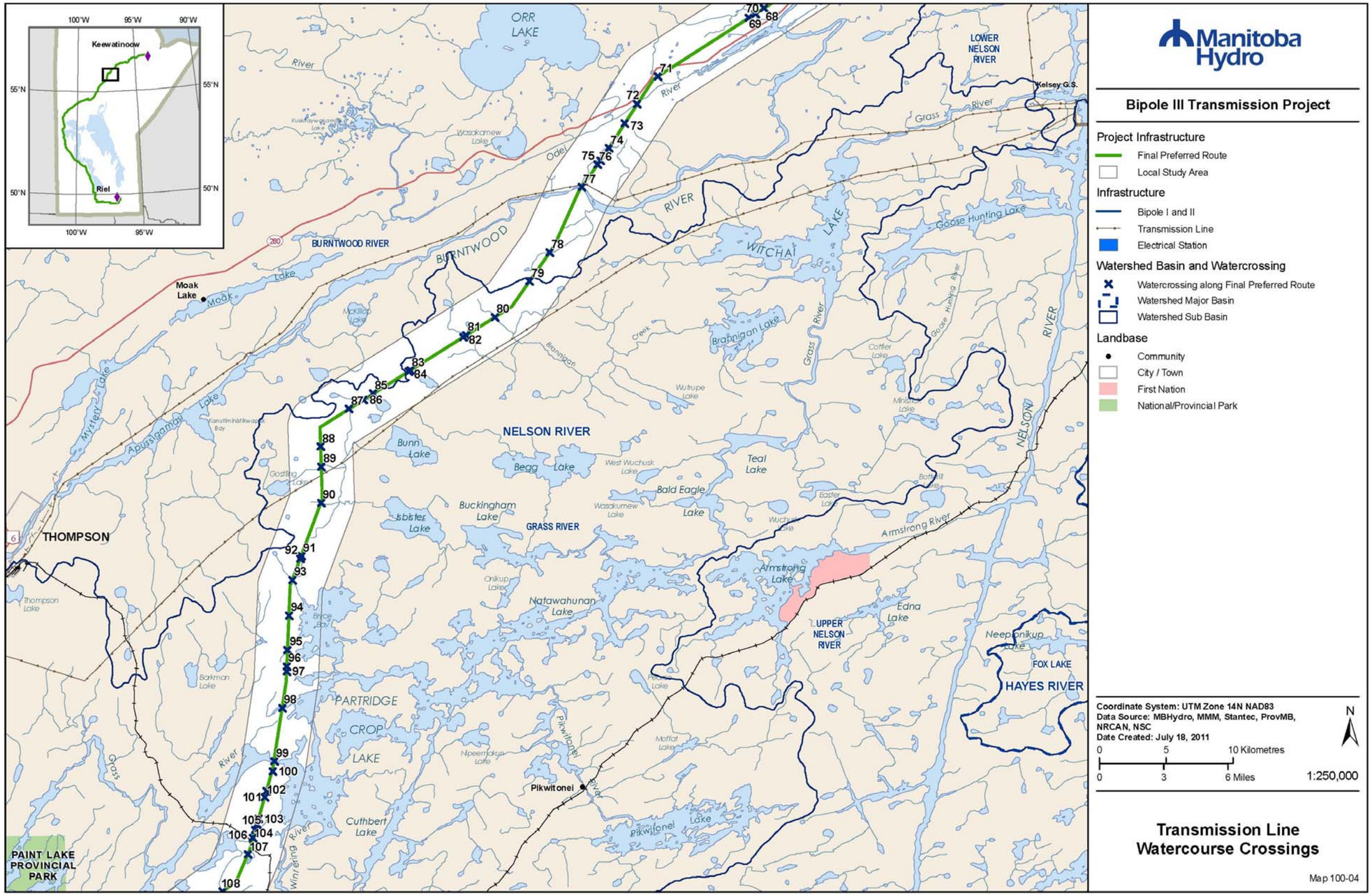
Map 100-01. Bipole III PR watercourse crossings.



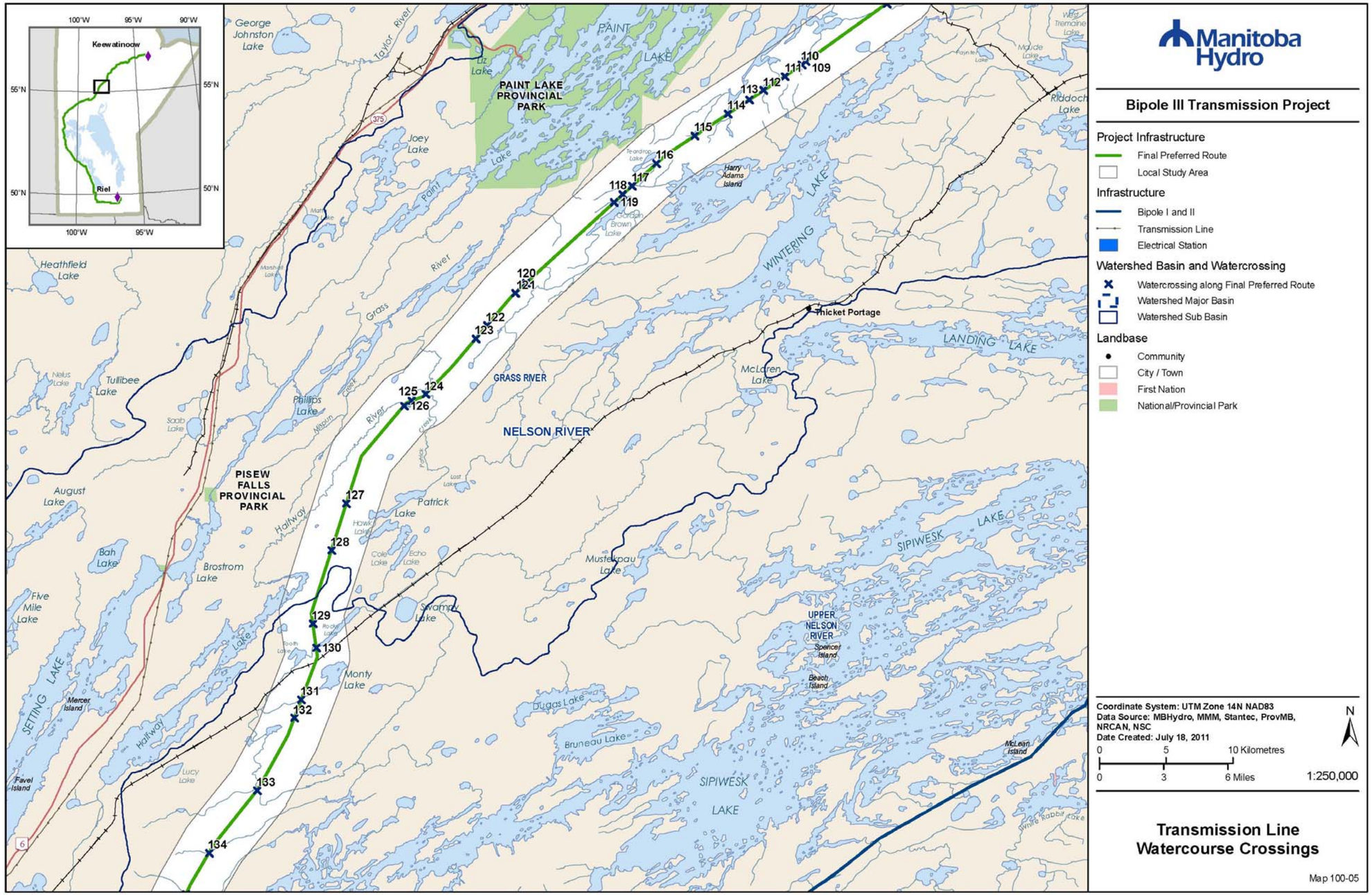
Map 100-02. Bipole III PR watercourse crossings.



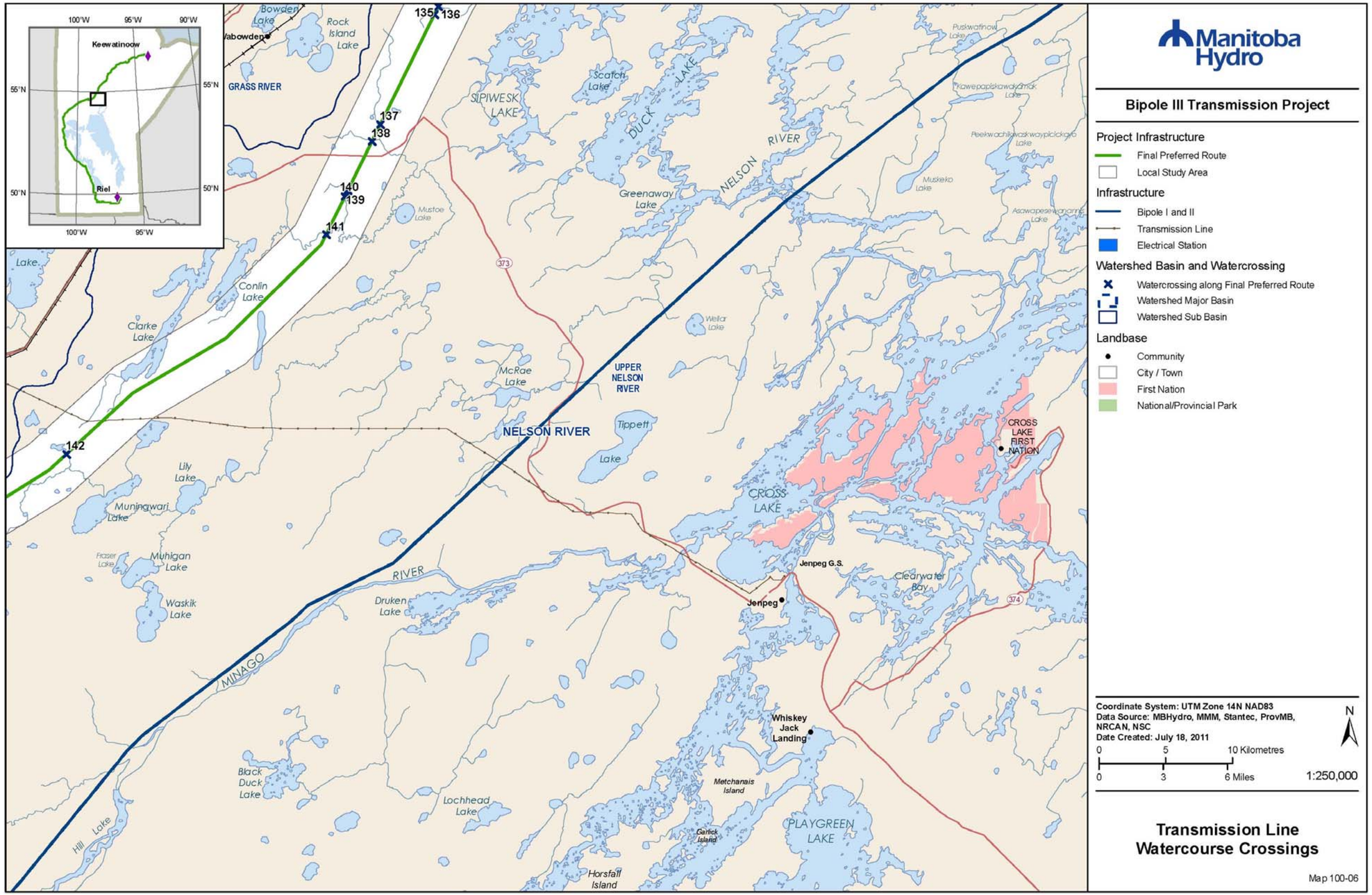
Map 100-03. Bipole III PR watercourse crossings.



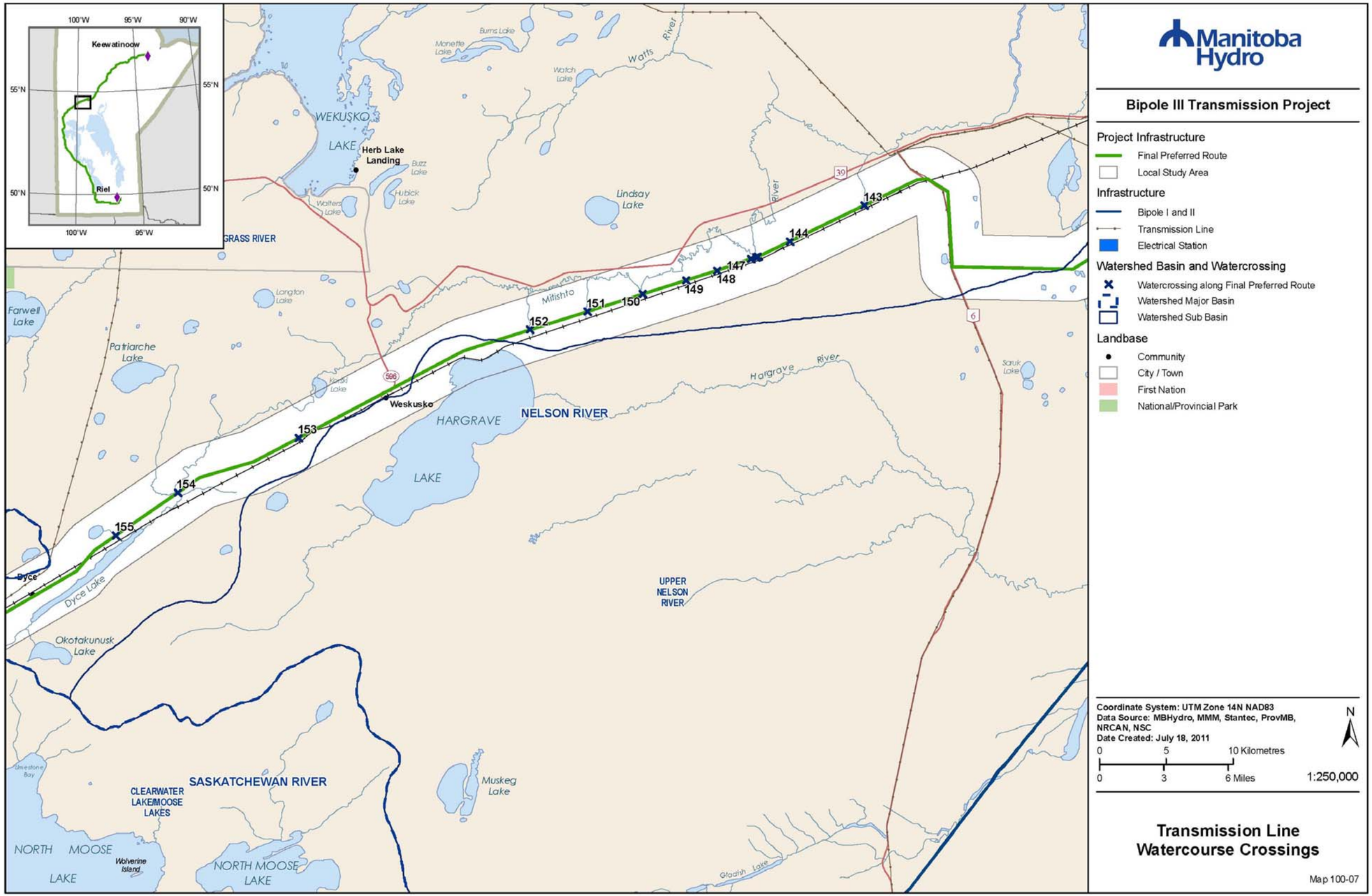
Map 100-04. Bipole III PR watercourse crossings.



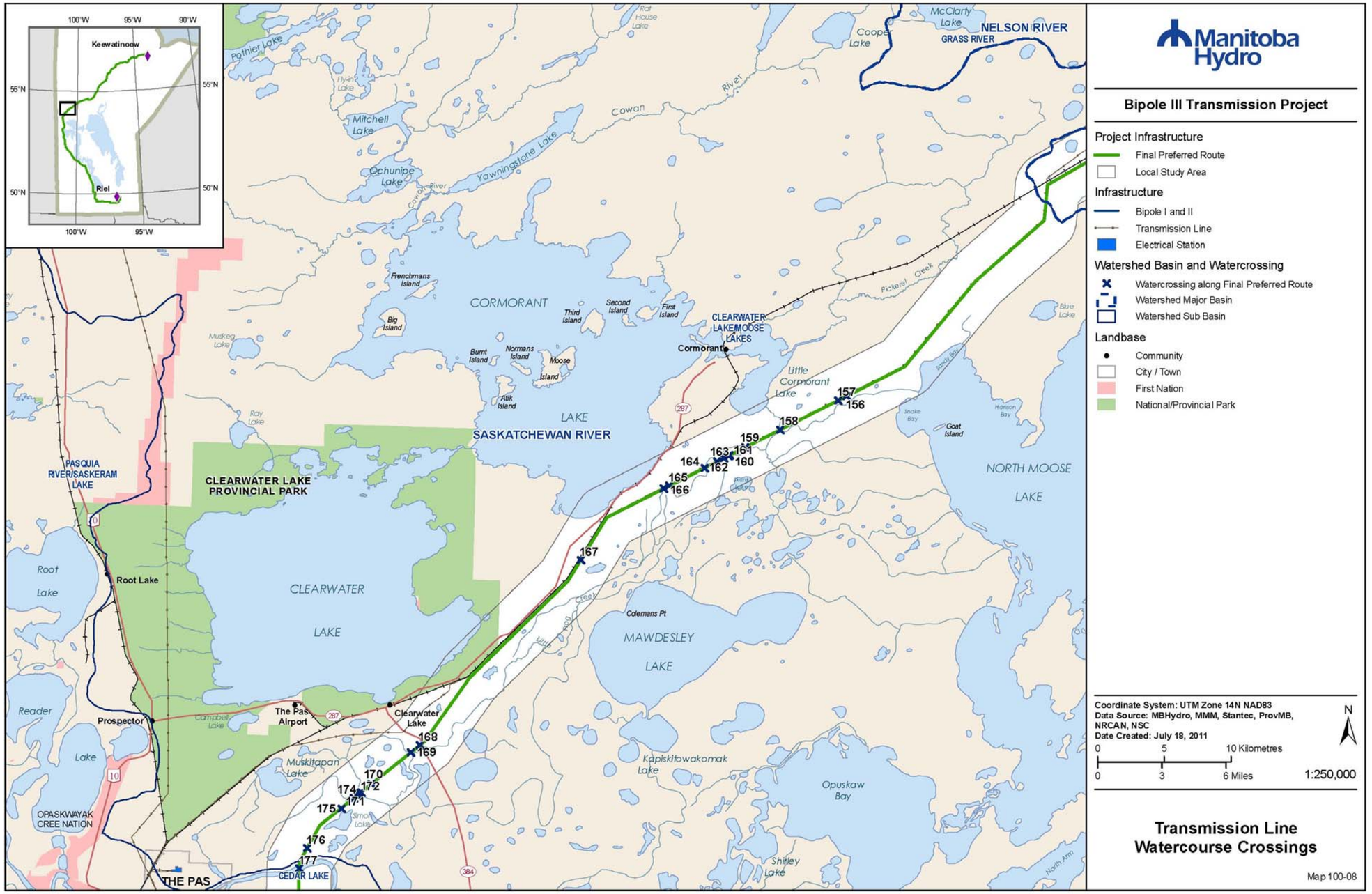
Map 100-05. Bipole III PR watercourse crossings.



Map 100-06. Bipole III PR watercourse crossings.



Map 100-07. Bipole III PR watercourse crossings.



Manitoba Hydro

Bipole III Transmission Project

Project Infrastructure
- Final Preferred Route
- Local Study Area

Infrastructure
- Bipole I and II
- Transmission Line
- Electrical Station

Watershed Basin and Watercrossing
- Watercrossing along Final Preferred Route
- Watershed Major Basin
- Watershed Sub Basin

Landbase
- Community
- City / Town
- First Nation
- National/Provincial Park

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, MMM, Stantec, ProvMB, NRCAN, NSC
Date Created: July 18, 2011

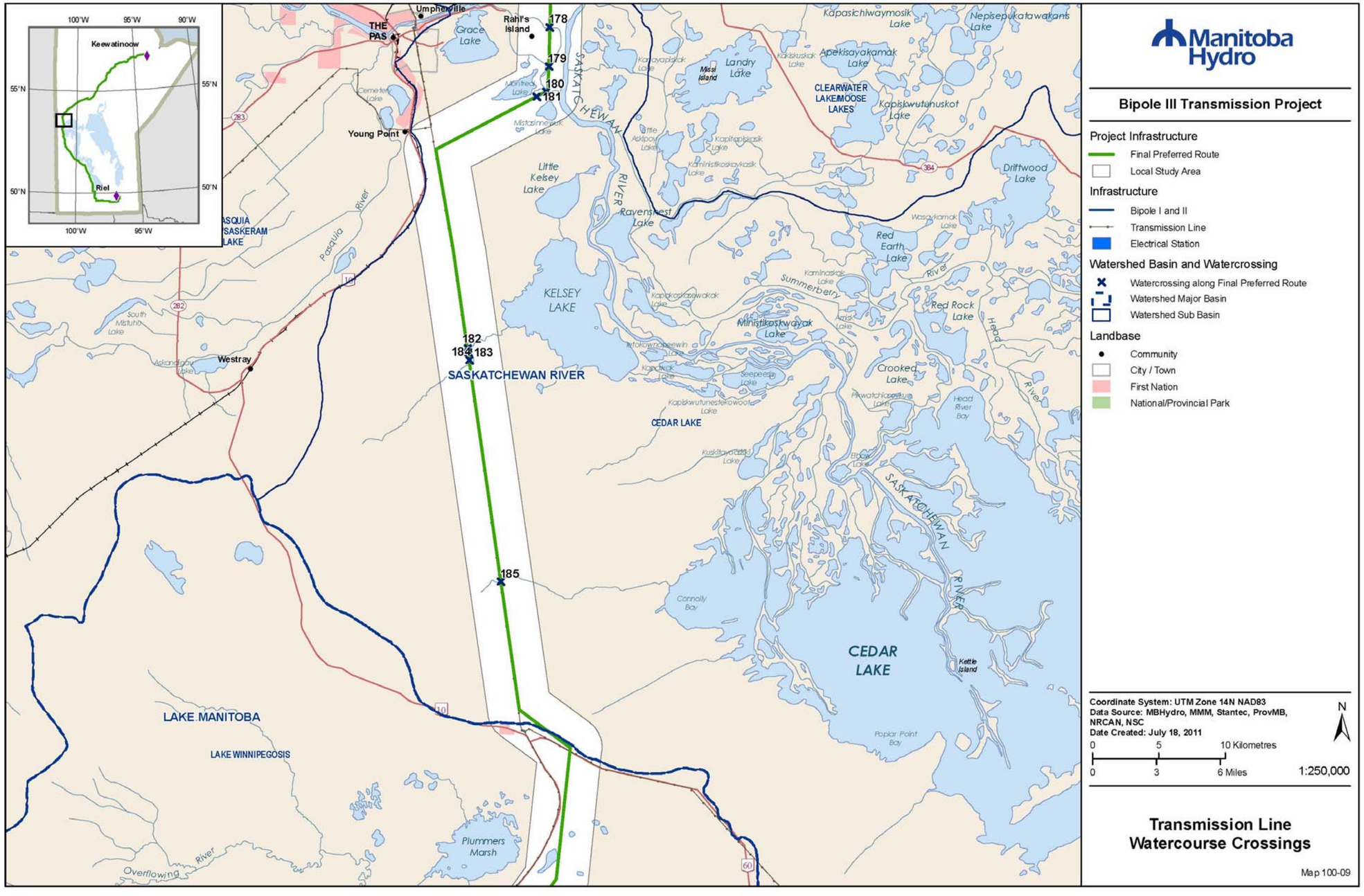
N

0 5 10 Kilometres
0 3 6 Miles
1:250,000

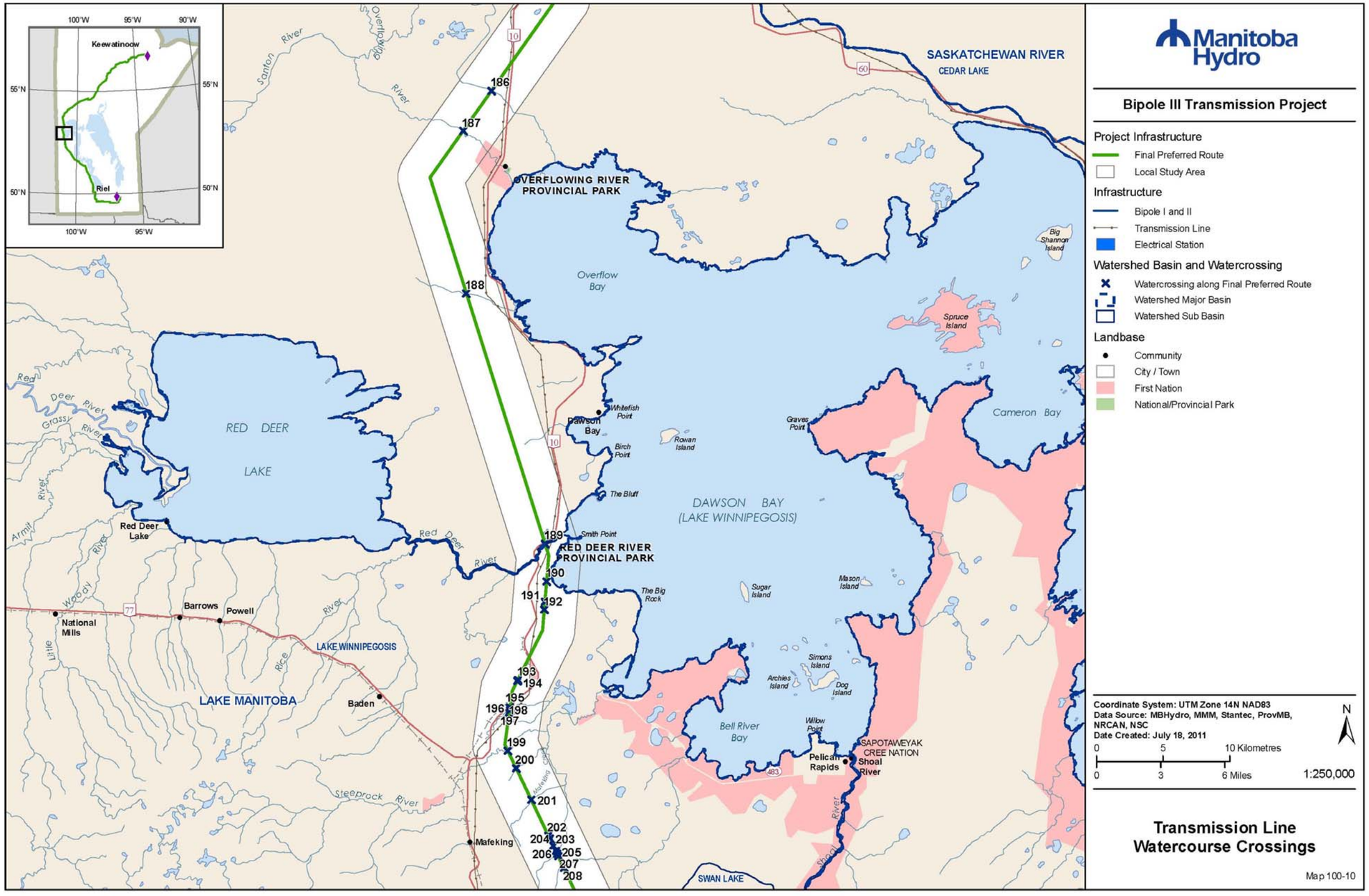
Transmission Line Watercourse Crossings

Map 100-08

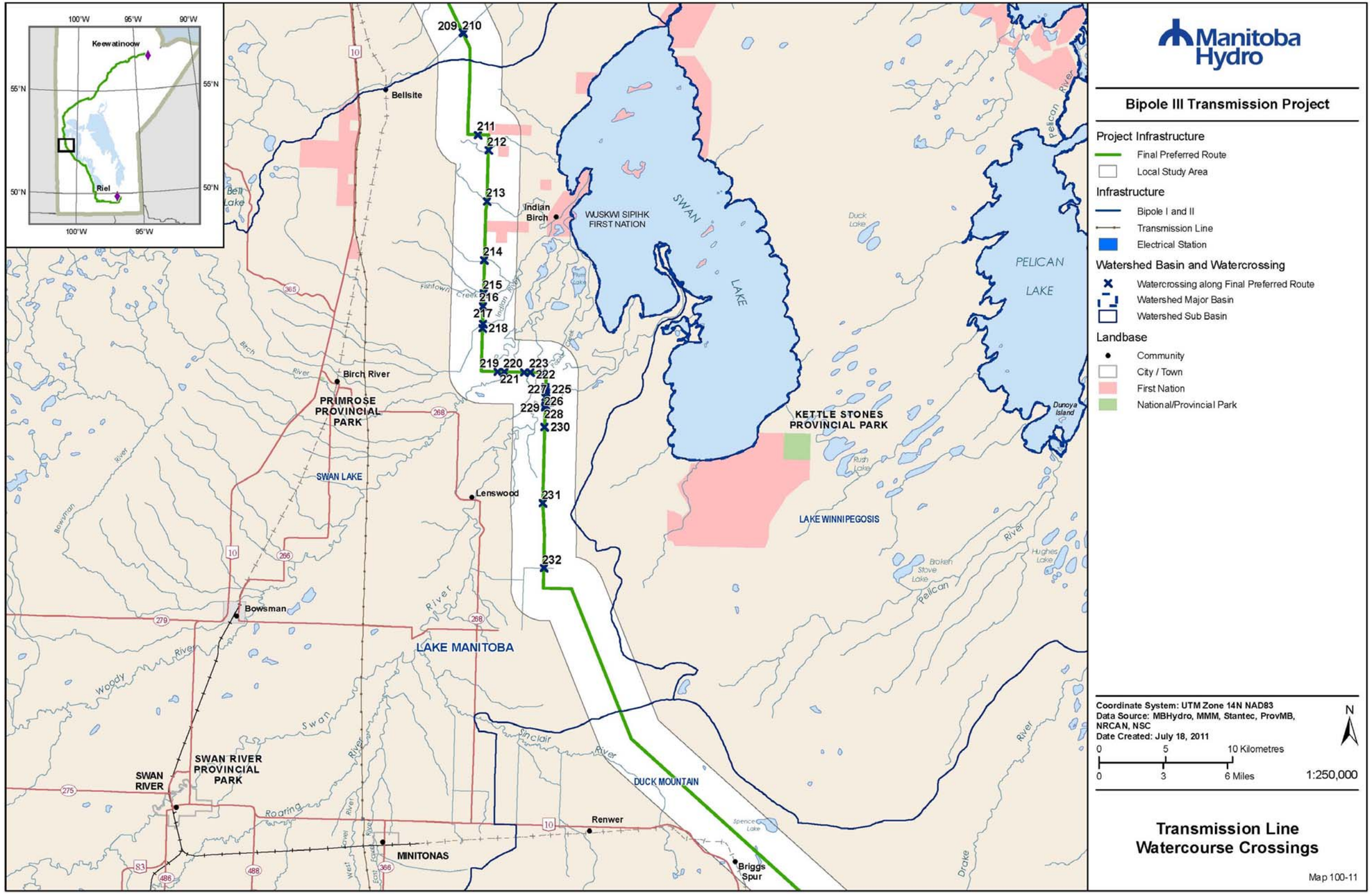
Map 100-08. Bipole III PR watercourse crossings.



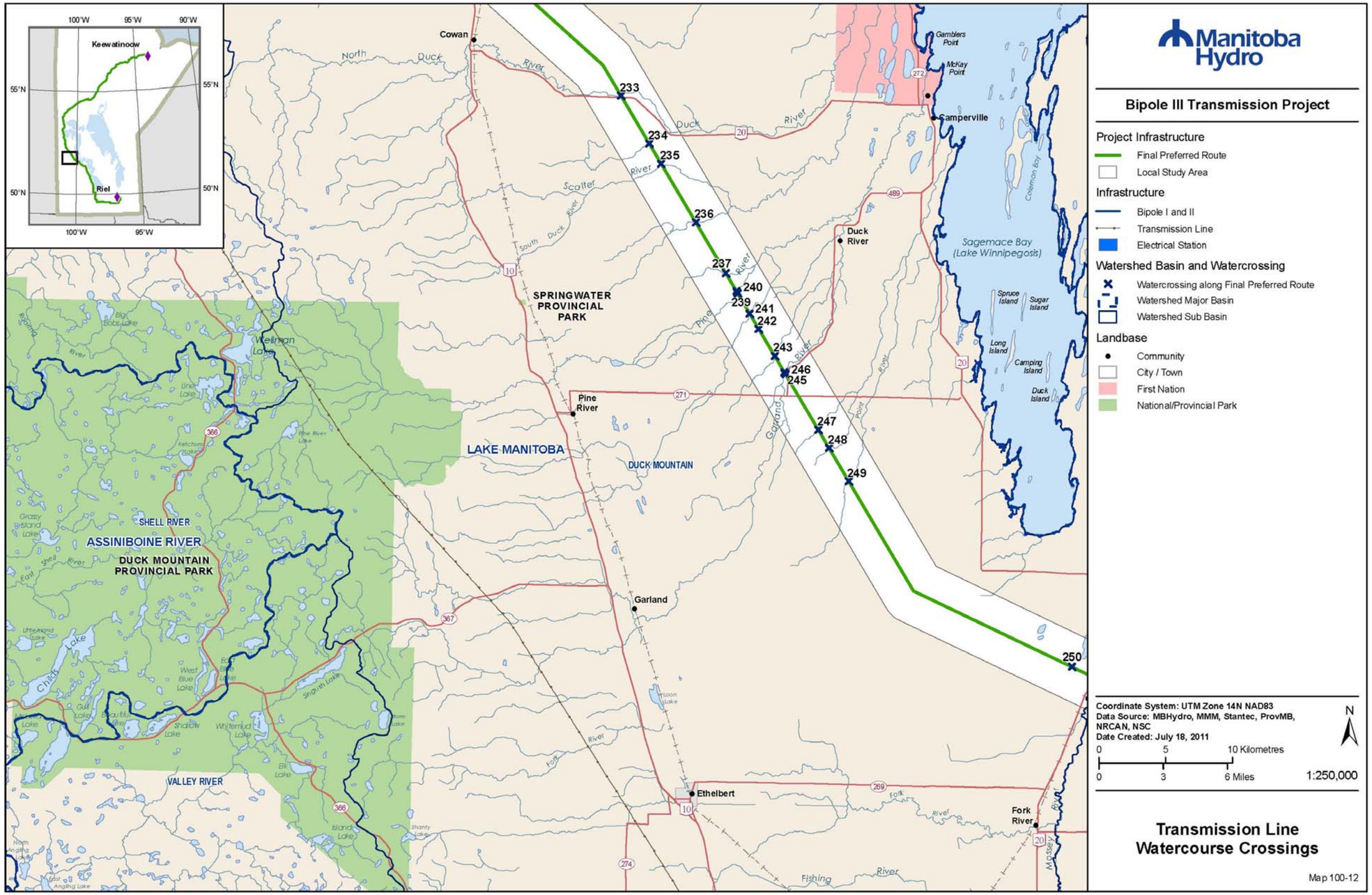
Map 100-09. Bipole III PR watercourse crossings.



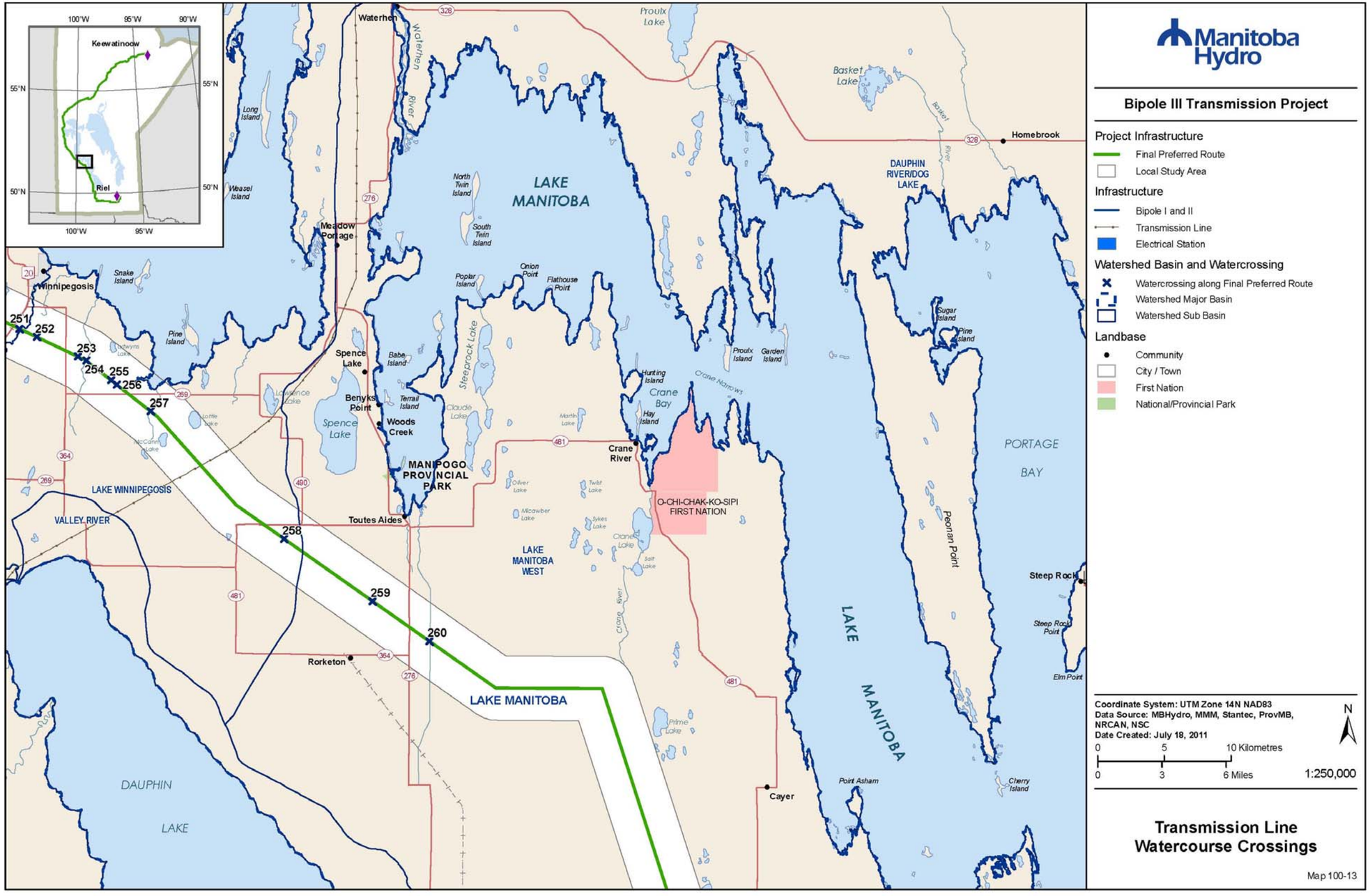
Map 100-10. Bipole III PR watercourse crossings.



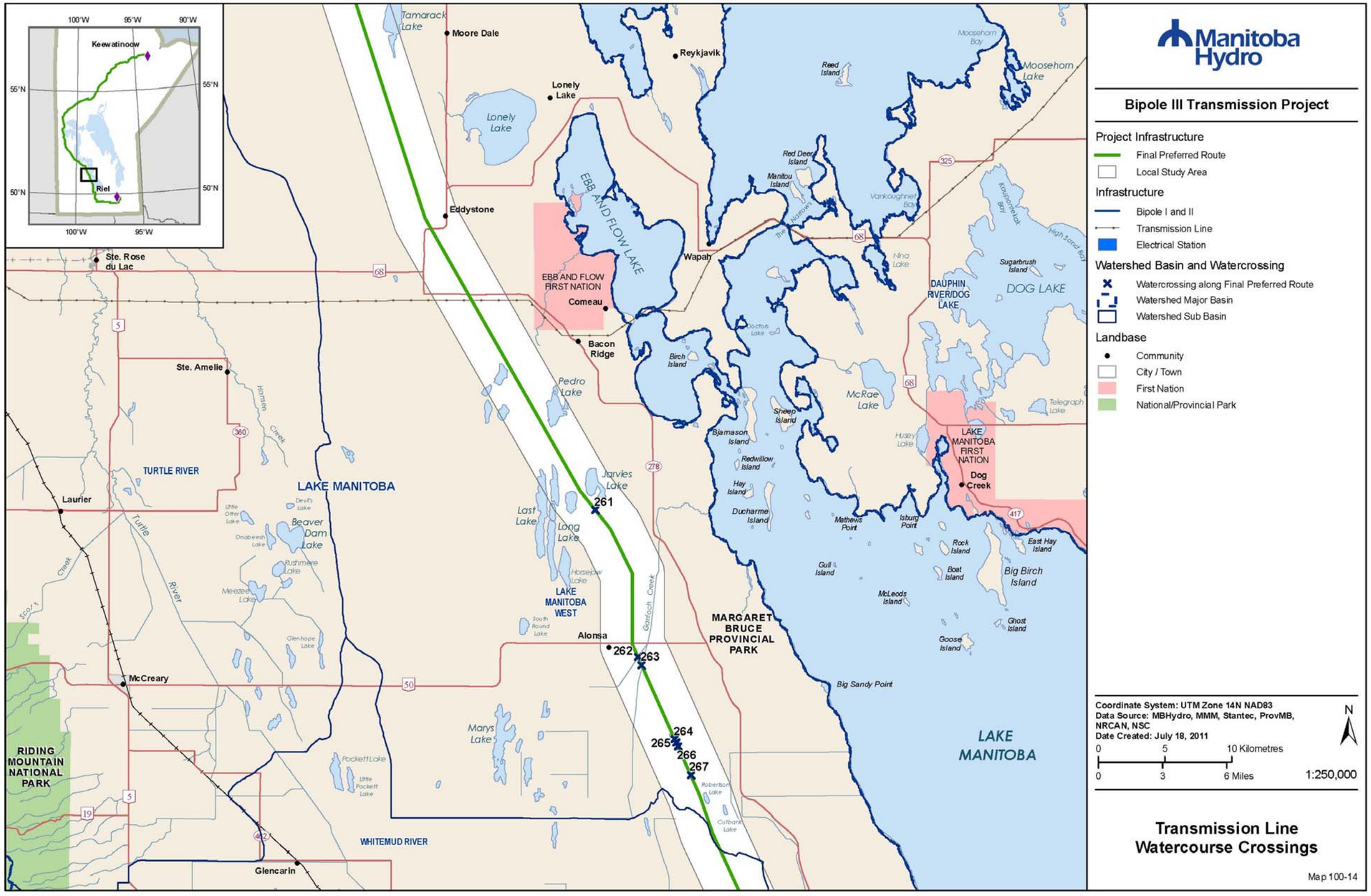
Map 100-11. Bipole III PR watercourse crossings.



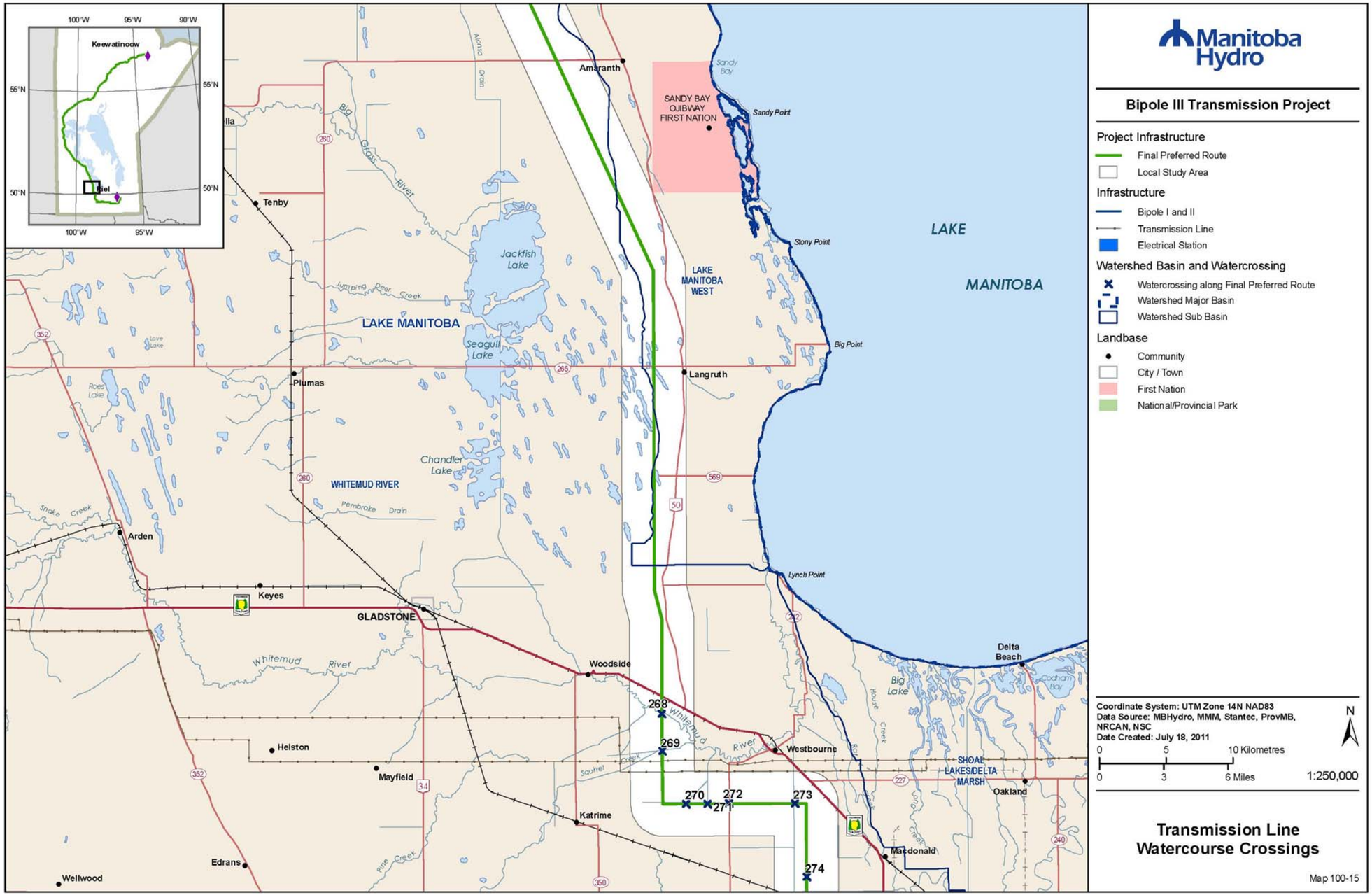
Map 100-12. Bipole III PR watercourse crossings.



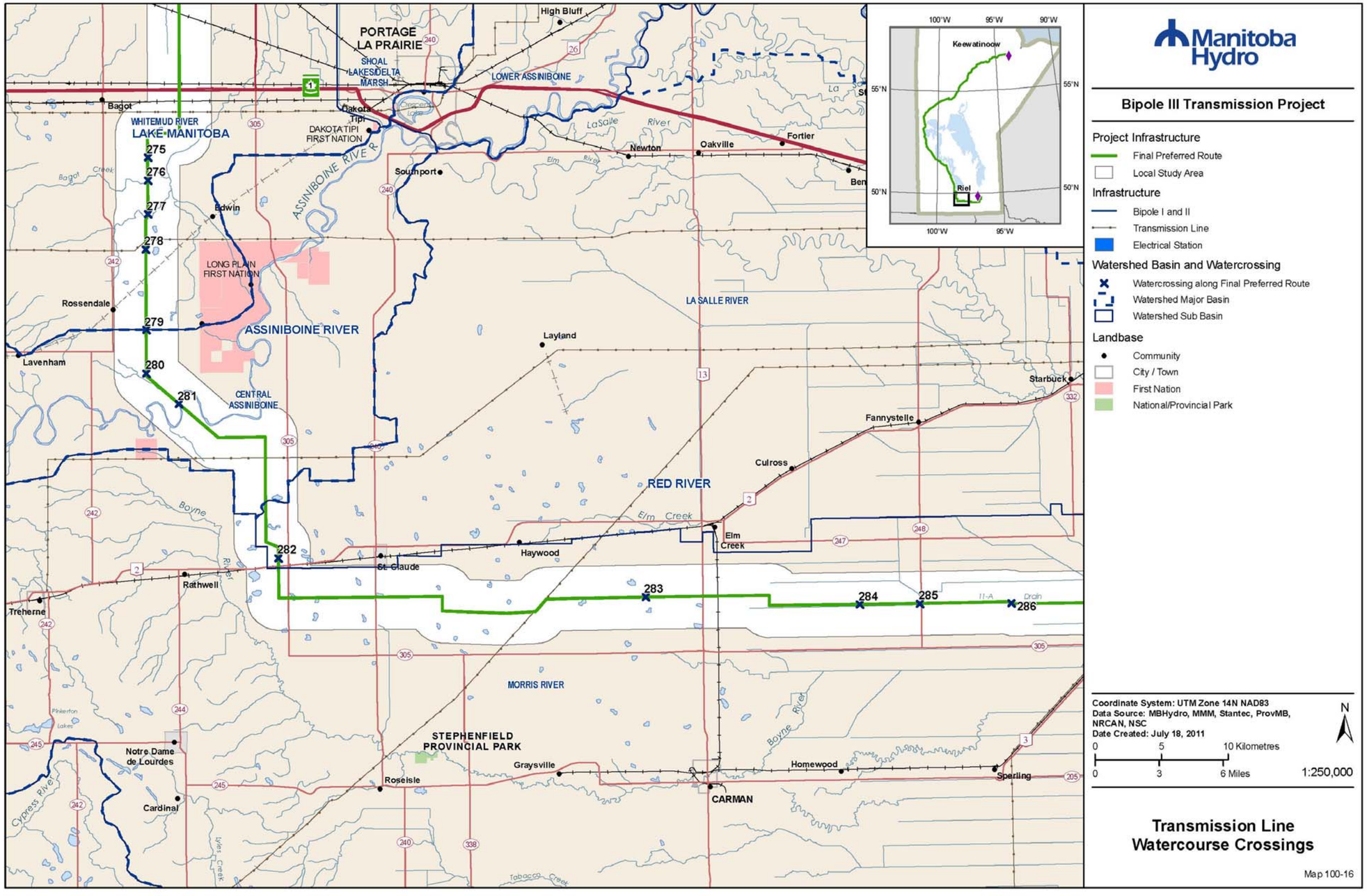
Map 100-13. Bipole III PR watercourse crossings.



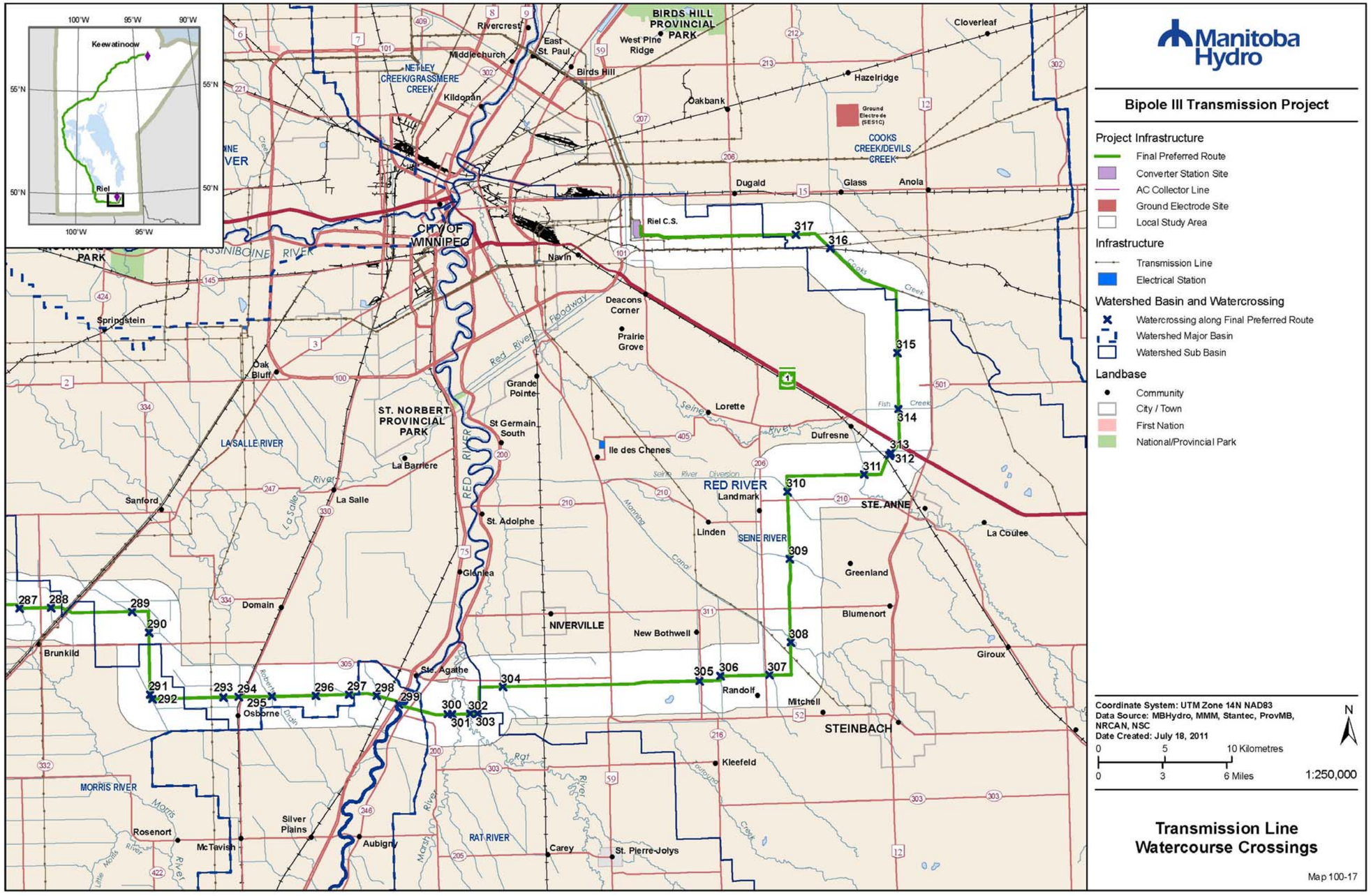
Map 100-14. Bipole III PR watercourse crossings.



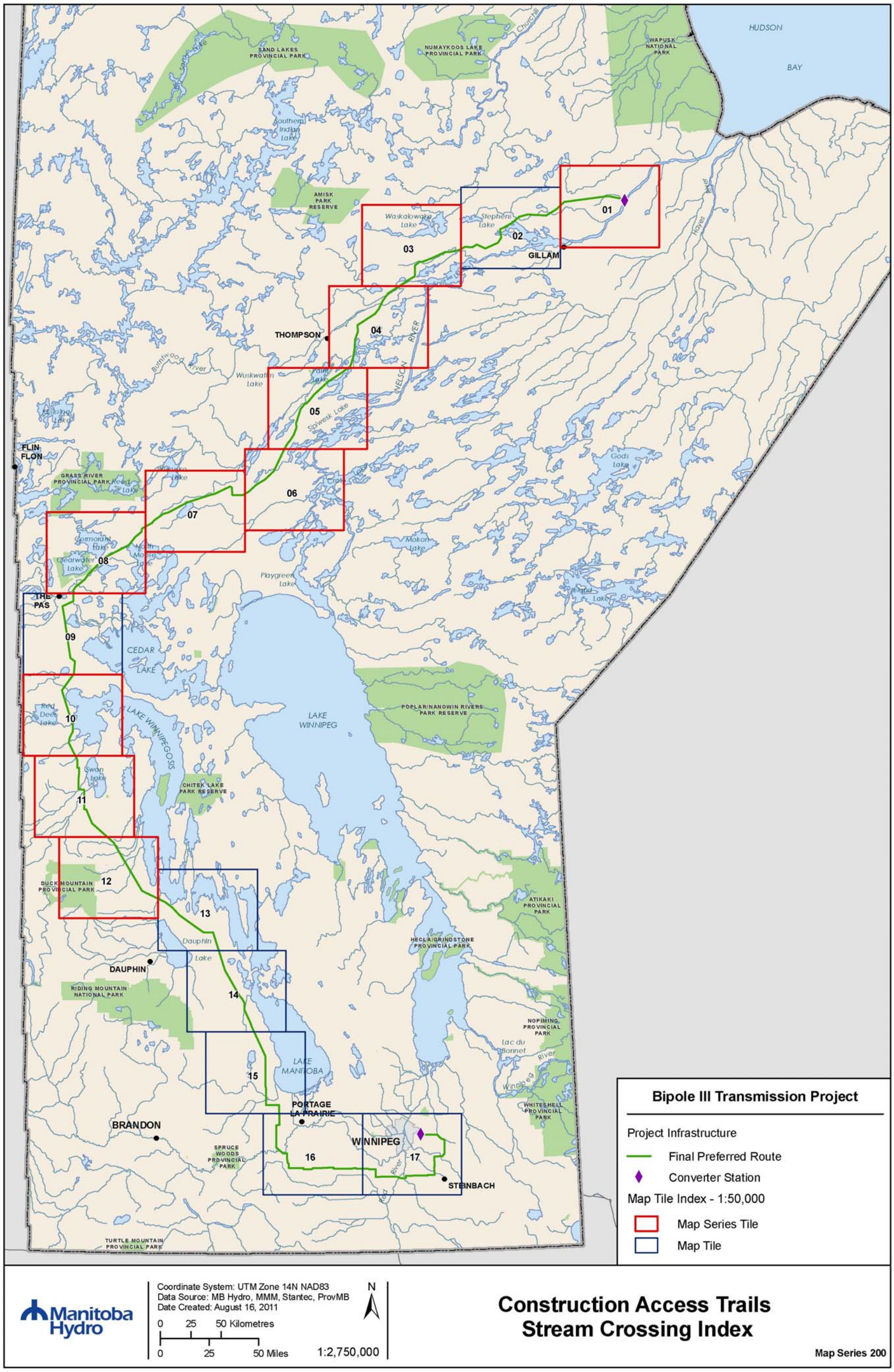
Map 100-15. Bipole III PR watercourse crossings.



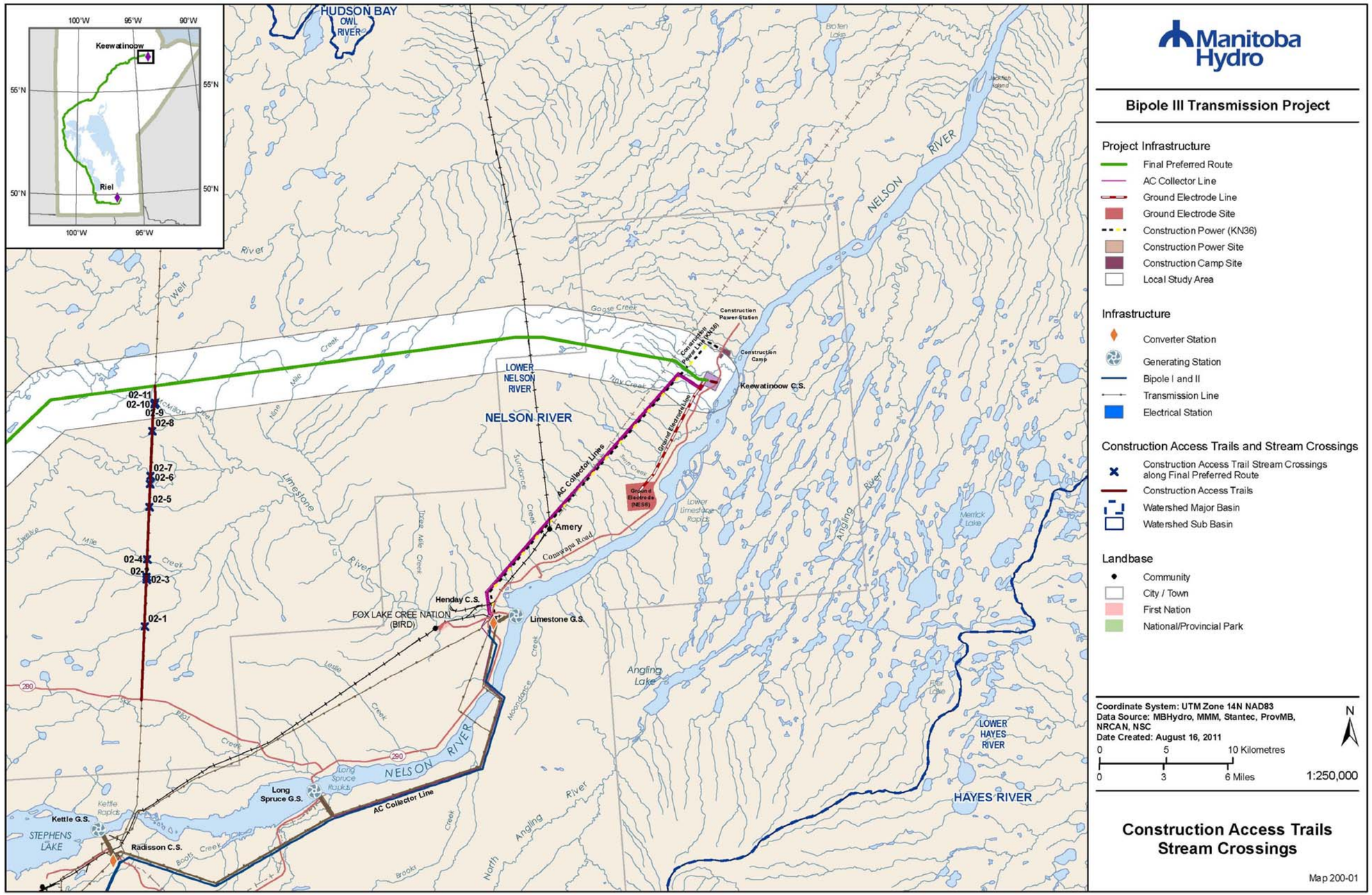
Map 100-16. Bipole III PR watercourse crossings.



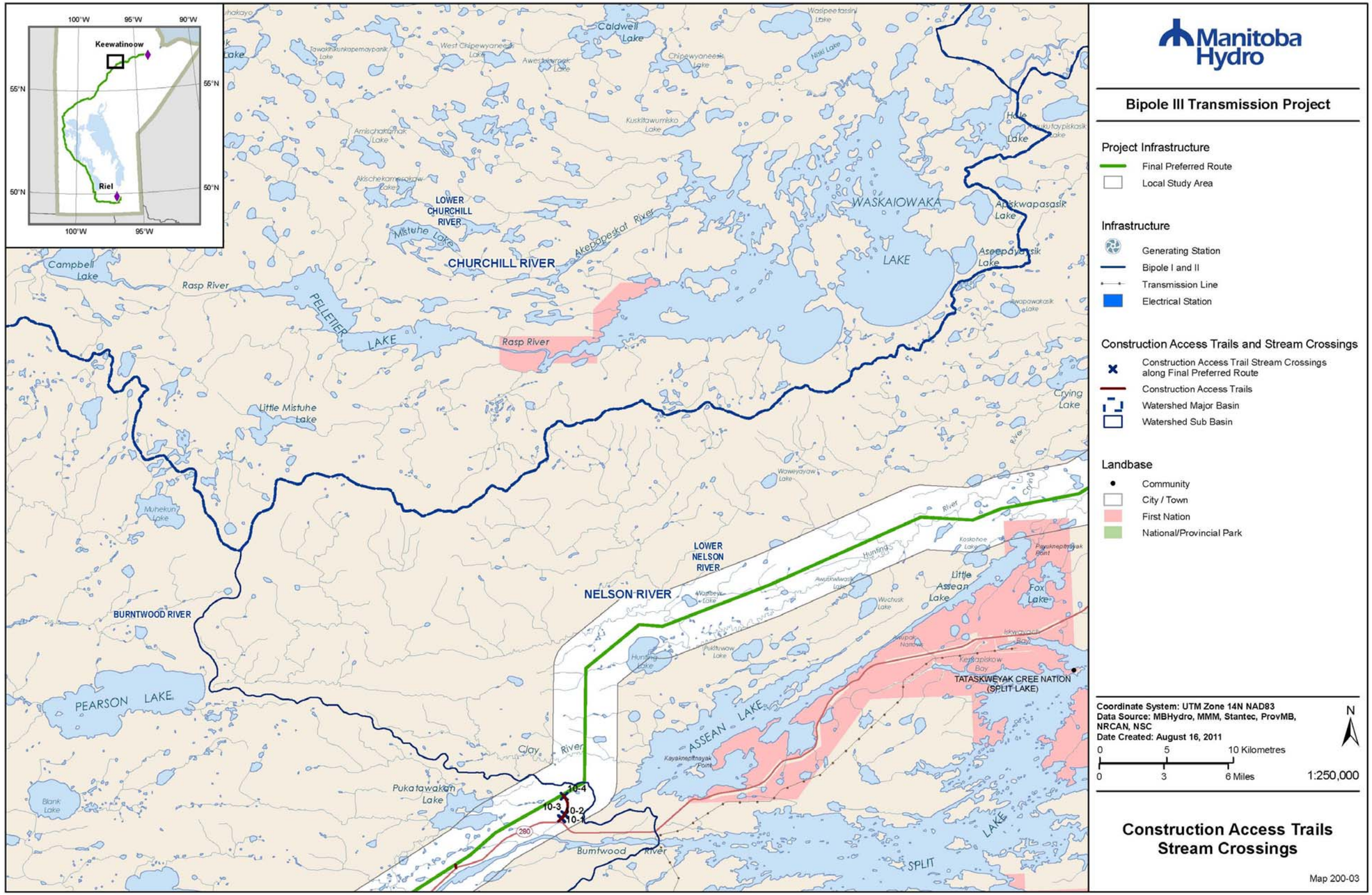
Map 100-17. Bipole III PR watercourse crossings.



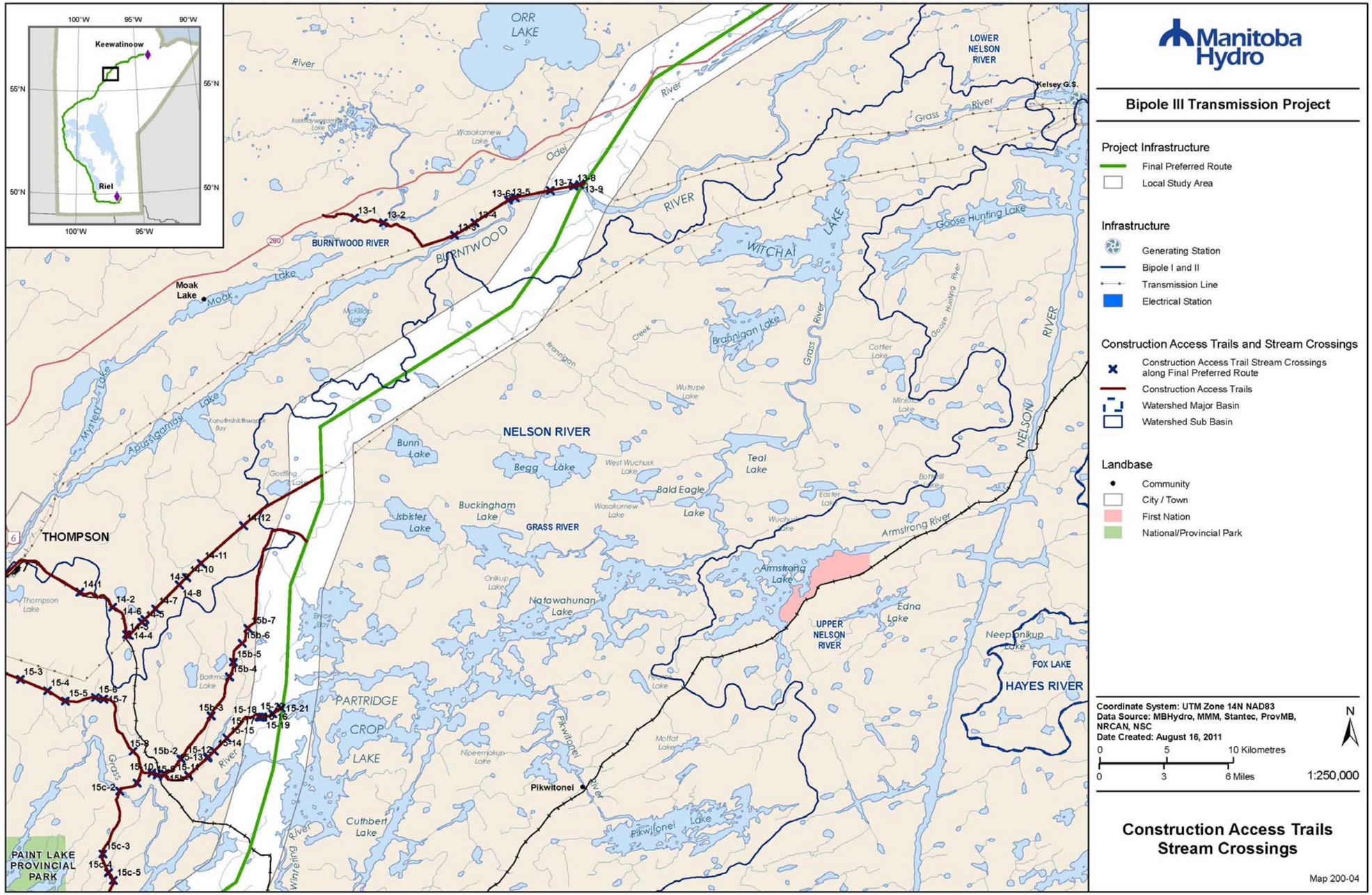
Map Series 200. Index map of Bipole III Construction Access Trails watercourse crossings.



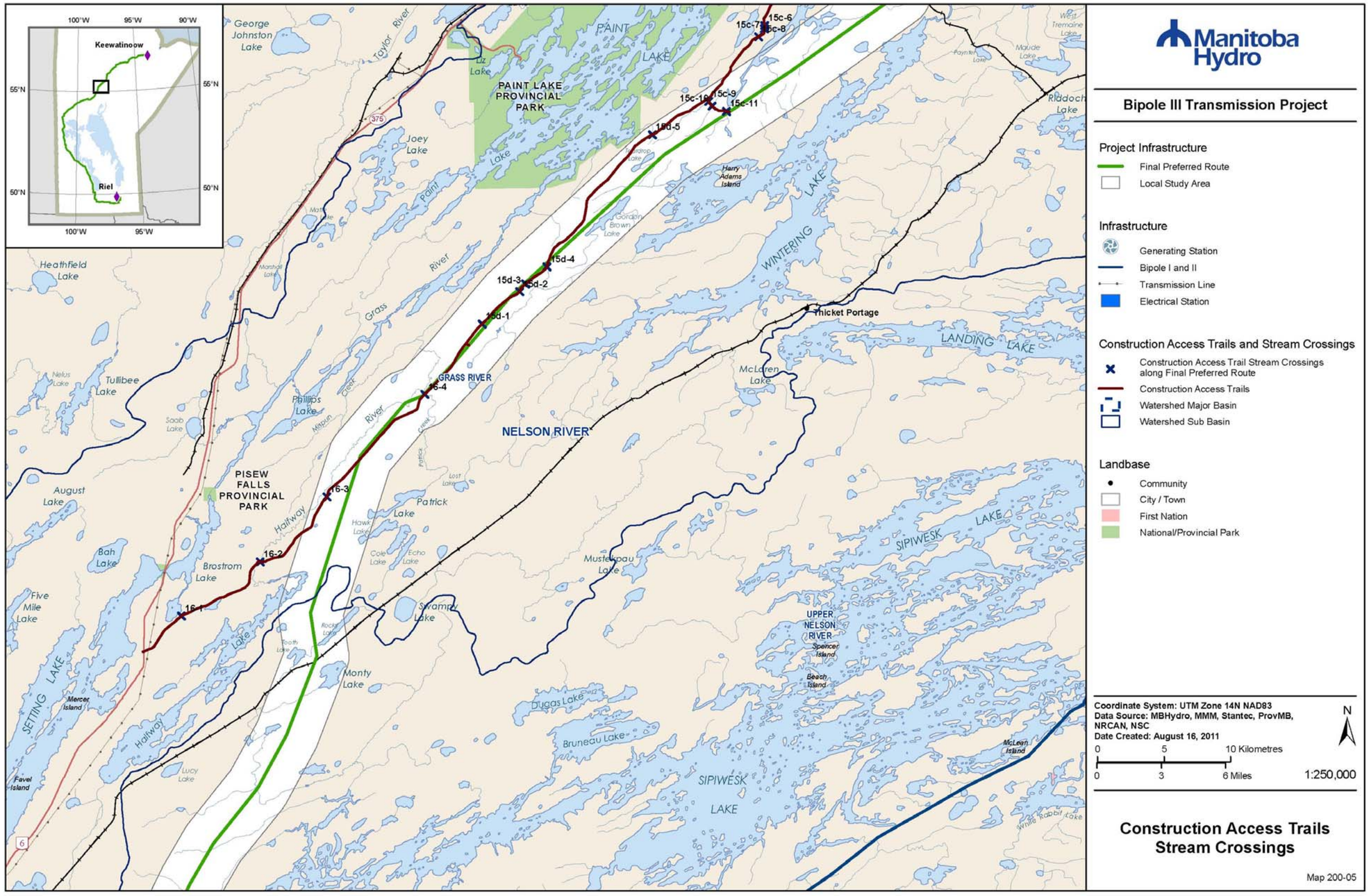
Map 200-1. Bipole III Construction Access Trails watercourse crossings.



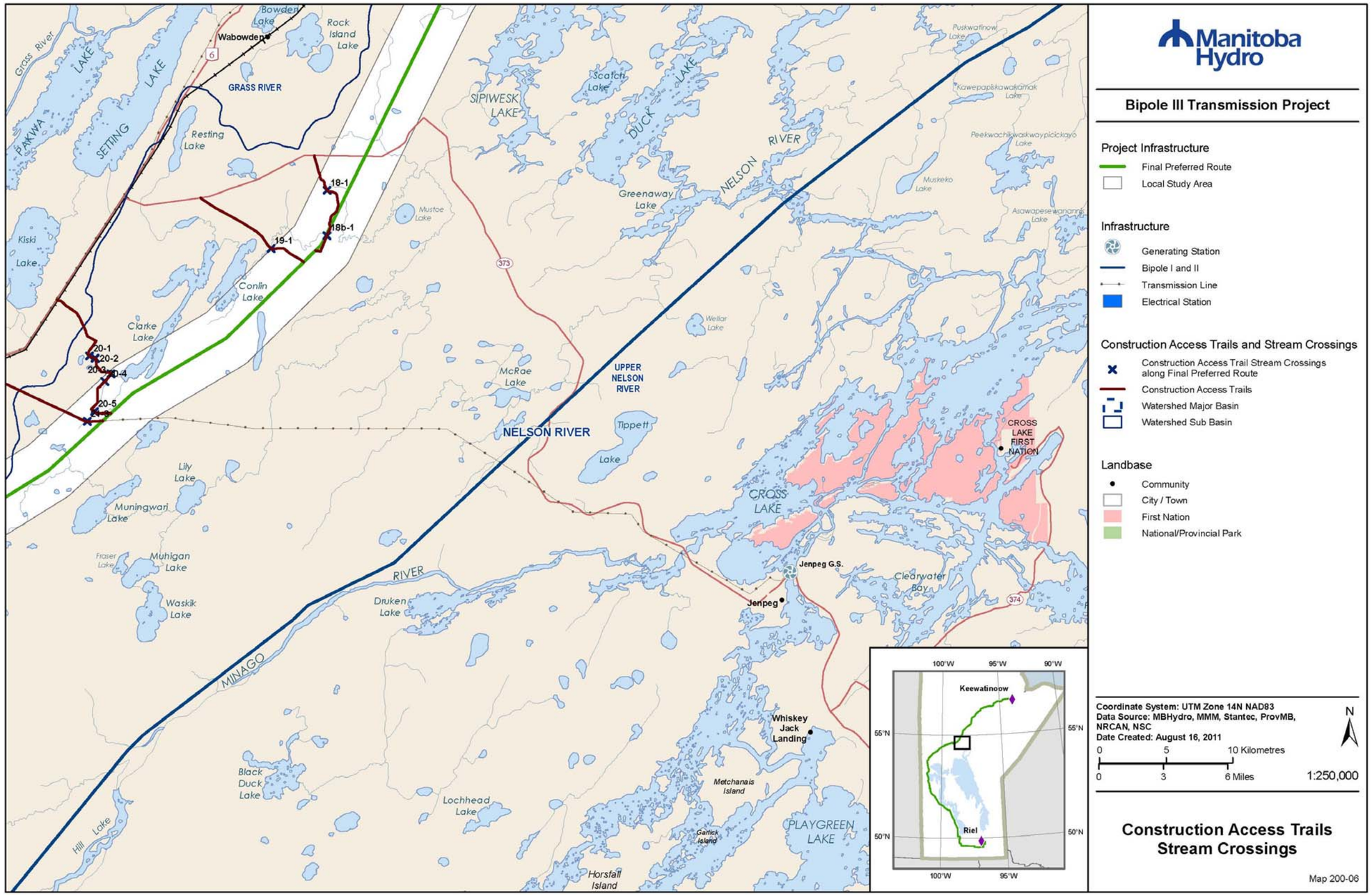
Map 200-3. Bipole III Construction Access Trails watercourse crossings.



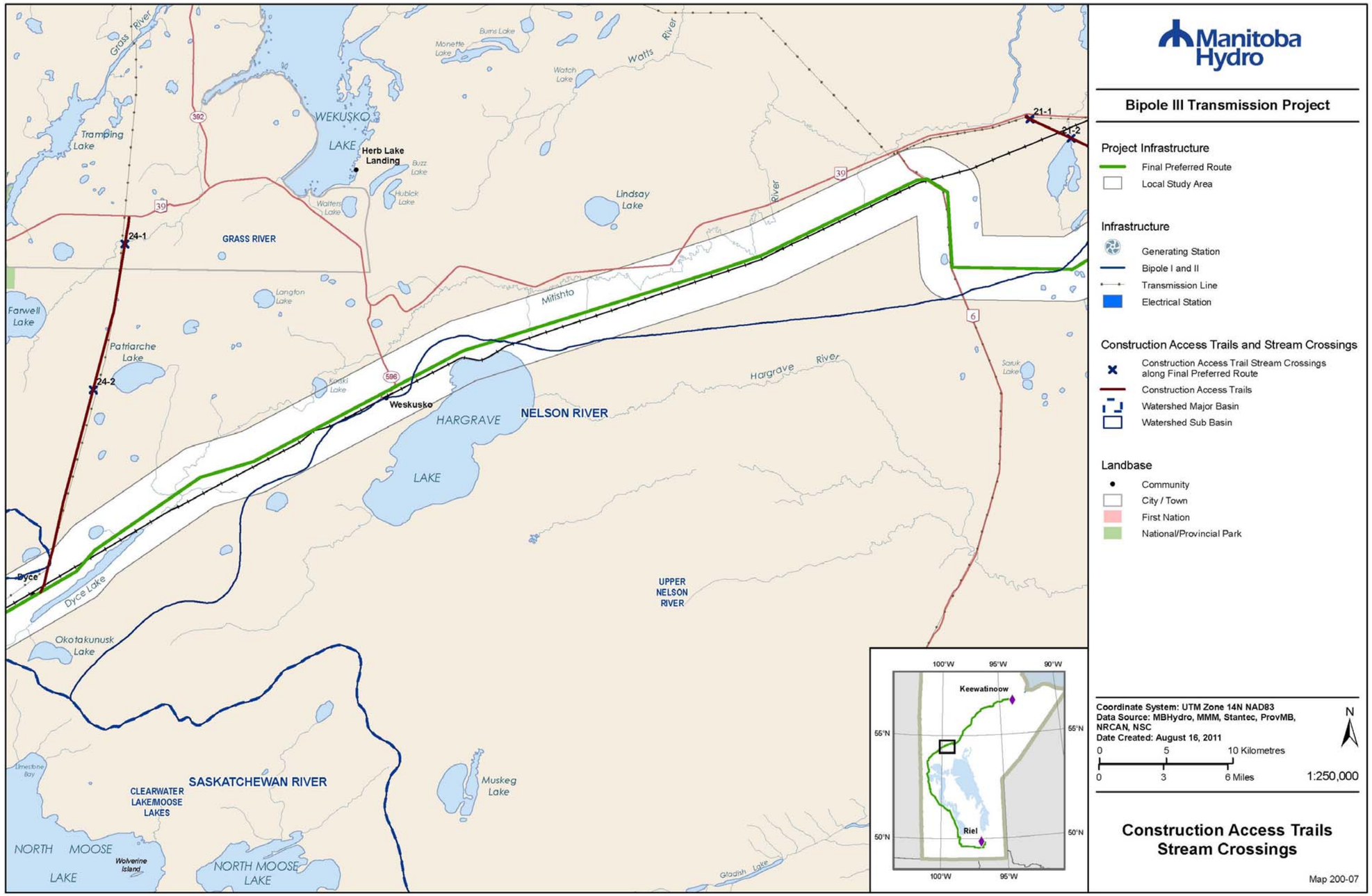
Map 200-4. Bipole III Construction Access Trails watercourse crossings.



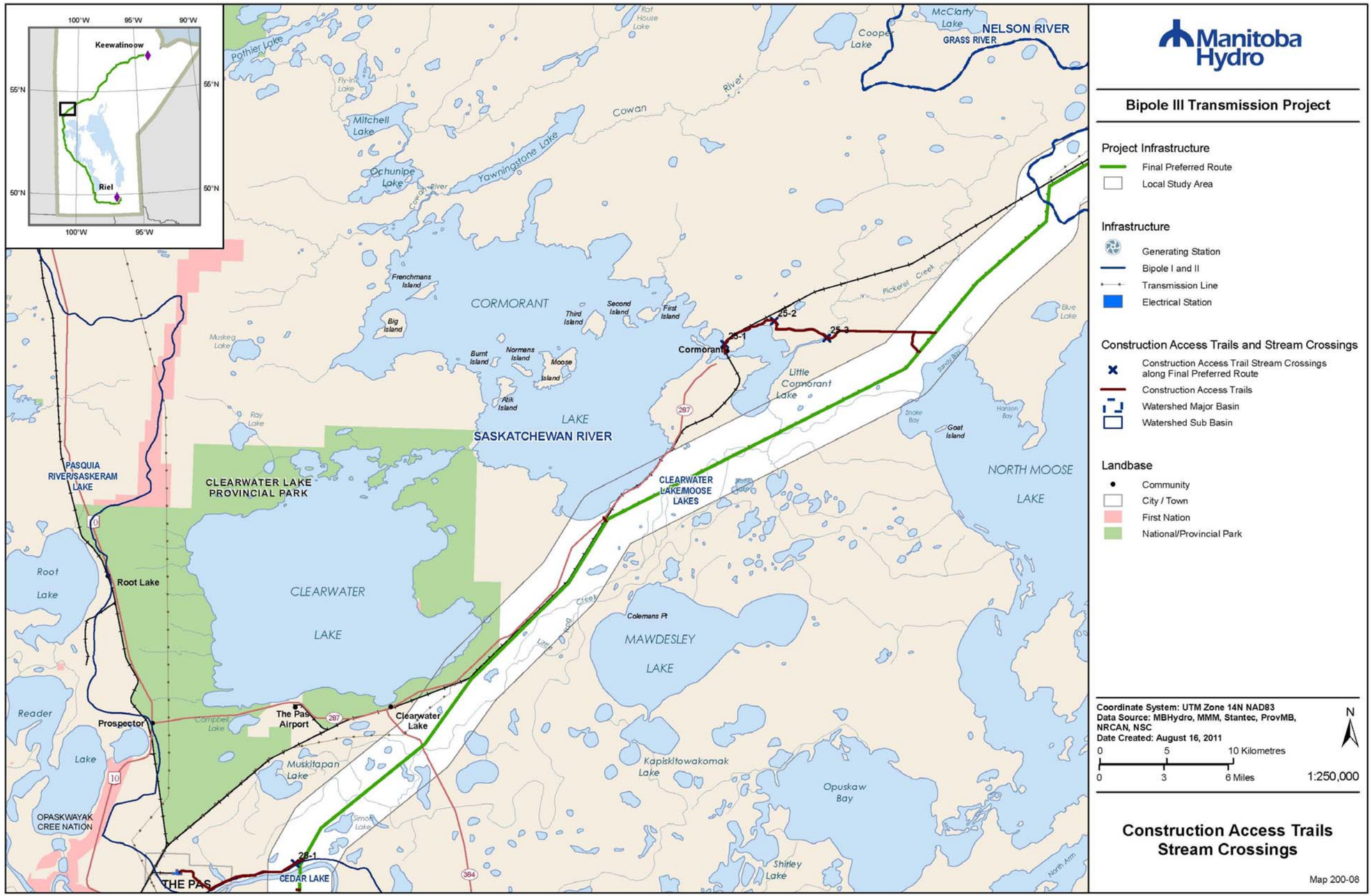
Map 200-5. Bipole III Construction Access Trails watercourse crossings.



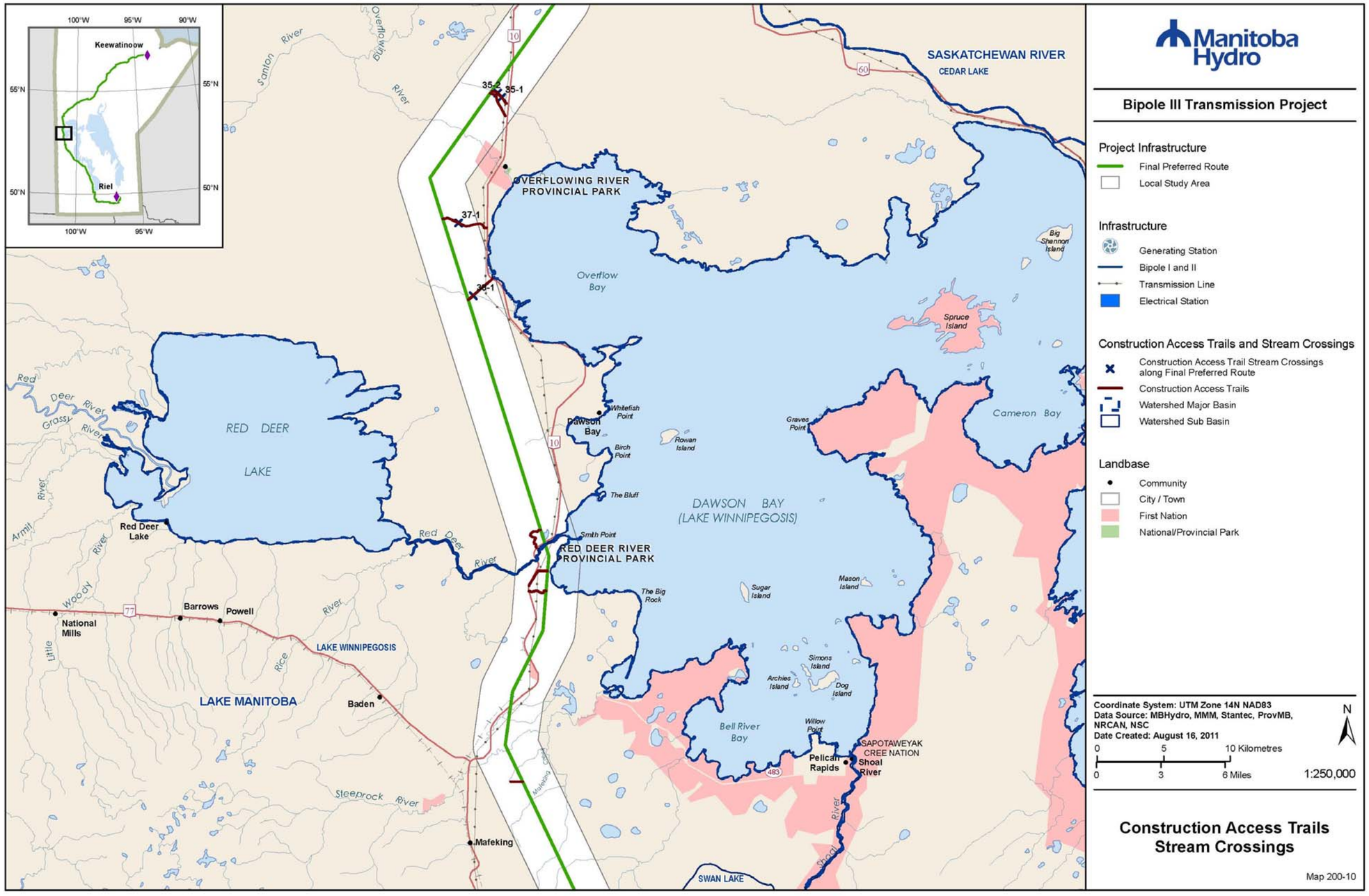
Map 200-6. Bipole III Construction Access Trails watercourse crossings.



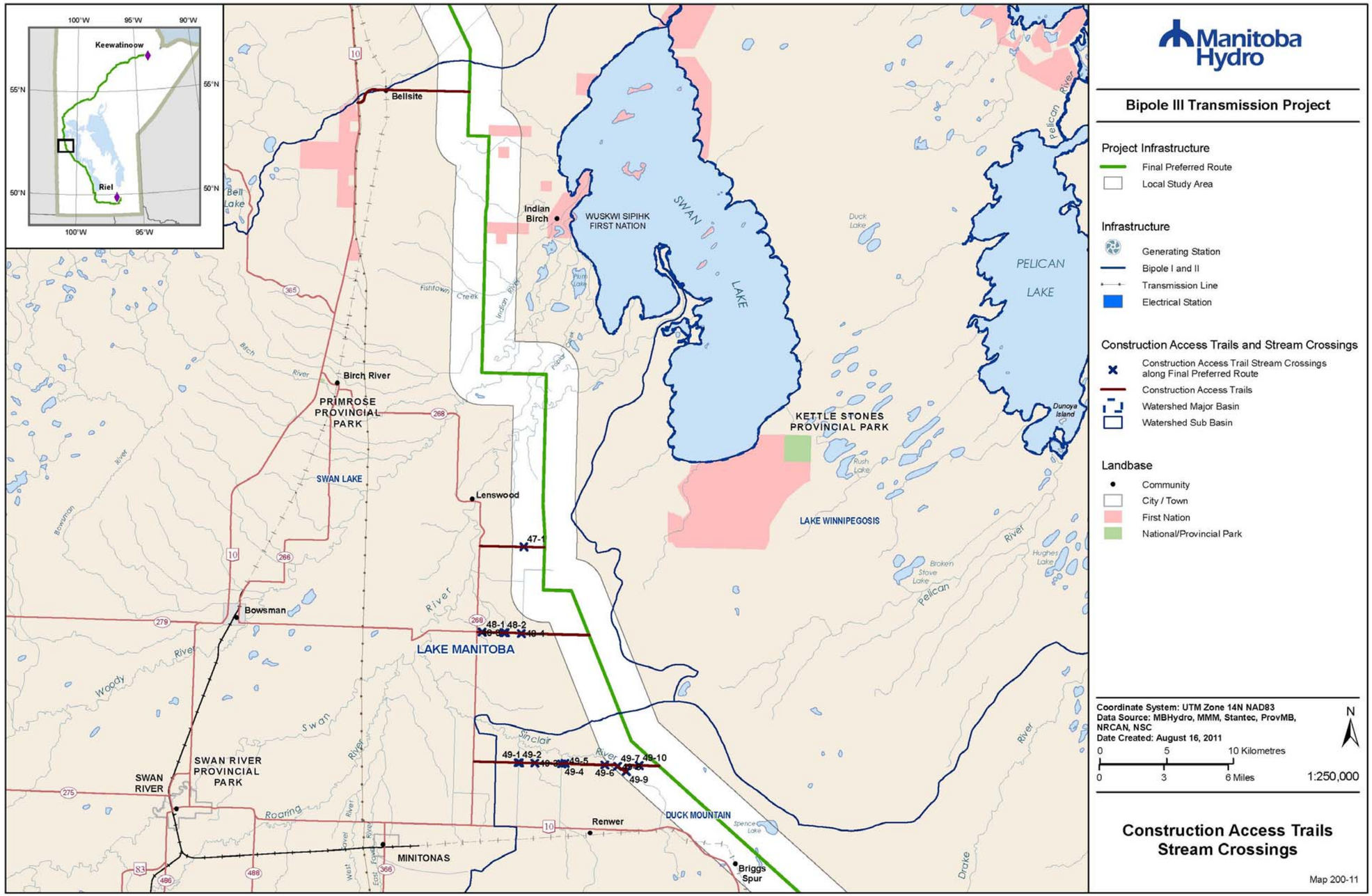
Map 200-7. Bipole III Construction Access Trails watercourse crossings.



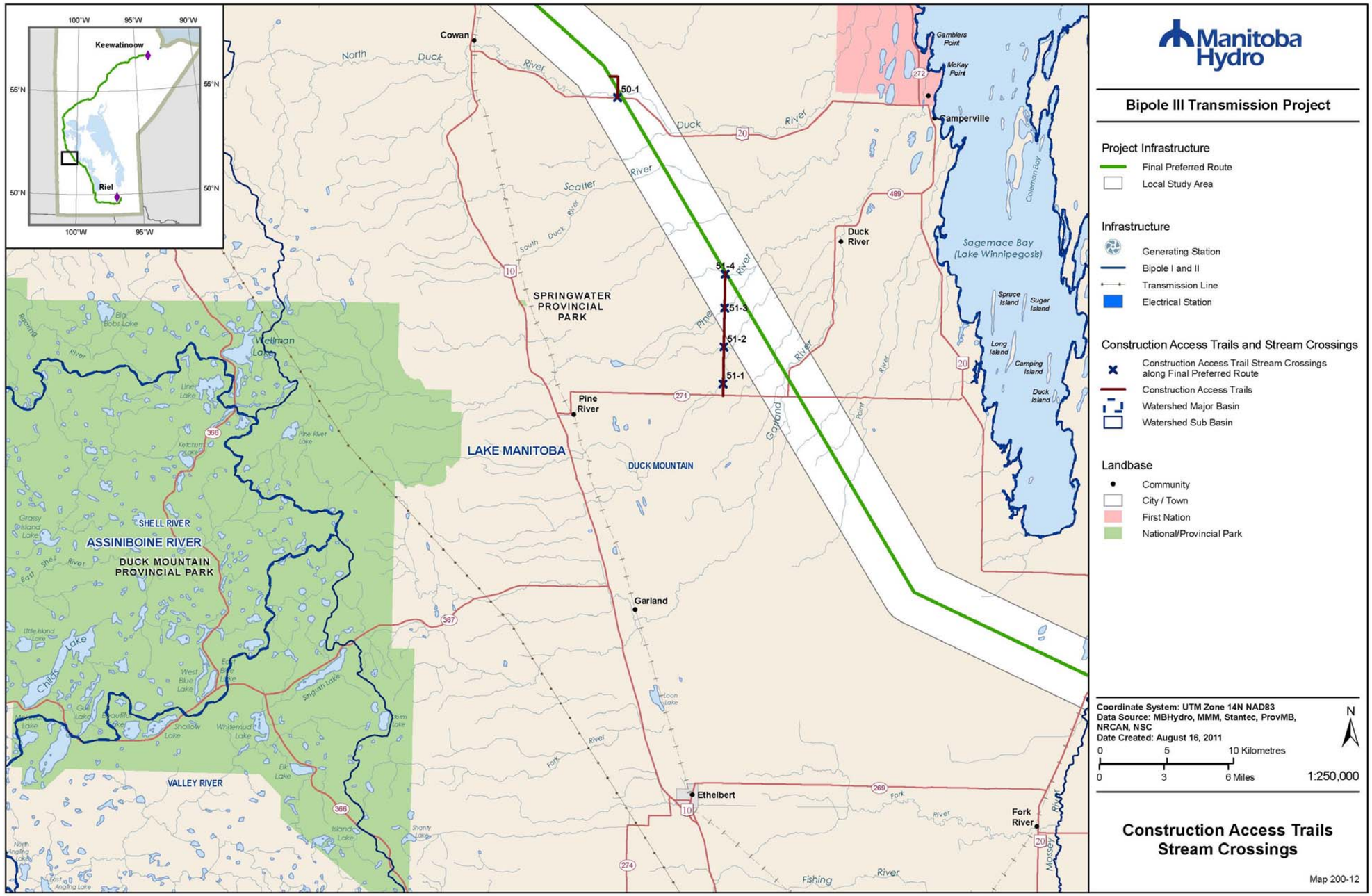
Map 200-8. Bipole III Construction Access Trails watercourse crossings.



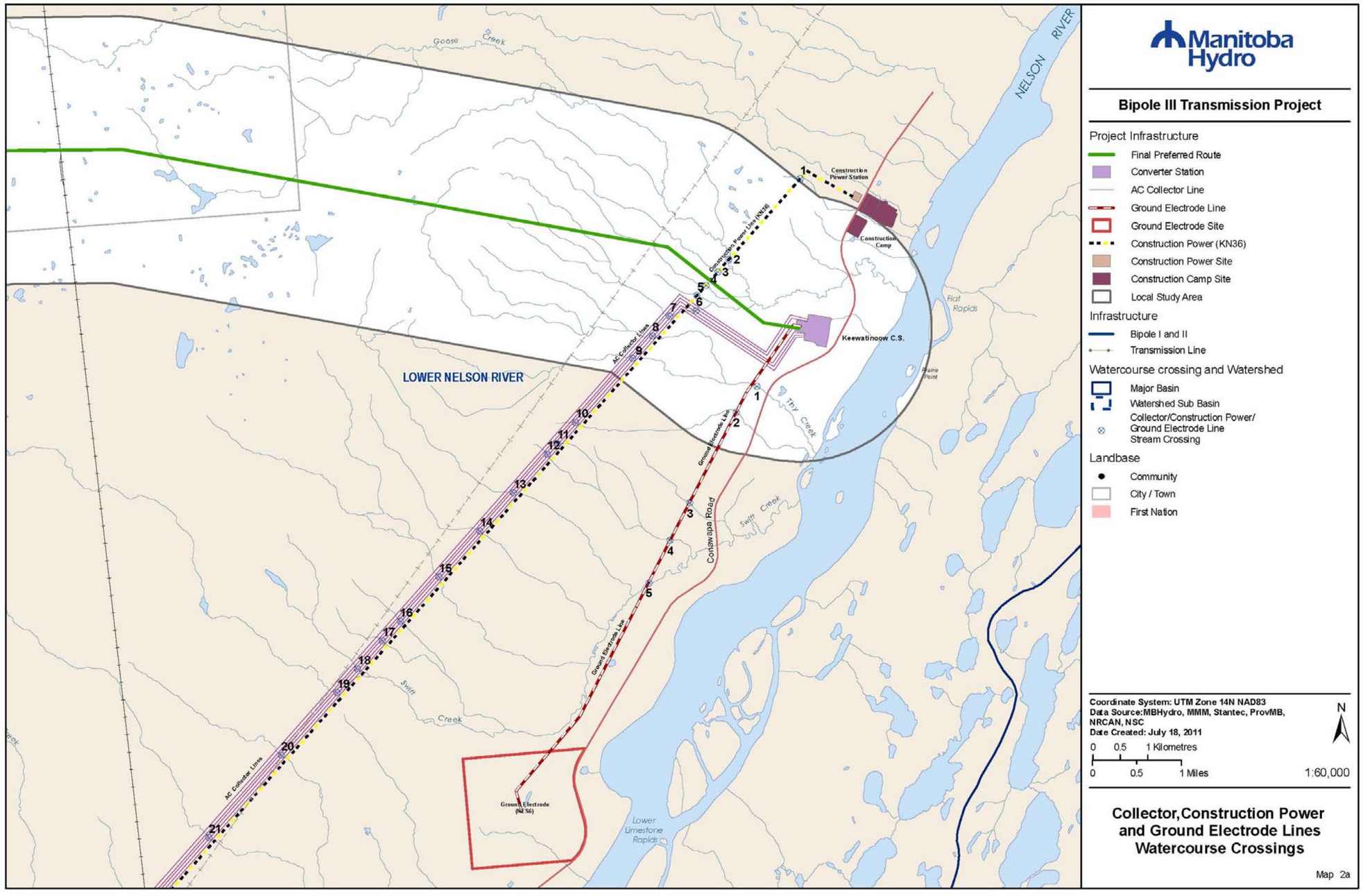
Map 200-10. Bipole III Construction Access Trails watercourse crossings.



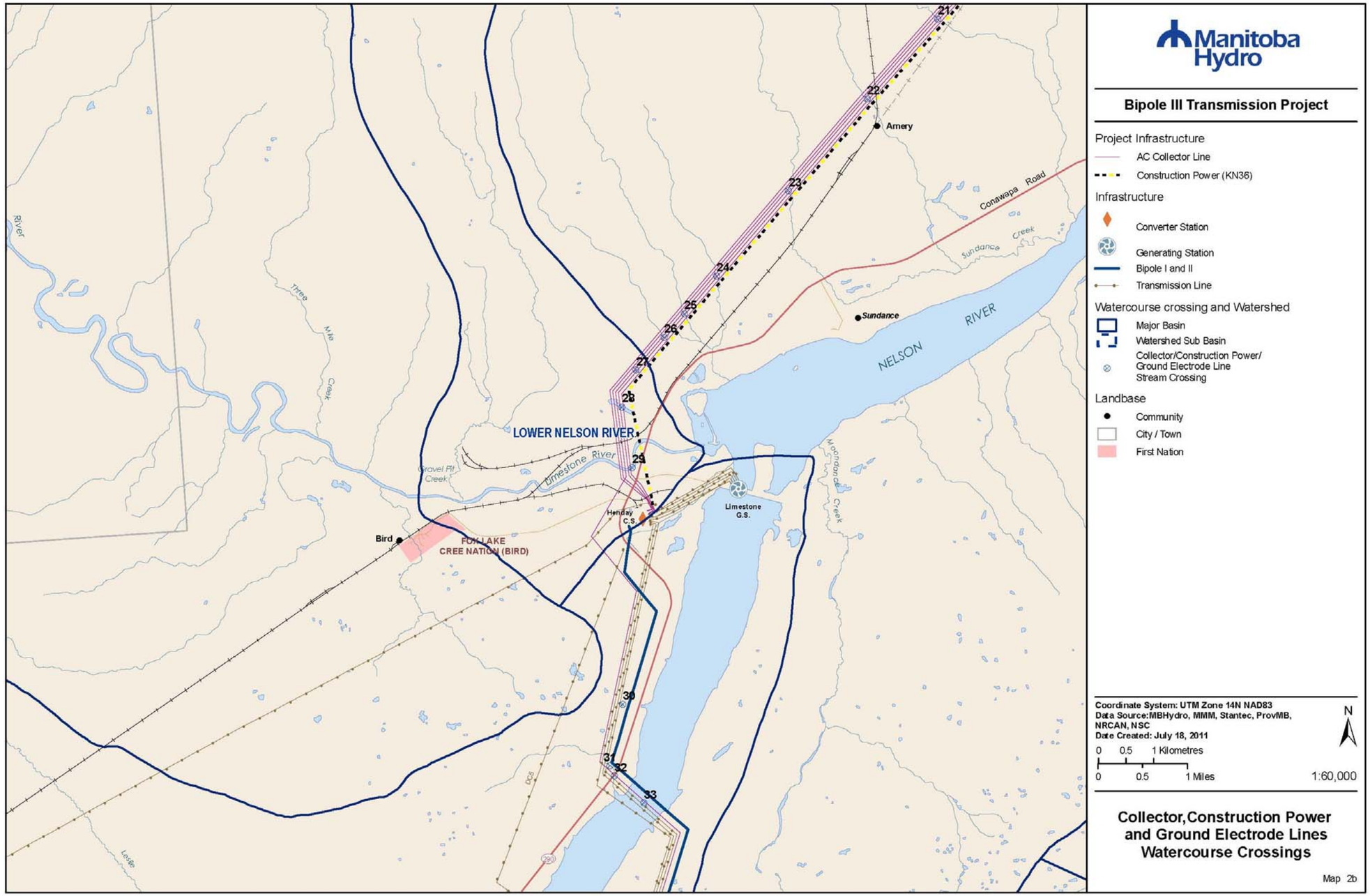
Map 200-11. Bipole III Construction Access Trails watercourse crossings.



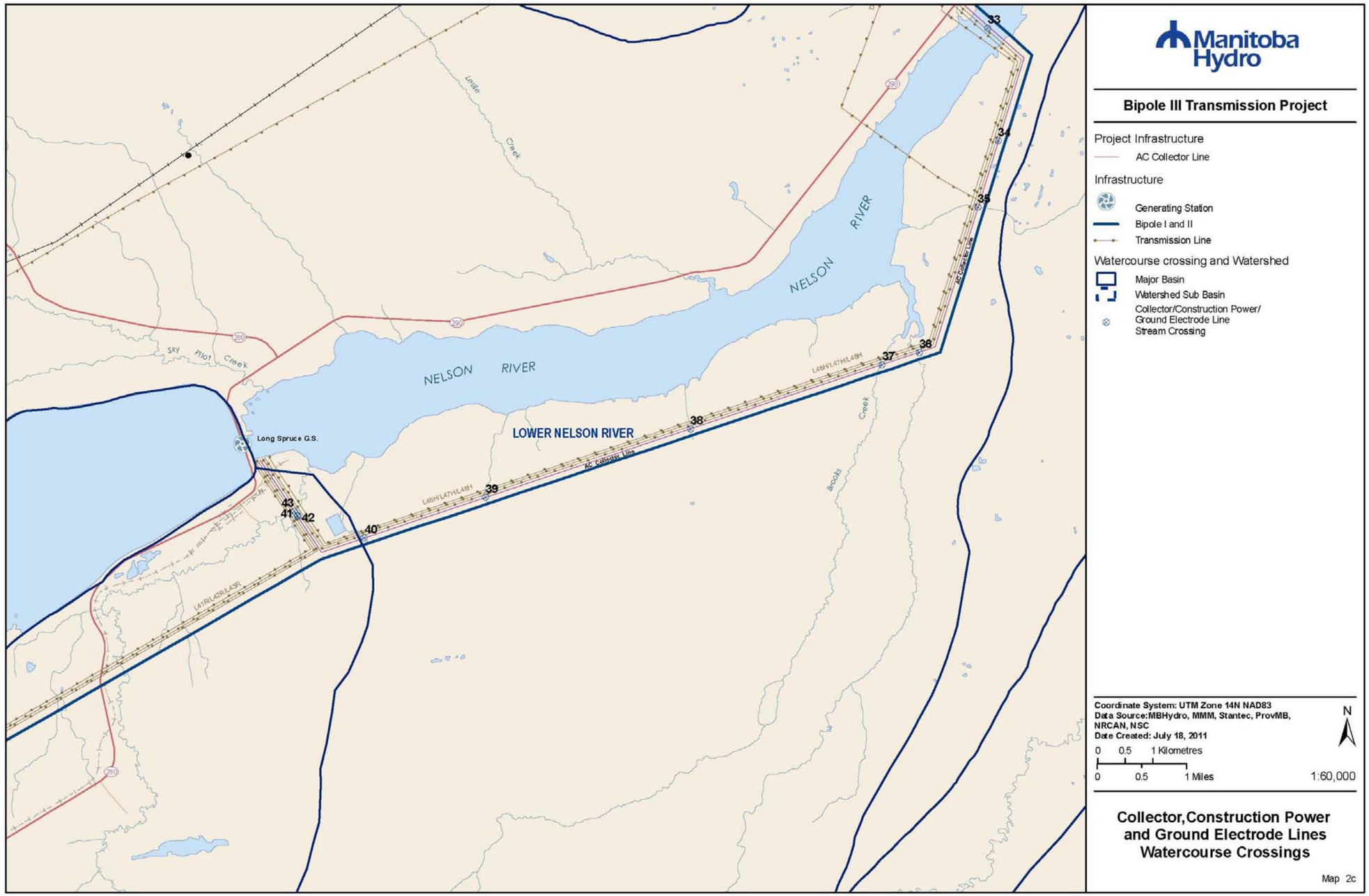
Map 200-12. Bipole III Construction Access Trails watercourse crossings.



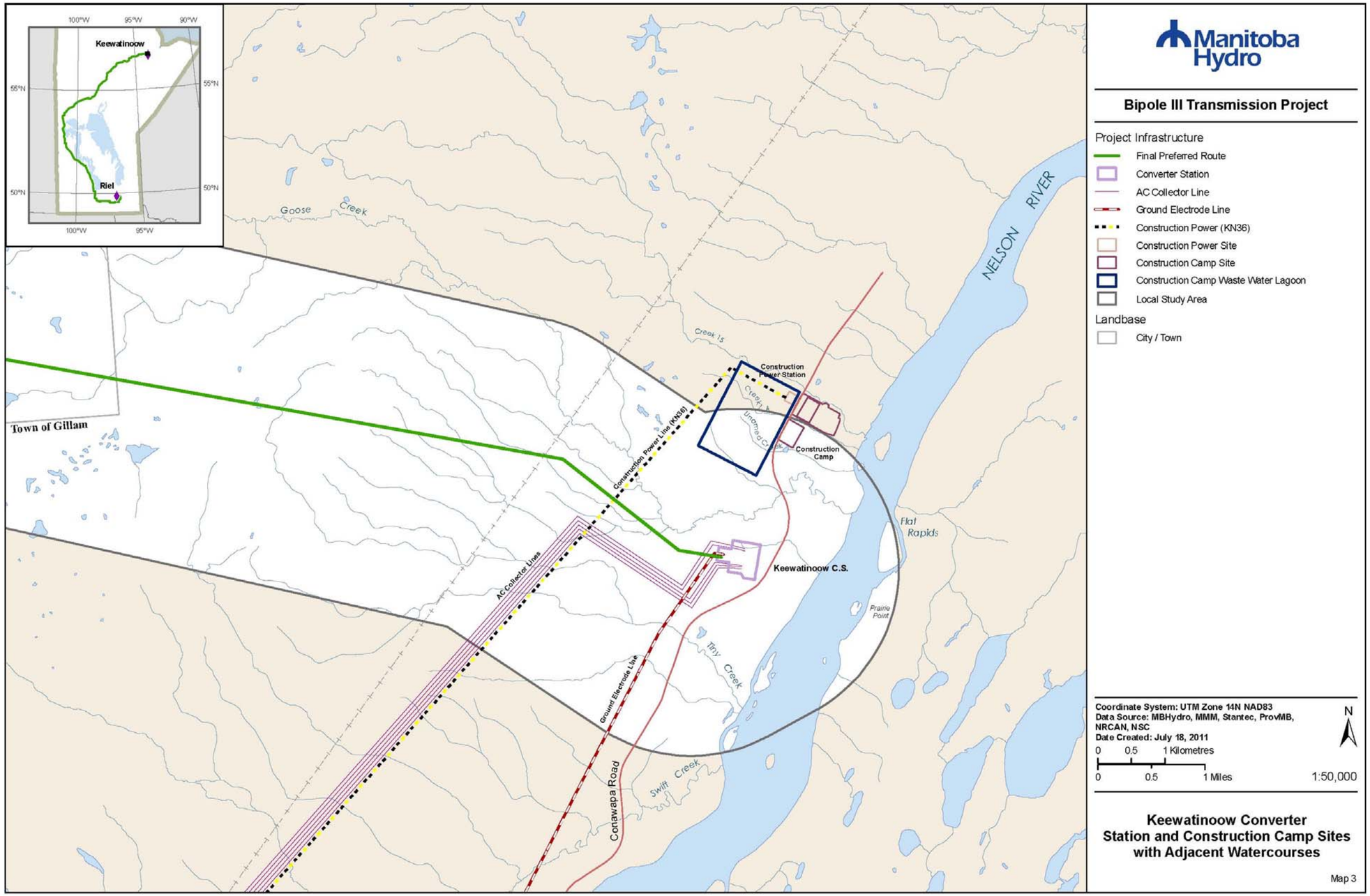
Map 2a. Bipole III collector line, construction power, and northern ground electrode line watercourse crossings.



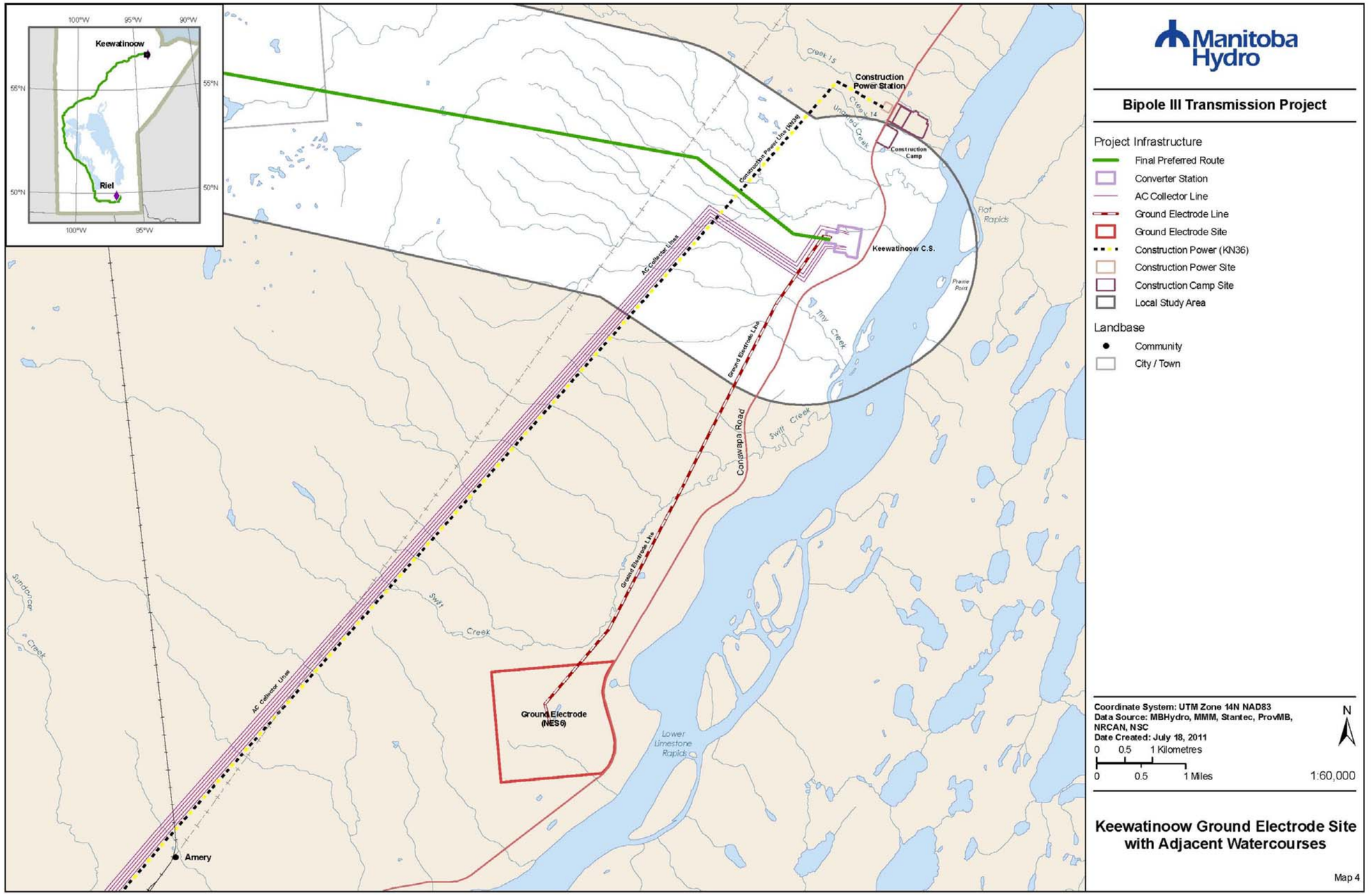
Map 2b. Bipole III collector line, construction power line watercourse crossings.



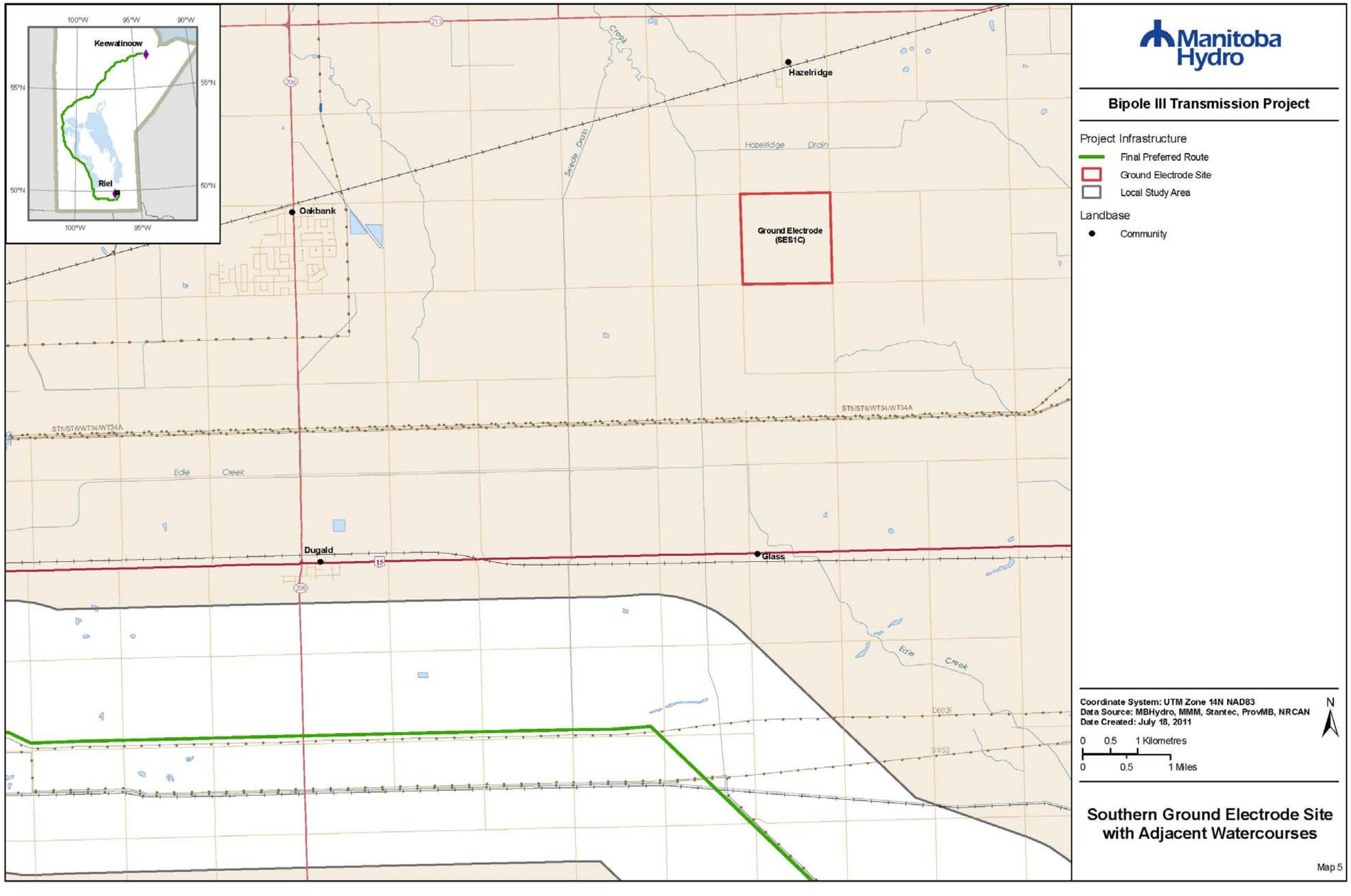
Map 2c. Bipole III collector line watercourse crossings.



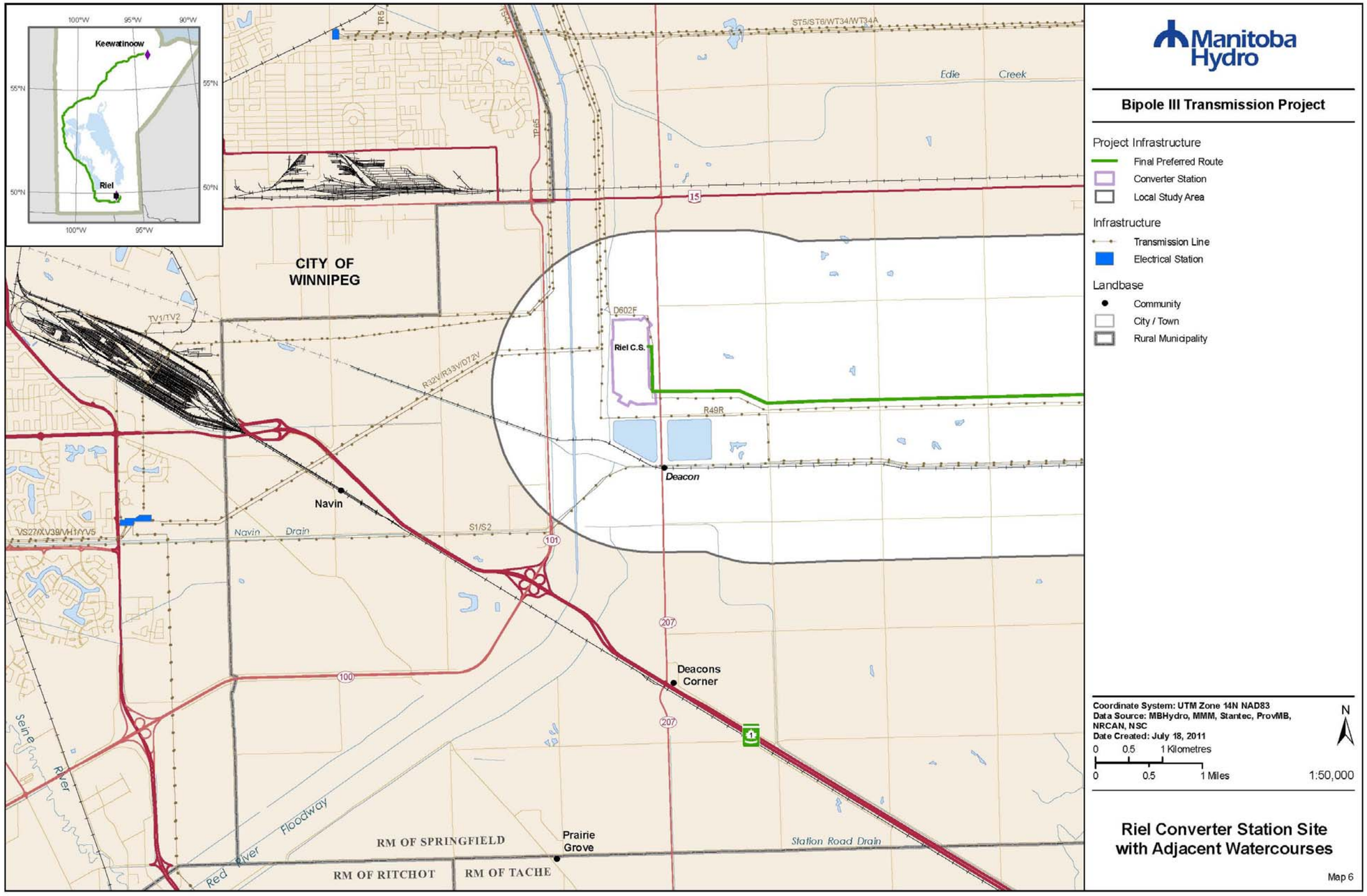
Map 3. Keewatinoow Converter Station site and construction camp site with adjacent watercourses.



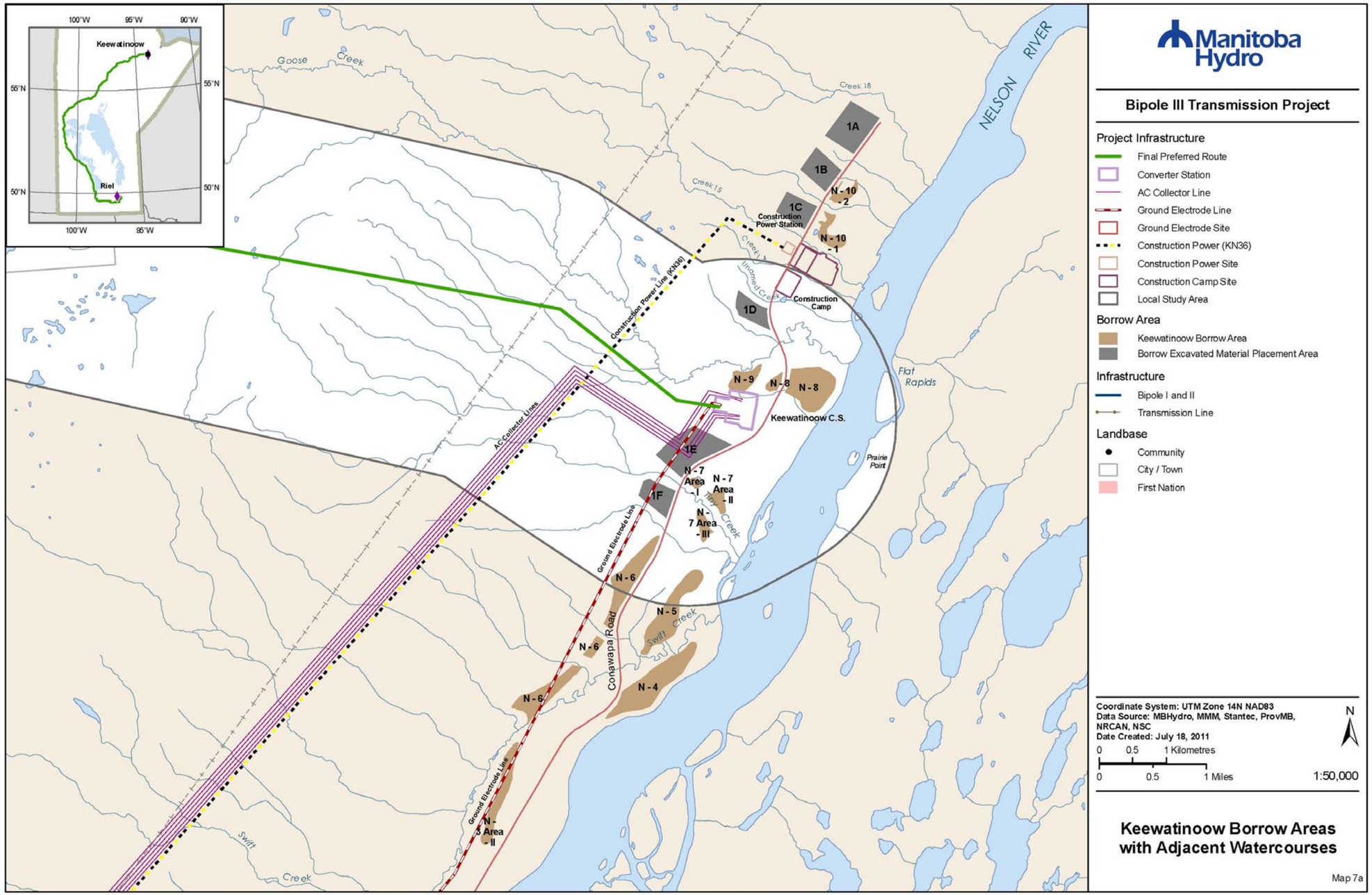
Map 4. Keewatinoow ground electrode site with adjacent watercourses.



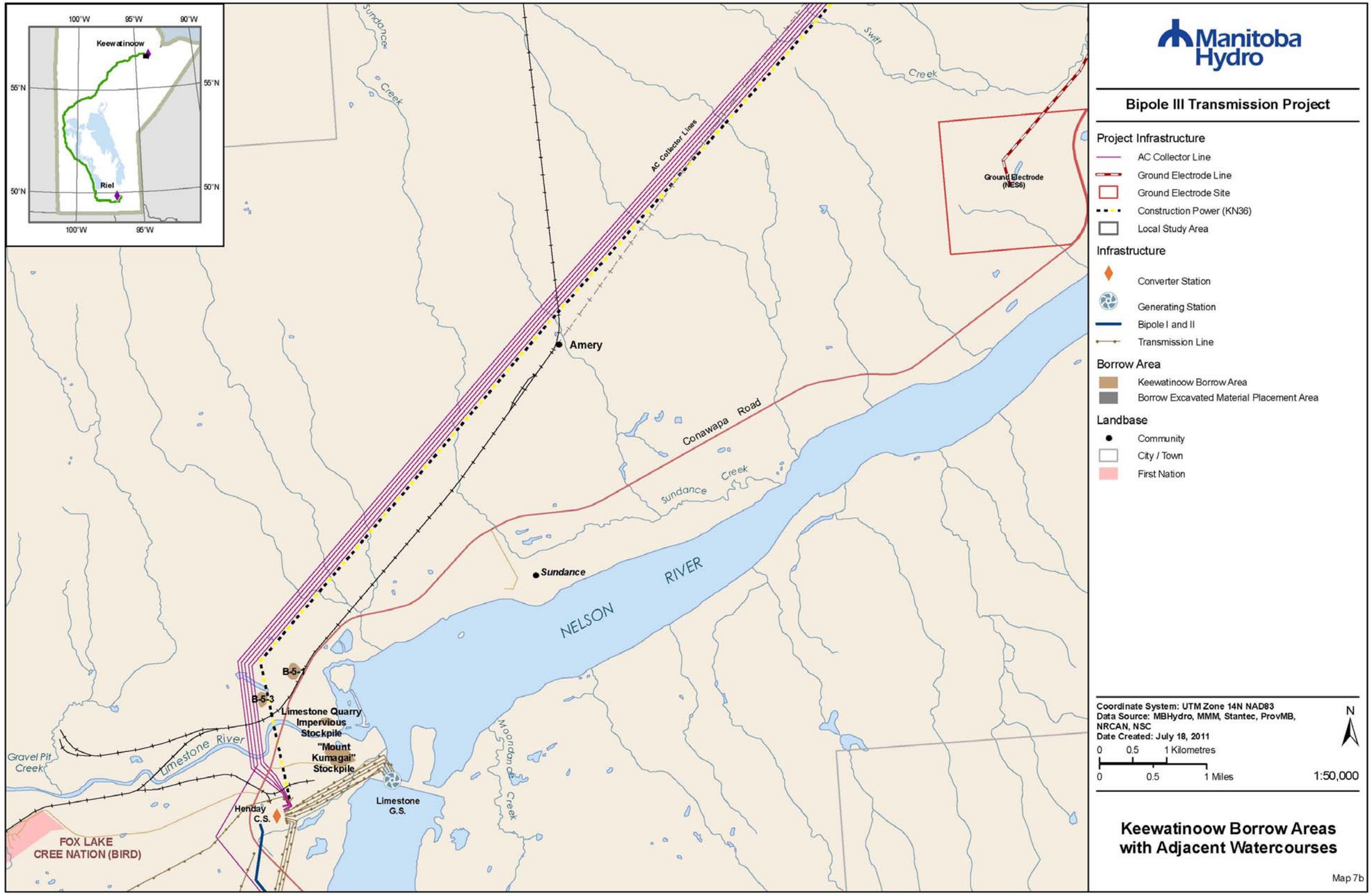
Map 5. Southern ground electrode site with adjacent watercourses.



Map 6. Riel Converter Station site with adjacent watercourses.



Map 7a. Keewatinoow borrow and excavated material placement areas with adjacent watercourses.



Map 7b. Keewatinoow borrow areas with adjacent watercourses.