East Side Road Authority

Project P7A: Little Grand Rapids First Nation to Pauingassi First Nation All Season Road

October 2014

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LITTLE GRAND RAPIDS FIRST NATION TO PAUINGASSI FIRST NATION ALL SEASON ROAD

Aquatic Environment Report

October 2014

Prepared for

East Side Road Authority

by

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EXECUTIVE SUMMARY

The Manitoba Floodway and East Side Road Authority (MFESRA) is designing and constructing an all season road from Little Grand Rapids First Nation to Pauingassi First Nation. The Project is currently in the preliminary design phase with final route selection and watercourse crossing design in progress. Based on the preliminary route, 13 watercourse crossings will be constructed, including 11 culverts, a single span bridge at Root Creek and a multi span bridge at the Fishing to Family Lake channel.

Risk Assessment

A detailed aquatic environmental study was undertaken in fall 2013 and spring 2014 to assess the risk that crossing construction would result in "serious harm to fish", pursuant to Section 35(1) of the *Fisheries Act* and to assess the potential impacts of the Project on aquatic habitats.

Under the *Fisheries Act*, "serious harm to fish" applies to fish and fish habitat that are part of or support a commercial, recreational or Aboriginal (CRA) fishery. The risk of serious harm to fish from crossing construction was assessed using a habitat-based approach. The approach considered the impact of the crossing on the productivity of relevant fish and fish habitat. The assessment was conducted based on the preliminary crossing design, literature review and results of field investigations.

The 11 proposed culvert crossings were assessed as a low risk of serious harm to fish. The habitat at these crossing sites ranges from no fish habitat (5 sites) to marginal habitat for forage fish species (3 sites) and marginal for large bodied fish (3 sites). Channel infilling at these sites is expected to have no measureable effect on fish, provided that measures to avoid harm are implemented.

Root Creek is a moderate size stream with a unique bedrock chute and plunge pool habitat at the downstream edge of the crossing. Although the chute is a barrier to upstream fish passage, habitat below the chute is suitable for spawning and rearing by a number of fish species, including suckers. The preliminary design of the Root Creek bridge is clear span (pers. comm. MFESRA). Clear span bridge construction and operation poses a low risk of serious harm provided that measures to avoid harm are implemented. Adherence to these mitigation measures will result in no measurable effects to fish.

The Fishing to Family Lake channel is a major perennial watercourse that provides habitat for a variety of fish species, including spawning, feeding and overwintering. The preliminary crossing design for this channel is a multi-span bridge with two instream piers. Channel infilling within the footprint of the instream piers is considered low risk of resulting in serious harm to fish. The

infill will be small and localized and the type of habitat affected is abundant in area and is not considered limiting or critical to CRA fish species. Consequently, construction of the bridge is expected to have no measurable effect on relevant fish species.

Impact Assessment

Potential project-related effects on aquatic habitats were evaluated using a Valued Environmental Component (VEC) approach. Fish habitat was selected as the aquatic VEC as it is protected under Section 35(1) of the federal *Fisheries Act* and is often used as a surrogate for productive capacity. Fish habitat was defined as habitats that support fish that are part of or support a CRA fishery. The assessment was conducted based on the project description, literature review and results of field investigations.

The primary potential effects of road development on fish habitat include erosion and sedimentation of streams, introduction of deleterious substances and habitat loss (riparian and instream) at watercourse crossing sites.

Following the application of proven mitigation measures, the adverse residual effects expected to result from the Project include: the introduction of total suspended solids to streams; the alteration or destruction of riparian habitats and; the destruction of instream habitat.

Inspection and monitoring will be conducted at stream crossing sites to ensure the mitigation measures are effective and to identify where adaptive management is required. Inspection programs will include sites inspections before, and regularly during construction to ensure that all appropriate mitigation measures are in place, are properly maintained and remain effective. Post-construction inspections will ensure that crossing sites have been adequately stabilized and disturbed areas are restored. Monitoring programs will include water quality monitoring at the Fishing to Family Lake channel to monitor potential increases in turbidity/total suspended solids during instream construction activities.

ACKNOWLEDGEMENTS

The Manitoba Floodway and East Side Road Authority is thanked for the opportunity to conduct this study. Ms. Leanne Shewchuk and Ms. Jaime Clarke provided technical support and direction during the course of this study.

Mr. Ken Kansas (Manitoba Conservation and Water Stewardship, Fisheries, Eastern Region) provided assistance with fish species and habitat distribution in the study area. Fisheries studies were conducted under Manitoba Water Stewardship Scientific Collection Permit 61-13 and 27-14

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1.0 INTRODUCTION

The Manitoba Floodway and East Side Road Authority (MFESRA) has been tasked with the design and construction of an all season road from Little Grand Rapids First Nation and Pauingassi First Nation to the Little Grand Rapids Airport (the Project). The Project is part of a larger initiative to provide improved, safe, and more reliable transportation service between all the communities on the east side of Lake Winnipeg.

The Project is currently in the preliminary design phase with final road crossing design in progress. Based on the preliminary alignment, the Project will require the construction of crossings at small headwater drainages, small and medium sized streams and a channel connecting two lakes. Detailed aquatic environmental studies were undertaken in September 2013 and May/June 2014 to identify and describe aquatic habitats potentially affected by the project and to assess the potential impacts of the Project on these habitats. Specific objectives include:

- To describe the existing aquatic habitat within the project study area;
- To assess the risk of the project to fish and fish habitat at watercourse crossing sites;
- To identify watercourse crossings where ASR construction may cause "serious harm to fish[1]" pursuant to Section 35(1) of the federal *Fisheries Act*;
- To assess the potential effects of the project to the aquatic environment and to propose measures to mitigate these effects;
- To assess the residual effects of the project on the aquatic environment; and
- To provide inspection and monitoring recommendations related to the aquatic environment for each phase of the ASR project.

This report presents the results of the assessment. The information provided in this report is intended to assist in project design and be used in support of an Environmental Assessment (EA) submission under the Manitoba *Environment Act.*

[1] "serious harm to fish" applies to fish and fish habitat that are part of or support a commercial, recreational or Aboriginal fishery and includes the death of a fish or any permanent alteration to or destruction of fish habitat.

2.0 PROJECT OVERVIEW

The proposed ASR will extend from the Pauingassi First Nation to the Little Grand Rapids First Nation (Figure 1) and will consist of an 8.5 m wide road top centered within a 60 m cleared right-of-way. The Project is currently in the planning stage and the road alignment and crossing design are yet to be finalized. Based on the preliminary route, the ASR project will require construction of 13 watercourse crossings. Although subject to change, the crossing design is expected to include the following:

- a multi-span bridge at the Fishing to Family Lake channel, including one instream pier;
- a single span bridge crossing over Root Creek; and
- culvert crossings at 11 unnamed streams and drainages.

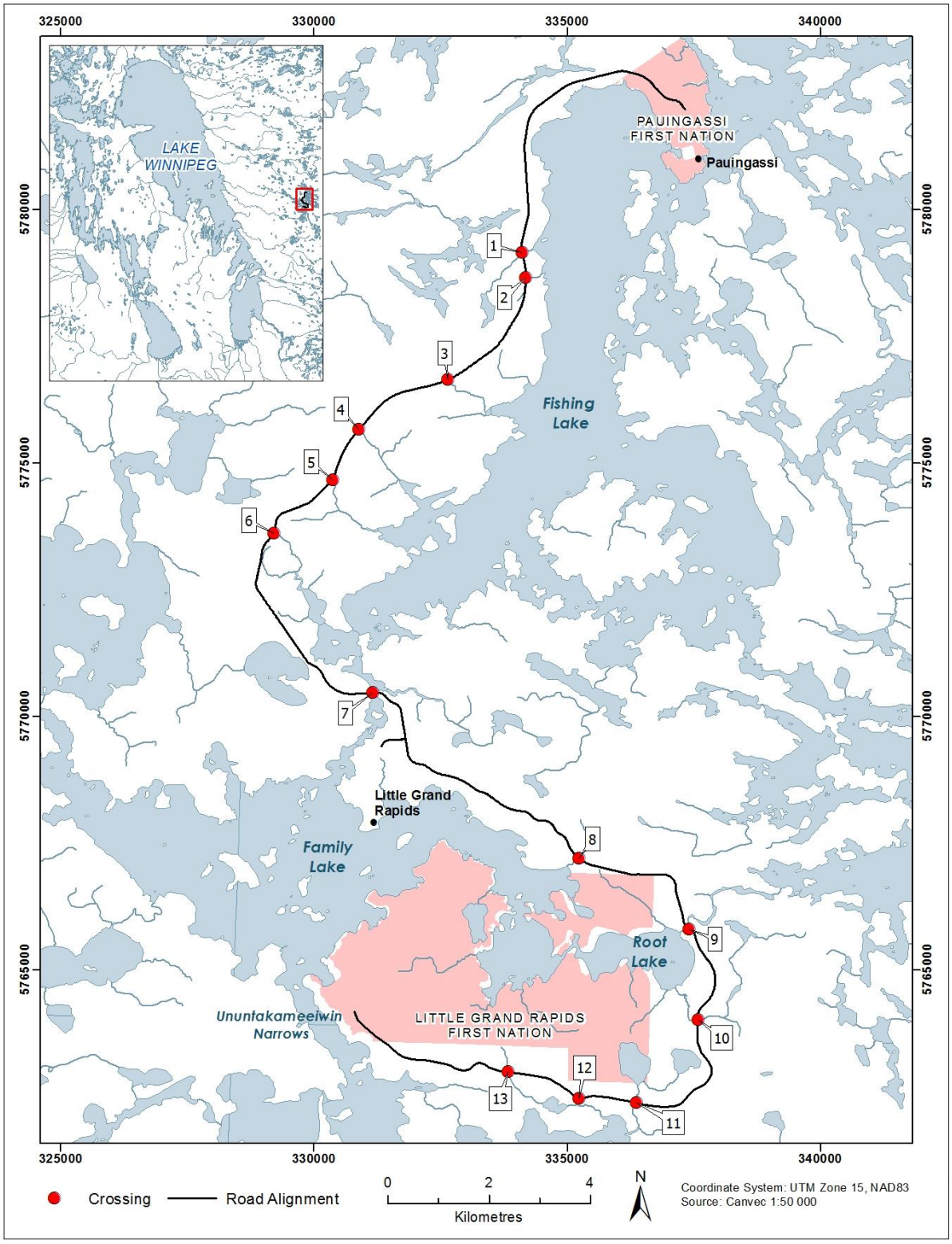

Figure 1. Project 7a - Little Grand Rapids FN to Pauingassi FN All Season Road study area and watercourse crossings.

3.0 EXISTING ENVIRONMENT

The Project is located on the east side of Lake Winnipeg, near the Manitoba-Ontario border. The east side of Lake Winnipeg is located within the Boreal Shield ecozone and encompasses the Lac Seul Upland ecoregion (Smith et al. 1998). Within the ecoregion, the Project lies within the Nopiming ecodistrict and is characterized as a bedrock-dominated landscape comprised of exposed bedrock outcrops, shallow till over bedrock, and localized deposits of deeper till over bedrock. Peatland areas (e.g. bogs and fens) are often interspersed between bedrock outcrops and within depressions (Smith et al. 1998).

Forest vegetation is dominated by coniferous trees. Jackpine is typically dominant in areas of shallow till over bedrock whereas black spruce is prevalent in deeper sandy soils, organic terrains and poorly drained areas.

The proposed route extends south from the Pauingassi FN on the west side of Fishing Lake, traverses the channel joining Fishing and Family lakes, continues along the east side of Family and Root lakes and enters the Little Grand Rapids First Nation (FN) from the south (Figure 1). The project area is relatively undeveloped; in addition to the Little Grand Rapids and Pauingassi communities other infrastructure developments include a winter road connecting the two communities and an electrical transmission line.

3.1 AQUATIC HABITATS

Surface waters within the Project area flow west to Lake Winnipeg and are part of the Lake Winnipeg East drainage division (Smith et al. 1998). Waterbodies within the area include Fishing, Family and Root lakes, numerous small streams, and medium and large rivers. The smaller streams are often part of boreal wetlands such as bogs and fens that drain local areas into larger creeks, rivers or lakes and are usually less than one metre in depth. Within the Project area, these types of stream typically drain to Fishing, Family and Root lakes. Discharges during spring flows may be a number of cubic metres per second, but become entirely dependent on precipitation during summer and can often reach zero during dry periods. Water temperatures in these streams may be near 0ºC at break-up in April or May, but can rise rapidly to the mid-twenties by late May. These streams may be used as spawning and nursery areas by larger fish species (e.g., Northern Pike) in spring, while smaller forage species such as minnows and stickleback may utilize the streams through the summer if water volume is adequate. Due to shallow depths and low winter flows, small streams generally provide little or no over-wintering habitat.

Moderate sized streams in the study area, such as Root Creek, may provide spawning habitat for larger fish such as suckers and Northern Pike. For the remainder of the year, these streams may

be utilized as a nursery for young fish, as well as providing habitat for various species of minnows, darters, sticklebacks and sculpins. Over-wintering of smaller fish in these types of streams will often occur when deeper pools are available. Water temperatures approach 0ºC during winter, but will increase to the mid-twenties during summer. Large river systems, such as the Pigeon River provide year-round habitat for large numbers of fish species. Due to perennial flows they may support both spring and fall spawning species.

Small boreal wetlands areas also occur within the study area. These habitats are generally not connected to fish bearing waters and typically become anoxic during winter. A few species of small-bodied fish that are tolerant of low oxygen levels may persist in these wetlands, but most are typically devoid of notable fish populations.

Fourteen fish species have been documented in Family and Fishing lakes. A summary of known species occurrences is provided in Table 1.

Table 1. Documented fish species presence in major waterbodies in the Little Grand Rapids to Pauingassi All-Season Road study area.

Common Name	Scientific Name	Family Lake[1]	Fishing Lake[2]
Burbot	*Lota lota*	X	
Cisco	*Coregonus artedii*	X	
Lake Whitefish	*Coregonus clupeaformis*	X	X
Lake Trout	*Salvelinus namaycush*		X
Northern Pike	*Esox lucius*	X	X
Rock Bass	*Ambloplites rupestris*	X	
Sauger	*Sander Canadensis*	X	
Shorthead Redhorse	*Moxostoma macrolepidotum*	X	
Slimy Sculpin	*Cottus bairdii*	X	
Spottail Shiner	*Notropis hudsonius*	X	
Troutperch	*Percopsis omiscomaycus*	X	
Walleye	*Sander vitreus*	X	X
White Sucker	*Catostomus commersonii*	X	
Yellow Perch	*Perca flavescens*	X	X

1 – Hagenson et al. 1980.
2 - Jardine and Sigurdson 1981.

3.2 WATER QUALITY

No water quality data were found for any of the creeks or rivers in the study area; however, Manitoba Conservation and Water Stewardship collected three samples from Family Lake in September, 2013 (MCWS 2013). Based on these data, water quality of Family Lake can be described as alkaline, moderately nutrient rich, and highly coloured with low turbidity (Appendix 1). Oxygen concentrations of the surface waters ranged from 5.8 to 8.6 mg/L, and the lower value is below the Manitoba Water Quality objective for the protection of cool- and cold-water species (6.0 and 6.5 mg/L, respectively; MWS 2011). No other routine parameters or metals and major ions measured in 2013 exceeded the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOGs; MWS 2011). However, the Canadian Environmental Assessment Agency (CEAA 2011) noted in the effects assessment of the East Side Road project (Provincial Road 304 to Berens River) that surface waters in the region have naturally high concentrations of some metals (e.g., copper, lead, and iron) that occasionally exceed the MWQSOGs (MWS 2011).

4.0 METHODS

The aquatic environment data collection and analysis, habitat and risk assessment and effects assessment methods are described in the following sections.

4.1 AQUATIC ENVIRONMENT DATA COLLECTION AND ANALYSIS

Aquatic environment data was collected through geographic information systems (GIS) and orthophoto analysis and field surveys conducted at locations where the ASR alignment intersected watercourses. The data was used to provide a physical description of fish habitat and assess potential fish use.

4.1.1 Watercourse Identification

Watercourse crossing sites were provided in Appendix B of the Request for Proposal (RFP) for this study (MFESRA 2013). In addition, the ASR alignment was overlaid on the CanVec 1:50,000 hydrographic dataset (version 8; Natural Resources Canada 2007) using ArcGIS® 10.2 GIS software (Environmental Systems Research Institute [ESRI], Redlands, California) to identify any sites not listed by the RFP.

4.1.2 Drainage Analysis

For each crossing site, the drainage area upstream of the proposed crossing and distance to the nearest downstream fish bearing waterbody were calculated. For drainage area, watershed boundaries were created using the Prairie Farm Rehabilitation Administration (PFRA) Incremental Gross Drainage Area dataset (PRFA 2008). Most watercourses crossed by the alignment are minor streams and their 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) (USGS, n.d.). The upstream drainage area was then calculated using ArcGIS® 10.2.

The linear distance from each crossing to the nearest major fish bearing waterbody was determined using ArcGIS® 10.2. Distances were calculated based on the CanVec 1:50,000 hydrographic dataset.

4.1.3 Aerial Reconnaissance

Orthophoto analysis and aerial surveys were conducted to classify each watercourse by their size and connection to other fish bearing waterbodies.

4.1.3.1 Connectivity

The importance of fish habitat in smaller streams is often related to its connectivity to more extensive downstream habitats. For each stream crossing, downstream connectivity was assessed aerially in the field and by orthophoto analysis. For each stream, the following features were noted:

- presence of a defined channel downstream of the crossing to the next major watercourse;
- permanent impediments to fish passage (e.g., waterfalls);
- ephemeral impediments to fish passage (e.g., beaver dams); and
- presence and extent of upstream habitat, including the three previous features.

Streams were assigned to one of four connectivity classes as presented in Table 2. The classifications were used to assess or support the known or expected migrations of large-bodied fish species. This was used in the risk assessment (Section 4.2) and in assessing the fish passage requirements for crossing design.

Table 2. Description of connectivity classes used to assess the connection of stream crossings to larger fish bearing waterbodies.

Connectivity Class	Class Description
Yes	Connection to downstream fish bearing waters apparent without impediments.
Yes – likely	Connection to downstream fish bearing waters apparent but permanent barrier visible but questionable if it presents a certain barrier; or ephemeral barriers present in low number and the crossing location is in close proximity to the downstream fish bearing water body.
Yes – unlikely	Connection to downstream fish bearing waters apparent, but due to the number of ephemeral barriers and the distance to the downstream water body, fish passage is considered unlikely in almost all years and, when possible, would not likely contribute to the productive capacity of the fishery.
No	Visible connection to downstream water body is not apparent, typically in the absence of a stream channel. Such streams typically diffuse into broad boreal wetlands.

4.1.3.2 Watercourse Classification

Based on aerial reconnaissance data, watercourses were classified as one of the following

Class 1: Medium to Large Streams and Rivers

Class 1 streams are typically named watercourses that maintain perennial flow and contain important fish habitat.

Class 2: Small Streams

Class 2 streams are small watercourses where a distinct stream channel is visible upstream and downstream of the crossing. These include many unnamed creeks as well as smaller named streams with fish habitat ranging from Marginal to Important.

Class 3: Drains

Class 3 streams are drains that may or may not be identified as a watercourse in the CanVec hydrographic dataset. These systems do not have channel connectivity to larger fish bearing waters upstream or downstream. In some cases a small downstream channel may be present, but dissipates into a wetland before connecting to a larger watercourse. Where upstream habitat and habitat at the crossing is peatland, the site is classified as Class 3 even though a channel may be present further downstream. This reflects the lack of habitat at the site. Fish habitat is generally marginal or not present.

4.1.4 Channel Sinuosity

Channel sinuosity was calculated for Class 1 and larger Class 2 streams using the following:

Sinuosity = channel length / channel valley length

Channel and valley length were measured from digital orthophotos using ArcGIS® Explorer (ESRI, Redlands California). Channel length was measured along the centreline over a minimum valley length of 100 m.

4.1.5 Physical Assessments

Physical assessments were conducted at Class 1 and Class 2 streams. At each crossing location, two study areas were established; 400 m upstream and downstream of the proposed crossing location. The 800 m study reach was established in consideration of potential uncertainties in the location of the road alignment. In each study area a physical assessment of fish habitat was conducted.

4.1.5.1 General

Transects were established within the upstream and downstream study areas. The number and location of transects were determined based on the watercourse classification and site-specific conditions, respectively.

Class 1 Streams

Three transects were established within the proposed cleared RoW (60 m on centreline) to record riparian and bank conditions. Transects were typically located at the crossing centreline and 25 m upstream and downstream of the centreline. Side scan sonar was used to capture channel profile and stream bed characteristics (Section 4.1.5.12) therefore transects to record this information were not required as per Class 2 stream assessments.

Class 2 Streams

Five transects were established: one at the centreline of the crossing and two each within the upstream and downstream study areas.

4.1.5.2 Water Quality

Due to the potential for blasting near watercourses during the construction of the ASR, at watercourses identified as supporting fish habitat, laboratory samples and *in situ* parameters were measured to establish baseline water quality.

Laboratory Samples

To minimize disturbance of streambed materials and contamination of the samples, surface water samples were collected from the centre of the channel at each site by attaching a clean 500 mL plastic collection jar to an extendable fiberglass pole. The collection jar was triple rinsed with site water prior to sample collection then the laboratory bottle was filled from the collection jar. Where necessary, samples were preserved according to instructions provided by the analytical laboratory. After collection, samples were kept cool and in the dark until submission (within 48 hours) to ALS Laboratories in Winnipeg, MB (a Canadian Association for Laboratory Accreditations, Inc. [CALA] accredited laboratory). The samples were analysed for the following parameters:

- Ammonia;
- Nitrate, nitrite, and nitrate/nitrite;
- Total Kjeldahl nitrogen (TKN);

- Total phosphorus (TP);
- Total organic carbon (TOC).
- Total suspended solids (TSS);
- Turbidity; and,
- Chlorophyll *a* and phaeophytin *a*.

Field and trip blanks were also submitted to the laboratory and analyzed for the above parameters. Field blanks are intended to provide information on sample contamination from atmospheric exposure and sample handling techniques (i.e., cleanliness of sampling equipment, carry-over contamination from site to site), as well as potential laboratory contamination and/or error (British Columbia Ministry of Environment, Lands, and Parks [BCMELP] 1998). Field blanks were prepared by filling sample bottles with deionized water (both provided by the analytical laboratory) in the field and submitting the blanks along with the environmental samples.

Trip blanks are used for evaluating the potential for sample contamination that may occur from the container or preservatives through transport and storage of the sample, as well as laboratory precision (BCMELP 1998). Trip blanks were prepared in the laboratory by filling sample bottles with deionized water. Trip blanks were transported to the field sampling sites, but remained sealed, and were then submitted to the analytical laboratory in conjunction with environmental samples for analysis.

Field and trip blank results were evaluated for evidence of sample contamination. Values for any parameter that exceeded five times the analytical detection limit (DL) were considered to be indicative of sample contamination and/or laboratory error.

In situ Parameters

In situ water quality was measured at each site and included: temperature; dissolved oxygen (DO); pH; turbidity; specific conductance; and conductivity. Turbidity was measured using an Analite NEP-160 (McVan Instruments Pty Ltd. Scoresby, Australia); all remaining parameters were assessed using a YSI 556 MPS multi-meter (YSI Inc., Yellow Springs, Ohio). Habitat type of the sample site (e.g., riffle, pool, run) was recorded.

4.1.5.3 Discharge

In Class 2 streams, discharge was measured at or near the proposed crossing at a relatively straight section of channel, free of vegetation, rocks and obstructions that may interfere with

velocity measurements. Discharge was not measured in Class 1 streams as depths exceeded the range of equipment.

To measure discharge, the total wetted width was divided into parcels – typically ten parcels for small streams and a minimum of twenty for larger systems. Depending on channel width, fewer than ten parcels may have been used. The parcel width was divided by two to obtain the distance of the first measurement location from the bank (i.e., distance to the center of the first parcel). Subsequent measurement locations were determined by adding the original parcel width to the previous distance. Where water depth is less than one meter, the water depth and velocity at 6/10 of the total depth were measured using a Swoffer velocity meter. Where the water depth was greater than one meter, velocity was measured at 2/10 and 8/10 of the total depth.

Stream discharge was calculated as:

$Q = \Sigma\ wdv$

where, Q = discharge
w = parcel width
d = parcel depth
v = velocity

4.1.5.4 General Morphology

The general stream morphology, including pattern, stage, confinement, flow regime and profile of the surveyed reach of the watercourse was visually assessed and described as follows:

- *Pattern* – the channel pattern was classified as straight, sinuous, irregular wandering, irregular meandering, regular meanders and tortuous meanders or braided.
- *Stage* – describes the water level in relation to bankfull and was classified as: Low (0 – 30% bankfull); moderate (30 – 90%); or high (>90%).
- *Confinement* – describes the ability of the channel to migrate laterally on a valley flat between surrounding slopes. Channel confinement was classified as: entrenched; confined; frequently confined; occasionally confined; or unconfined.
- *Flow Regime* – describes the permanence of flow. Flow regime was classified as:
    - Perennial - Contains water at all times throughout the year, except during extreme drought;
    - Ephemeral - Stream bed is above the water table; stream flow is a direct response to a precipitation event (snowmelt or rainfall); or

- Intermittent - Carries water a considerable portion of the time, but ceases to flow occasionally or seasonally because bed seepage and evapotranspiration exceed available water supply.

- *Channel Profile* – describes the cross sectional shape of the channel and was classified as: notched; U-shaped; V-shaped; or planar.

4.1.5.5 Channel Profiles

At Class 1 streams, the wetted width (water's edge) and the channel width (bank to bank) were estimated at each transect using a laser range finder (±1 m). The channel profile was determined using side scan sonar. Detailed methods for sonar surveys are provided in Section 4.1.5.12.

At Class 2 streams, the wetted width (water's edge) and the channel width (bank to bank) were measured at each transect. Water depth at 25%, 50%, and 75% of the wetted width, starting at the left bank and maximum depth also were recorded. The left and right bank designations were determined while facing upstream.

4.1.5.6 Riparian Area/Floodplain

At each transect the floodplain and riparian vegetation (vegetation directly influenced by the watercourse) width was measured perpendicular from each bank. The dominant 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 (%).

4.1.5.7 Substrate

At Class 1 streams, substrate composition was determined using side scan sonar (Section 4.1.5.12).

At Class 2 streams, substrate composition (%) was visually estimated at each transect. Substrate composition was based on the following size classifications:

Class	Size
fines	<2 mm
small gravel	2 – 16 mm
large gravel	17 – 64 mm
cobble	65 – 256 mm
boulder	>256 mm

4.1.5.8 Banks

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

- *Bank Materials* – Each bank was classified according to the dominant bank material. Materials were classified as: organic/mineral soils; mineral; mineral/rock; rock/boulder; and bedrock.
- *Bank Height* – The vertical height of each bank from the water's edge to the top of the bank was measured.
- *Bank Shape* – The shape of each bank was classified as follows:
    - Vertical steep sloping/vertical (45 – 90°);
    - Undercut protruding over the channel; or
    - Sloping gradual or shallow slope (<45°).
- *Bank Stability* – Bank stability was visually assessed as follows:
    - Highly stable banks well vegetated or covered in large boulders;
    - Moderate stability >50% vegetated or rocked and some undercut banks;
    - Low stability <50% of the bank is vegetated or rocked; or
    - Unstable massive slumping, large silt deposition, exposed soil.

4.1.5.9 Stream Gradient

Stream gradient (%) was measured using a clinometer aimed at eye level at another crew member or at a survey rod.

4.1.5.10 Habitat Inventory

The percent composition of habitat types in each study area was visually assessed. Habitat types were classified as follows:

Falls	vertical drop
Cascade	high gradient and velocity, extremely turbulent, armoured 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 (glide)	moderate to high velocity, surface mostly unbroken, deeper than a riffle
Flat	low velocity, near-uniform flow, differential 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
Boulder Garden	significant occurrence of large boulders, providing significant instream cover, in association with other habitat unit such as riffle or run.

4.1.5.11 Cover

The total available cover for fish (%) was estimated for each study reach. Within the available cover, the composition of cover types (%) was determined. Cover types included the following:

- Large woody debris (or coarse woody debris)
- Overhanging vegetation (< 1 m from the water surface)
- Instream vegetation
- Deep pool
- Boulder
- Undercut banks
- Surface turbulence
- Turbidity

4.1.5.12 Bathymetry and Substrate Mapping

At Class 1 streams, boat-based habitat mapping was conducted using a Lowrance® HDS-5 with StructureScan® HD sonar imaging (Navico Inc.) and internal integrated global positioning system (GPS) receiver. Side imaging sonar captures detailed information on bottom topography and fish-attracting structure orientation. This device also was used to record water depths for bathymetric mapping.

Data Collection

The two transducers (skimmer and side scan) were mounted onto the transom of the boat and connected to the HDS-5 head. Care was taken to mount the transducer in an area that was relatively free of turbulent water and as far as possible from the propeller to minimize interference from water turbulence. Mounting depth was noted and later used as a correction factor for the depths recorded.

The boat was driven across the width of the river at 15-20 m intervals, down the centerline, and along each shoreline 400 m upstream and downstream of the crossing. Boat speed was maintained under 12 km/hr to minimize interference due to water turbulence.

Depth and geographic coordinate data (UTM) were collected along transects covering the study areas and logged to a flash memory card. Ponar grab samples were collected during each survey to verify substrate data collected by side scan sonar. For each ponar grab, substrate type and UTM location were recorded using a handheld GPS. Substrate type was based on the size classifications listed in Section 4.1.5.7. Ponar grab data are provided in Appendix 2.

Data Analysis

Shorelines of the Class 1 streams were digitized at a scale of 1:1500 from summer/autumn 2012 colour orthophotos (50 cm pixel), provided by MFESRA, using ArcGIS® 10.2. Stream discharge and shoreline elevation were unknown at the time of orthophoto acquisition. The digitized shorelines were assumed to be representative of a normal flow condition for the studied streams.

The recorded data was exported from a Lowrance log file format (.sl2) to a Microsoft Excel format. Depths were corrected according to the transducer mounting depth. The corrected depth files were then imported into ArcGIS and projected to a UTM Zone 15 (NAD83) projection and saved to a GIS ready ESRI® shapefile format.

Prior to the creation of the bathymetric depth surfaces, shoreline zero depth points were created along the digitized shorelines at a 5 metre interval and merged with the corrected depth data set. The inclusion of these shoreline points allows the surface model to conform to the shoreline.

Bathymetric surfaces were interpolated from the corrected transducer depths using Surfer® 11 (Golden Software Inc.). A linear kriging variogram was used to create 5 m grid surfaces covering the extents of the survey. Final Surfer 11 format grid files were exported to an ESRI ascii format for import into ArcGIS® 10.2. Depth contouring and cartographic outputs were completed using ArcGIS® 10.2.

Substrate mapping techniques followed Kaeser and Litts (2010). Side scan images of the river bottom collected during field surveys were analysed using Dr. Depth, where the positional and bearing information from the GPS data were used to georeference the side scan images of the riverbed and display them in a seamless mosaic. The side scan image mosaic was exported to an ESRI grid format and imported into ArcGIS® 10.2. Major substrate change boundaries were delineated and digitized from the imagery and validation data (ponar grabs) obtained during field studies were used to verify the visually delineated substrate classes. Final symbolization of substrate classes and cartographic output were generated in ArcGIS® 10.2.

4.1.6 Biological Assessments

Sampling was conducted at each site to determine fish and mollusk species presence and potential habitat use.

4.1.6.1 Fish

Fish sampling was conducted within the study reach to confirm fish presence and in Class 1 streams, to determine species use. Gear type was selected based on site-specific conditions and 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. Gill nets were set in larger waterbodies (typically Class 1) that could not be sampled by backpack electrofishing. Gillnet gangs were 137.2 m long and consisted of five 22.9 m long by 1.8 m deep panels of 1.5, 2.0, 3.0, 3.75, 4.25 and 5.0 inch twisted nylon mesh. Gillnet set locations were recorded with a handheld GPS. Set and pull time and water depth also were recorded.

Captured fish were identified and enumerated according to species. Large-bodied fish species were measured for fork length (±1mm). All fish were released into the area from which they were captured.

Results of the fish sampling program presented in this report have been limited to presence, abundance and size of the species captured. Additional data on specific sampling locations and effort have not been provided in order to reduce the size of the report. These data are available if required.

4.1.6.2 Mollusks

Mollusk sampling was conducted in Class 1 streams with sampling targeted within the crossing area (30 m length of stream). At sites where the crossing location could not be sampled due to

the presence of rapids, sampling was conducted at a distance upstream or downstream. Sampling methodology was selected based on site-specific conditions (i.e., depth) and included ponar grabs in deeper areas and visual inspection using a bathyscope in wadeable areas. Captured mussels were identified and enumerated by species and replaced at the area of capture.

4.1.7 Fish Habitat Assessment

At each crossing site, the potential fish use within the surveyed reach was assessed. The assessment was based on the field data, drainage analysis results and existing watercourse information and included:

- Assessment of fish overwintering, spawning, rearing and feeding potential (rated low [marginal], moderate or high); and
- Identification of areas that may be sensitive to disturbance, particularly downstream of the crossing site.

4.2 RISK ASSESSMENT

Section 35(1) of the federal *Fisheries Act* (the Act) prohibits "serious harm" to fish and fish habitat that are part of or support a commercial, recreational or Aboriginal (CRA) fishery. "Serious harm" is defined as the death of a fish or permanent alteration to or destruction of fish habitat. The purpose of this fisheries protection provision is to "provide for the sustainability and ongoing productivity" of CRA fisheries (DFO 2013a).

Small, localized infills that are typically associated with stream crossings (e.g., culverts, multi span bridges) can directly impact fish populations and fisheries yields through habitat loss (DFO 2013b). The potential effects to fisheries productivity from such small-scale projects would be difficult to measure due to the relatively small area of impact (Randall et al. 2013). Thus, an assessment method that considers the relative amount of habitat change is the best approach to determine impacts to CRA fisheries productivity (DFO 2013b; Randall et al. 2013) and risk of serious harm.

DFO is currently developing a risk management framework to provide guidance in assessing the risk of serious harm to fish from a project or project activity. In the absence of a framework, a habitat-based approach was developed to assess the likelihood that ASR crossing construction would result in a serious harm to fish. This approach was developed based on review of the Fisheries Protection Policy Statement (DFO 2013a) and relevant Canadian Science Advisory Secretariat Science Advisory Reports (DFO 2013b; Randall et al. 2013) and considered the following:

- the type of impact;
- the amount and quality of the affected habitat for each life history stage of fish species that are present; and
- the impact of the project on relevant fish and fish habitat.

The risk assessment is based on the Impacts to Fish and Fish Habitat criteria outlined by DFO (DFO 2013a). The risk assessment considered the residual effect at each crossing assuming that the mitigation measures would be applied as necessary. Each component of the risk assessment is described in the sections below.

A risk assessment was not conducted at crossings sites that did not support fish habitat or where an existing waterbody type was identified by DFO as not requiring authorization under the *Act* (e.g., agricultural and roadside ditches). In these cases, it was assumed that measures to avoid harm would be implemented where necessary.

4.2.1 Impacts to Fish and Fish Habitat

The Impacts to Fish and Fish Habitat was assessed through a rating system using the following six criteria outlined in the *Fisheries Protection Policy Statement* (DFO 2013a) as follows:

1. Residual Impact

Following the pathway of effects, potential impacts to fish and fish habitat were identified and after the application of avoidance and mitigation measures the residual impacts remaining were identified and listed for each site.

2. Duration of Impact

Description:	The amount of time that a residual effect will persist.
Scale:	Short term (days; low); medium term (weeks-months; medium); long term (years-permanent; high).

3. Extent of Impact

Description:	The direct footprint of the development as well as indirectly affected areas, such as downstream areas.
Scale:	Site or segment (localized; low); channel reach or lake region (medium); entire watershed or lake (high).

4. Availability and Condition

Description: The relative availability of the type and quality of habitat that is being impacted in the watercourse and/watershed.

Scale: Low - The habitat is common and widespread in the region and is relatively intact.

Medium - The habitat has a limited distribution within the region or river system, or is prevalent but degraded.

High - The habitat is rare or similar habitats are present within the area, but are threatened or have been significantly degraded.

5. Impact on Relevant Fish

Description: The resulting effect to fish from the project in consideration of the first four criteria and results of fish and fish habitat studies.

Low - The habitat is used for a range of life requisites by the relevant fish and is not critical or limiting. Habitat impacts are unlikely to result in a measureable effect to local fish populations.

Medium - The habitat is important and is used for a specific life function by the relevant fish, but it is not critical or limiting habitat. Similar habitat is available within the area, but may have a limited distribution. Habitat impacts may result in a small effect on local fish populations.

High - The habitat is critical to the survival of the affected species or the affected species is sensitive or rare. Habitat impacts will likely result in decreased fish production.

6. Avoidance and Mitigation Measures

The risk assessment assumes that all standard measures to avoid and mitigate harm will be implemented and the assessment is based upon the residual impacts that remain.

DFO has developed a list of projects and project activities near waterbodies that are considered low risk of serious harm. These listed activities, which include clear span bridge construction, do not require authorization under the *Act* provided that measures to avoid harm are implemented. Consequently, an assessment of impacts to fish and fish habitat was not conducted where the preliminary design is a clear span bridge.

4.2.2 Categorization of Risk

Risk was assigned to each stream crossing site by reviewing the ratings of the criteria outline above and providing a qualification of the determined risk.

4.3 EFFECTS ASSESSMENT

The environmental effects assessment for the Project will use a Valued Environmental Component (VEC) approach. The potential effects, mitigation measures, and residual effects will be assessed relevant to the VEC's. Using existing literature, available project information and habitat assessment result these potential effects, mitigation and residual effects were described. The assessment of residual effects followed the "Reference Guide for the Canadian Environmental Assessment Act" and includes the identification of spatial and temporal criteria relative to potential effects as outlined in Appendix 3.

4.3.1 Valued Environmental Components

Fish habitat was selected as the VEC for the aquatic environment effects assessment. Fish habitat was defined as habitat that supports fish species that are part of or support a CRA fishery. It was selected because:

- it is an important aquatic environmental component potentially affected by the ASR project;
- Section 35(1) of the federal *Fisheries Act* prohibits the permanent alteration or destruction of fish habitat that supports fish and habitat that are part of or support a CRA fishery;
- it encompasses a variety of biophysical parameters, including hydrology, channel and flow characteristics, substrate, cover, water and sediment quality, aquatic plants and benthic invertebrate communities; and
- it is often used as a surrogate for the productive capacity of aquatic habitats.

4.3.2 Measurable Parameters

Measurable parameters to be used to assess the potential effects of the Project on fish habitat include:

- physical fish habitat (substrate composition; channel characteristics; cover for fish; habitat type);
- water quality (TSS and turbidity);
- hydrology (velocity and water depth); and

- riparian vegetation (riparian vegetation composition).

4.3.3 Net Habitat Change

Habitat change includes loss due to destruction and/or alteration of instream habitat. Habitat change was calculated for all crossing locations that support CRA fisheries species. In calculating habitat loss, the best available information on crossing design was used. Where information was deficient, conservative assumptions were made.

4.3.3.1 Destruction

Instream habitat destruction will occur where crossing design requires the construction of permanent instream structures. Instream habitat destruction was calculated based on the dimensions (footprint) of permanent crossing structures located below the high water mark. For culvert crossings, the road bed width was assumed to represent the width of the instream destruction. Therefore the destructed area would equal the road bed width by the stream channel width at the crossing location. For multi-span bridges, it was assumed that only bridge piers would result in instream destruction and that all remaining bridge components (e.g., abutments) would be located above the high water mark. In the absence of a crossing design, the pier dimensions used in the bridge design for similar sized watercourse on MFESRA's PR 304 to Berens River ASR Project (AECOM 2011) was selected and used to estimate the destruction.

4.3.3.2 Alteration

Alterations of instream fish habitat may occur where rip rap placement is required to reinforce bridge piers and protect channel banks. Rock placement along stream channels is expected to diversify habitats, provide cover for fish and increase productivity, as long as it does not have a harmful effect to flow patterns. Areas of habitat alteration will be determined following final design.

5.0 FISH HABITAT ASSESSMENTS

A detailed summary of the physical and biological data, collected during fall 2013 and spring 2014 at streams crossed by the proposed ASR alignment, are provided in appendices 4 and 5. These data were used to determine the potential risk to fish habitat and assess the likelihood of serious harm resulting from construction of crossing structures.

5.1 WATER QUALITY

5.1.1 *In situ* Parameters

In situ parameters varied between the eight stream crossings sampled in September 2013 or spring 2014. The larger watercourses (Fish to Family Lake Channel and Root Creek) were generally warmer and more oxygenated than the other tributaries (Table 3). However, DO at Site 3 was below the Manitoba water quality objective for the protection of cool- and cold-water species (6.0 and 6.5 mg/L, respectively; MWS 2011). It should be noted that DO usually varies inversely with temperature; therefore, fewer or greater numbers of exceedances may occur at other times of the year. *In situ* pH at six of the sites was also below the lower pH limit for the protection of aquatic life (PAL; 6.5 pH units). Specific conductance and turbidity were low at all sites, with the exception of Site 8 where *in situ* and laboratory turbidity results were elevated beyond those of the other sites.

5.1.2 Laboratory Analyses

The laboratory samples collected in the study area in fall 2013 or spring 2014 indicate that the sites have moderate to high nutrient concentrations but relatively high clarity and low productivity (Table 4). Ammonia and nitrate concentrations measured during fall or spring were well within the MWQSOGs (site specific guideline and 2.93 mg N/L, respectively) but the guidelines for Total Phosphorus (TP) were often exceeded. The guideline for TP in streams and rivers (0.05 mg/L) was exceeded at sites 1, 2, 3, 8 and 12. Although it doesn't directly apply, the TP guideline for lakes, ponds, and tributaries at the point where it enter such waterbodies (0.025 mg/L) was also exceeded at site 10 (700 m from Root Lake). Nutrient concentrations vary dramatically between seasons (e.g., during freshet) and TP and ammonia concentrations could exceed the guidelines at other times of the year or under different flow conditions. As noted above, some sites also had laboratory pH levels below the lower limit for PAL (6.5 pH units).

The QA/QC analyses indicated good accuracy and a lack of contamination of the laboratory samples, as all results were within five times the DLs (Table 4).

Table 3. *In situ* water quality measured at streams crossed by the Little Grand Rapids FN to Pauingassi FN All Season Road.

Site ID	Watercourse	Sample Date	Temperature (^{0}C)	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Specific Conductance (µS/cm)	Conductivity (µS/cm)	Turbidity (NTU)	pH (pH units)
MWQSOG			-	***6.0**-6.5*	-	-	-	-	***6.5**-9.0*
1	Unnamed Fishing Lake Tributary	30-Sep-13	11.71	7.63	70	30	22	1.89	***5.42***
2	Unnamed Fishing Lake Tributary	30-Sep-13	12.84	9.82	93	40	30	6.36	***6.23***
3	Unnamed Fishing Lake Tributary	30-Sep-13	11.97	***1.15***	11	29	22	2.10	***5.00***
7	Fishing to Family Lake Channel	30-Sep-13	14.80	9.14	90	49	39	1.02	6.97
8	Unnamed Family Lake Tributary	30-Sep-13	10.29	6.95	62	29	21	26.7	***4.85***
9	Root Creek	30-Sep-13	13.33	9.72	93	40	31	0.61	6.76
10	Unnamed Root Lake Tributary	30-Sep-13	11.01	9.23	84	30	22	3.26	5.46
12	Unnamed Creek	02-Jun-14	15.48	-	-	40	33	8.66	***4.69***

Table 4. Laboratory water quality results for streams crossed by the Little Grand Rapids FN to Pauingassi FN All Season Road.

			Nitrogen							
Site ID	Watercourse	Sample Date	Ammonia (mg N/L)	Nitrate/nitrite (mg N/L)	Nitrate-N (mg N/L)	Nitrite-N (mg N/L)	Total Kjeldahl N (mg/L)	Dissolved Inorganic N[1] (mg/L)	Organic N[2]	Total N[3] (mg/L)
Detection Limit			*0.010*	*0.0051*	*0.0050*	*0.0010*	*0.20*			
MWQSOG			*5.89-58.2*	*2.93*	*2.93*					
1	Unnamed Fishing Lake Tributary	30-Sep-13	<0.010	<0.0051	<0.0050	<0.0010	1.22	0.0076	1.22	1.22
2	Unnamed Fishing Lake Tributary	30-Sep-13	0.033	0.0362	0.0346	0.0015	1.10	0.0692	1.07	1.14
3	Unnamed Fishing Lake Tributary	30-Sep-13	0.049	<0.0051	<0.0050	<0.0010	1.31	0.0516	1.26	1.31
7	Fish to Family Lake Channel	30-Sep-13	0.028	0.0386	0.0386	<0.0010	0.33	0.0666	0.30	0.37
8	Unnamed Family Lake Tributary	30-Sep-13	<0.010	<0.0051	<0.0050	<0.0010	1.20	0.0076	1.20	1.20
9	Root Creek	30-Sep-13	0.061	0.0178	0.0178	<0.0010	0.33	0.0788	0.27	0.35
10	Unnamed Root Lake Tributary	30-Sep-13	0.023	<0.0051	<0.0050	<0.0010	0.81	0.0256	0.79	0.81
12	Unnamed Creek	02-Jun-14	0.013	0.0130	0.0130	<0.0010	1.27	0.0260	1.26	1.28
QA/QC										
Trip Blank		30-Sep-13	<0.010	<0.0051	<0.0050	<0.0010	<0.20	0.0076	0.10	0.103
		02-Jun-14	<0.010	<0.0051	<0.0050	<0.0010	<0.20	0.0076	0.10	0.103
Field Blank		30-Sep-13	0.046	<0.0051	<0.0050	<0.0010	<0.20	0.0486	0.05	0.103
		02-Jun-14	<0.010	<0.0051	<0.0050	<0.0010	<0.20	0.0076	0.10	0.103

1 – Calculated as the sum of ammonia-N and nitrate/nitrite-N.
2 – Calculated as the difference between total Kjeldahl N and ammonia
3 – Calculated as the sum of total Kjeldahl N and nitrate/nitrite-N.
4 – Narrative guideline for any lake, pond, or tributary at the point where it enters such waterbodies.
5 – Narrative guideline for streams

Table 4. Continued.

Site ID	Watercourse	Sample Date	Total Phosphorus (mg/L)	Total Organic C (mg/L)	Water Clarity: Total Suspended Solids (mg/L)	Water Clarity: Turbidity (NTU)	Lab pH	Algal Pigments: Chlorophyll *a* (µg/L)	Algal Pigments: Phaeophytin *a* (µg/L)
Detection Limit			*0.0010/0.010*	*1.0*	*2.0*	*0.10*	*0.10*	*0.10*	*0.10*
MWQSOG			*0.025* [4]***/0.05*** [5]				***6.5-9.0***		
1	Unnamed Fishing Lake Tributary	30-Sep-13	***0.071***	39.9	<2.0	1.42	***6.17***	0.51	0.72
2	Unnamed Fishing Lake Tributary	30-Sep-13	***0.083***	32.2	4.0	5.01	6.95	3.99	4.13
3	Unnamed Fishing Lake Tributary	30-Sep-13	***0.098***	43.2	8.4	2.91	***5.36***	12.1	10.3
7	Fishing to Family Lake Channel	30-Sep-13	0.011	14.0	<2.0	0.80	7.57	2.13	0.79
8	Unnamed Family Lake Tributary	30-Sep-13	***0.079***	41.7	10.0	12.9	***5.92***	0.71	2.39
9	Root Creek	30-Sep-13	0.0090	11.6	<2.0	0.52	7.45	0.47	1.06
10	Unnamed Root Lake Tributary	30-Sep-13	*0.032*	32.9	2.0	1.86	6.61	0.66	1.78
12	Unnamed Creek	02-Jun-14	***0.084***	50.8	3.6	4.70	**6.23**	4.03	2.70
QA/QC									
Trip Blank		30-Sep-13	<0.0010	<1.0	<2.0	<0.10	6.04	<0.10	<0.10
		02-Jun-14	<0.0010	<1.0	<2.0	<0.10	6.42	<0.10	<0.10
Field Blank		30-Sep-13	0.0049	<1.0	<2.0	0.19	6.11	0.19	0.12
		02-Jun-14	<0.0010	<1.0	<2.0	<0.10	6.59	<0.10	<0.10

1 – Calculated as the sum of ammonia-N and nitrate/nitrite-N.
2 – Calculated as the difference between total Kjeldahl N and ammonia
3 – Calculated as the sum of total Kjeldahl N and nitrate/nitrite-N.
4 – Narrative guideline for any lake, pond, or tributary at the point where it enters such waterbodies.
5 – Narrative guideline for streams

5.2 SPECIES PRESENCE

Fish and mollusk species presence within watercourses crossed by the ASR was determined based on field sampling results, literature review and key person interviews. The potential presence of aquatic species-at-risk was assessed based on current and historical range, documented occurrences within project areas streams, and preferred habitats.

5.2.1 Fish

Eight fish species have been reported within study area streams. These species records are limited to two watercourses: the Fishing to Family Lake channel and Root Creek. Field sampling conducted as part of this study reported Sauger, Walleye, White Sucker, Yellow Perch in the Fishing to Family Lake Channel. In Root Creek, electrofishing surveys confirmed the presence of Burbot, Spottail Shiner, White Sucker, Johnny Darter (*Etheostoma nigrum*) and Northern Pearl Dace (*Margariscus nachtriebi*).

Of the small tributary streams, one unidentified forage fish was observed in Site 2 (Unnamed Fishing Lake Tributary). Fish presence was not confirmed through field sampling or in the literature in the remaining streams crossed by the ASR.

5.2.2 Mussels

The small tributary streams crossed by the ASR alignment are unsuitable for mussels. Mussels are typically found in medium to large river systems in areas predominately composed of silt/clay and sand and to a lesser extent gravel. Two empty Fatmucket (*Lampsilis siliquoidea*) shells were captured in gill nets in the Fishing to Family Lake Channel. Ponar grabs and visual searches did not identify live mussels or empty shells at or near the crossing site. Although unconfirmed, the captured empty valves may have originated upstream of the study area.

5.2.3 Species-at-Risk

The Manitoba *Endangered Species Act* (MBESA) was enacted to protect and enhance the survival of threatened and endangered species in Manitoba, to enable reintroduction of extirpated species into the province, and to designate species as threatened, endangered, extirpated, or extinct. At the federal level, the SARA is intended to protect wildlife species at risk in Canada. Within the Act, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was established as an independent body of experts responsible for identifying and assessing wildlife species considered at risk. Wildlife species that have been designated by COSEWIC may then qualify for legal protection and recovery under SARA.

Currently the MBESA lists one aquatic species-at-risk, Mapleleaf Mussel (*Quadrula quadrula*), and SARA recognizes two aquatic species-at-risk with distributions that extend into the Lake

Winnipeg East drainage area; the Shortjaw Cisco (*Coregonus zenithicus*) and Mapleleaf Mussel. Although not protected under SARA, Lake Sturgeon is designated as Endangered by COSEWIC (COSEWIC 2006). In Canada, Lake Sturgeon populations have been greatly impacted by human activities and the species is currently under consideration for listing under SARA. Although they are not legally protected, the potential presence of sturgeon within the Project area was assessed in consideration potential future listing under SARA.

Shortjaw Cisco

The Shortjaw Cisco is listed as Threatened under SARA. In Manitoba, distribution is believed to be restricted to large, deep lakes, including Lake Winnipeg. There are no records of this species from riverine habitats in Manitoba. Their preferred spawning habitat is unknown. Shortjaw Cisco has not been documented within streams in the ASR project area and their preferred habitat is not present on route; as a result, no risk to the species is expected.

Mapleleaf Mussel

The Mapleleaf Mussel is listed as Endangered under MBESA and SARA. The species is found in medium to large rivers with slow to moderate currents and firmly packed sand, coarse gravel or clay/mud substrate. This species has been documented in the lower reaches of medium to large rivers on the east side of Lake Winnipeg (North/South Consultants 2010, 2014) but not in the project area.

The small tributary streams crossed by the ASR alignment are unsuitable for mussels and their preferred habitat is not present in the immediate crossing area of the Fishing to Family Lake channel; as a result, no risk to Mapleleaf Mussel is expected.

Lake Sturgeon

Lake Sturgeon inhabit larger lakes and rivers. They are typically benthic and are most often found over sand substrates. They spawn in fast moving water, such as rapids or at the base of falls. Lake Sturgeon have been reported in project drainage basin, but have not been documented within the project area by western science or through traditional knowledge studies. Little Grand Rapids FN and Pauingassi FN members reported that sturgeon are not known to occur near their communities, including in Fishing and Family lakes (MFESRA, pers. comm). This could be due to the presence of many impassable rapids located both upstream and downstream of the assessment area.

The Fishing to Family Lake channel crossing site provides high velocity run habitat with rocky substrates. Localized areas of sand/fines substrates near the crossing may provide foraging

opportunities for sturgeon. Although the crossing area is unsuitable for spawning; potential spawning habitat is located at a set of rapids, 900 m downstream from the crossing.

Impacts to Lake Sturgeon in the vicinity of the proposed crossing are anticipated to be low provided that mitigation measures are in place. The species has been documented within the drainage basin, but are not known to occur in the project area. Further, the habitat at the crossing would not be considered critical to the species and the extent of instream impacts from construction of the bridge pier is small.

5.3 RISK ASSESSMENT

All season road stream crossings will consist of culverts, a single span bridge at Root Creek, and a multi span bridge at the Fishing to Family Lake channel (pers. comm. MFESRA). The duration and extent of impact for each crossing structure is discussed below.

Culverts

In the absence of preliminary design information, culverts were assumed to be 18 m long, the approximate width of the road footprint (pers. comm. MFESRA). Habitat loss within the footprint of the crossing will be permanent and therefore duration is rated as high, the extent of the affected habitat is small and rated as low. The overall assessment considers that some productivity will be maintained within the culvert following construction as culverts will be embedded and designed for fish passage.

Single Span Bridge

The proposed single span bridge at Root Creek will be clear span (pers. comm. MFESRA). Clear span bridge construction does not require DFO review provided that measures to avoid harm are implemented. Of key consideration is that all bridge abutments be located above the high water mark. It is assumed that all necessary best practices will be implemented, avoiding direct negative effects to fish habitat; as a result an assessment of duration and extent of impacts was not conducted.

Multi Span Bridge

The proposed Fishing to Family Lake Channel multi span bridge is assumed to be three-span with two instream piers. Habitat loss within the footprint of the crossing will be permanent and therefore duration is rated as high, the extent of the affected habitat is small and rated as low.

5.3.1 Summary of Impacts to Fish and Fish Habitat

Thirteen watercourse crossings were identified on the proposed ASR alignment. Five proposed culvert sites (sites 4-6, 11 and 13) were assessed as No Fish Habitat (Class 3 streams) based on the absence of a channel at the crossing and connectivity to downstream fish bearing waterbodies. Individual assessments for these watercourses are provided in Appendix 5. Field studies and subsequent risk assessments were conducted at the remaining eight crossings (class 1 and 2 streams). A habitat description and risk assessment summary for individual crossings are provided in Appendix 5.

Three proposed culvert sites (sites 1, 3, 10) were assessed as marginal habitat, suitable for forage fish species. These sites are located on small first or second order streams that are poorly connected to downstream fish-bearing waters due to numerous ephemeral barriers or a poorly defined channel. They typically have small watersheds and limited flows which are often impounded by beaver dams. These flow conditions may result in degraded water quality due to low dissolved oxygen. Habitat at these crossings is considered unsuitable for large bodied fish, and the crossings were assessed as Low risk of causing serious harm to fish.

The remaining five ASR crossings, including three culverts, one single span bridge and one multi span bridge, were assessed as Low risk of causing serious harm to fish. None of the proposed crossing sites were assessed as Medium or High risk.

5.3.1.1 Culvert Crossings – Sites 2, 8 and 12

The three Low Risk culvert sites are located on small tributaries of Fishing and Family lakes. They are first order streams with small drainage areas. All three sites have been impacted by beaver activity, evident by presence of historical impoundments and breached and intact dams. These dams may restrict fish passage to the crossing sites in some years or under certain flow conditions.

The habitat at sites 2 and 8 consists of relatively small and shallow channels (<0.5 m) and at Site 12, a beaver impoundment greater than 1 m depth. All three are considered marginal for large bodied fish. The crossings are typically located near the headwater area of the stream; as a result, there is limited habitat available upstream of the crossing. Near their receiving lakes, these streams transition to a broader channel within soft sedge/grass floodplain. These lower reaches provide low flow habitat with low to moderate levels of instream vegetation. In spring, areas of instream vegetation and inundated floodplain vegetation would provide suitable habitat for spawning by Northern Pike. Rearing habitat is also present near the creek mouths at sites 2 and 8. There were no fish captured in these streams during the surveys; although one unidentified forage fish was observed at Site 2.

The Availability and Condition and Impacts on Fish were rated as Low. The habitat provided by these streams is common within the area and is not critical or limiting to Northern Pike or other CRA species. Northern Pike and their habitats are abundant within the Family Lake fishery area and there are no known threats to the habitat or the species.

Based on the habitat assessment and duration and extent ratings the three proposed culvert crossings are classified as Low Risk (Table 5). Although each stream may support Northern Pike, suitable habitat for the species is located downstream of the crossing and outside of the anticipated cleared ROW. The habitat at and upstream from the crossings is marginal and considered unsuitable for fish species that are part of or support a CRA fishery. Construction of the crossing is expected to have no measurable effect on the ongoing productivity of CRA fish species.

Single Span Bridge Crossing - Root Creek (Site 9)

The single span bridge crossing is located on Root Creek (Site 9). The bridge site consists of boulder garden and pool habitat. It is located at the top of a steep bedrock chute that is considered a barrier to upstream fish movement. Fish may move into the crossing site from upstream Douglas Lake during periods of high water; however they may become stranded as a small upstream chute may preclude fish passage and the site lacks deeper areas for overwintering.

Downstream from the crossing, a large plunge pool and riffles with boulder cover provide rearing and feeding habitat for juvenile suckers and Burbot. The rocky substrates are also suitable for spawning by Walleye and suckers in spring. Areas of instream vegetation near the creek mouth may be used for spawning and rearing by Northern Pike. Juvenile Burbot and White Sucker were captured in the creek, downstream from the chute.

The Availability and Condition, and Impacts on Fish were rated as Low. Although the habitat supports species including Burbot and White Sucker and potentially Walleye, the habitat is not considered limiting to these species. The bedrock chute and plunge pool are a unique feature in the study area, but spawning, rearing and feeding habitat is not limited in the area.

The preliminary design of the Root Creek Bridge is clear span (pers. comm. MFESRA). Implementation of measures to avoid harm during design, construction and operation of the crossing will result in a low level of risk of causing serious harm.

5.3.1.2 Multi Span Bridge Crossing – Fishing to Family Lake Channel

The multi span bridge at the Fishing to Family Lake Channel was assessed as Low of causing serious harm to fish. The channel is part of a major drainage system that provides perennial fish

habitat for a variety of fish species. The crossing is located on the reach between Family and Fishing lakes and parallels an existing transmission line crossing. Within the reach, the fish habitat is diverse and includes: a high velocity run habitat with sand, gravel and/or rocky substrates; shallow, low velocity areas with soft substrates and extensive macrophyte beds, and deep-water habitats (16-18 m) with sand and cobble substrates. The area provides suitable spawning, rearing, feeding and overwintering habitat for forage fish species and a variety of large bodied fish such as Northern Pike, Walleye and suckers.

The Availability and Condition, and Impacts on Fish were rated as Low. Although the crossing area provides suitable spawning, rearing, feeding and overwintering for several CRA fishery species, this type of habitat is common within the system and no critical habitats were identified. The CRA fisheries species it supports are abundant, and there are no known threats to the habitat or species.

Based on the habitat assessment and duration and extent ratings, the proposed bridge at the Fishing to Family Lake channel is classified as a Low risk. Although the crossing will result in a permanent loss of habitat that supports a CRA fishery, the impacts are localized and are not expected to affect the ongoing productivity of the fish species.

Table 5. Summary of the Risk Assessment related to construction and operation of the proposed Little Grand Rapids FN to Pauingassi FN ASR stream crossings.

Crossing	Stream Name	Crossing Structure	Fish Habitat Present	Supports a Fishery[a]	Extent	Duration	Availability & Condition	Impacts on Fish	Risk of Serious Harm
1	Unnamed Fishing Lake Tributary	Culvert	Yes	No	Low	High	Low	Low	LOW
2	Unnamed Fishing Lake Tributary	Culvert	Yes	Yes	Low	High	Low	Low	LOW
3	Unnamed Fishing Lake Tributary	Culvert	Yes	No	Low	High	Low	Low	LOW
4	Unnamed Drainage	Culvert	No	No	-	-	-	-	-
5	Unnamed Drainage	Culvert	No	No	-	-	-	-	-
6	Unnamed Drainage	Culvert	No	No	-	-	-	-	-
7	Fishing to Family Lake Channel	Multi span Bridge	Yes	Yes	Low	High	Low	Low	LOW
8	Unnamed Family Lake Tributary	Culvert	Yes	Yes	Low	High	Low	Low	LOW
9	Root Creek	Clear span Bridge[b]	Yes	Yes	N/A	N/A	N/A	N/A	LOW
10	Unnamed Root Lake Tributary	Culvert	Yes	No	Low	High	Low	Low	LOW
11	Unnamed Drainage	Culvert	No	No	-	-			-
12	Unnamed Tributary	Culvert	Yes	Yes	Low	High	Low	Low	LOW
13	Unnamed Drainage	Culvert	No	No	-	-			-

a – commercial, recreational or Aboriginal fishery.
b – On the DFO Minor Impact List.

6.0 EFFECTS AND MITIGATION

The potential effects of the Project on the VEC (fish habitat), the prescribed mitigation measures and resulting residual effects were identified using available project information and design, literature review and habitat assessments results.

6.1 POTENTIAL EFFECTS

The primary potential effects of ASR construction and operation to fish habitat are erosion and sedimentation of streams, introduction of deleterious substances and habitat loss. These and other potential effects of the Project on the aquatic VEC are discussed below.

6.1.1 Erosion and Sedimentation of Streams

Vegetation removal and improper construction practices near watercourses can result in increased erosion leading to sedimentation of streams. Clearing streamside vegetation may result in decreased bank stability and exposure of bare soils that are susceptible to erosion. Heavy machinery and equipment working near the watercourse can damage vegetative cover and cause rutting and erosion of floodplains and channel banks.

There are multiple negative effects associated with increased levels of suspended and deposited sediment, including impacts to primary producers, invertebrates, and fish. A decrease in light penetration due to higher turbidity (suspended sediment) can lead to decreased photosynthesis by primary producers. Since primary producers form the base of the food chain, decreases in photosynthesis can impact higher trophic levels, such as invertebrates and fish. Large influxes of deposited sediment can bury aquatic invertebrates, an important food item for many fish species, resulting in reduced invertebrate species diversity and abundances. Fine sediment deposition over existing larger substrates may result in habitat loss 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. Infilling of existing coarse or rocky substrates with finer materials may create unsuitable spawning habitat for some fish species, smother deposited eggs or inhibit larval emergence from spawning substrates (Kondolf 2000). Short- and long-term increases in turbidity impair 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).

6.1.2 Loss of Instream Habitat

A crossing design that includes the placement of permanent structures below the high watermark will have direct effects to fish habitat. Infilling of stream substrates due to bridge piers will result in the permanent loss of instream habitat. The armouring of channel banks below the high water mark may alter the quality and productivity of instream habitat; however depending on design certain types of armouring, such as rip rap, may increase habitat productivity by providing suitable substrates for insect production (i.e. fish diet items) and cover for fish.

6.1.3 Loss of Riparian Vegetation

Riparian vegetation contributes nutrients to streams and lakes through litter and terrestrial insect drop. The removal of riparian vegetation to accommodate temporary crossings, bridge approaches and line of sight requirements may reduce nutrient inputs into the aquatic food web. In many streams, terrestrial insects contribute to the diet of fish. Further, leaf litter and other organic matter are consumed by aquatic invertebrates, another important food source for many fish species (Allan et al. 2003).

6.1.4 Introduction of Deleterious Substances

Introduction of deleterious substances into watercourses can degrade water quality, resulting in toxic effects to aquatic organisms, including fish. Harmful substances may enter the watercourses from a variety of sources during construction of the ASR through accidental spills and leaks and in run off.

Cast-in-Place Concrete Structures

Construction of cast-in-place concrete structures such as bridge abutments, footings and bridge decks may result in accidental releases of concrete or concrete wash water into the watercourse. 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 organisms, including fish. Accidental discharges into an aquatic environment may result in an increase in the pH of the water. Elevated pH can damage fish tissue and increase the toxicity of other substances in the water, such as ammonia. Concrete and concrete wash water can also contain sediments and spills can result in increased turbidity and sedimentation of the stream.

Construction Vehicles, Machinery and Equipment

Hydrocarbons, such as oil, fuel, gasoline, lubricants, or hydraulic fluids can enter watercourses during the operation, maintenance and fuelling of construction vehicles and machinery near watercourses. 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.

Stormwater Runoff

Stormwater runoff from impervious surfaces, such as bridge decks and approaches can contain a number of pollutants including suspended solids, hydrocarbons, metals, nutrients and road salts. During and after significant rainfall events, stormwater runoff into streams can cause short term changes in water quality. Stormwater runoff may also results in physical impacts to streams, including bank and channel erosion and/or sediment deposition due to increased runoff frequency, velocity and volume.

Explosives

Explosives used in blasting use oxidizing agents such as ammonium nitrate, calcium nitrate and sodium nitrate. Nitrates from these materials may enter the watercourse due to accidental spills, leaching from wet blastholes or in run off from undetonated explosives in blast rock. Increased nitrate levels can have toxic effects on aquatic organisms and cause eutrophication of surface waters. In addition, if ammonium nitrate is introduced into water, it dissociates to form ammonia which can have both lethal and sublethal effects on fish.

6.1.5 Disruption of Habitat due to Blasting

The compressive shock wave resulting from the detonation of explosives near watercourses can cause serious harm to fish and fish habitat. Shock waves with overpressure levels greater than 100 kPa can rupture the swim bladder and vital organs such as the liver and kidney (Wright and Hopky 1998). The vibrations generated by a blast can also damage incubating eggs. Other impacts to habitat include physical alteration of habitat, sedimentation of streams (Section 6.1.1) from particles generated by blasting and introduction of deleterious substances (Section 6.1.4).

6.1.6 Temporary Crossings

The construction and use of temporary crossings can result in loss or damage to riparian vegetation (Section 6.1.3), and erosion and sedimentation of streams (Section 6.1.1). Temporary crossings, such as fords, can disrupt sensitive fish life stages, such as spawning and incubation periods, resulting in decreased reproductive success.

6.1.7 Improved Access to Sensitive Habitats

ASR construction may result in improved access to sensitive habitats by both work crews and the public. Motorized vehicles, such as ATVs may disturb stream banks and riparian areas leading to erosion and sedimentation of streams.

6.2 MITIGATION

The following section describes measures to minimize the severity of or prevent the potential impacts of the Project to fish habitat. These measures include those to be followed when working at or near watercourses that are fish habitat or are directly connected to fish bearing waters, as well as site specific-measures based on the fish habitat information collected in the field. Mitigation measures are presented by project phase including: design; construction; and operation and maintenance.

6.2.1 Design

Many potential effects of road developments, including introduction of deleterious substances and channel erosion and sedimentation, can be minimized through proper design. The following measures will be incorporated into the project design to mitigate potential disruptions to fish habitat:

- Where possible, roads should be located a minimum of 100 m from waterbodies except when crossing a watercourse. Where this is not feasible, a buffer of undisturbed vegetation equal to 10 m plus 1.5 times the slope gradient will be left between the road and adjacent waterbodies. These buffers will minimize runoff velocity and volume during rain events, encouraging the settling of sediment and contaminants. They will also preserve riparian function such as allochthonous inputs into streams, shading and bank stability.

- Single span bridges will be clear span design; bridge abutments will be located above the high water mark to avoid direct impacts to the aquatic habitat.

- Clear span bridges design will not require any construction work, including bank armouring (i.e. riprap) or excavation for bridge abutments or wing walls, below the high water mark to avoid disruptions to aquatic habitat.

- Culvert and bridge crossings will be designed to direct stormwater runoff into a vegetated area or retention pond to decrease the velocity and volume of runoff and encourage the settling of sediment and removal of contaminants.

6.2.2 Construction

6.2.2.1 Deleterious Substances

The following measures will be implemented to minimize the potential introduction of deleterious substance into watercourses:

- Construction crews will be adequately trained on the handling, storage, and disposal of deleterious substances.
- Spill clean-up kits will be available on site at all times.
- Deleterious substances will be stored a minimum of 100 m from the high water mark.

Additional measures related to construction vehicles and equipment, concrete work and explosives are provided in sections 6.2.2.2, 6.2.2.7 and 6.2.2.8, respectively.

6.2.2.2 Construction Vehicles and Equipment

The following measures will be implemented to mitigate the introduction of deleterious substances and erosion and sedimentation of streams resulting from construction vehicles and equipment working near watercourses:

- Construction vehicles and equipment will arrive on site clean and free of leaks.
- Vehicle and equipment fueling and maintenance will be conducted a minimum of 100 m from the high water mark.
- Machinery will remain above the high water mark except where temporary fording of a watercourse is required.

6.2.2.3 Erosion and Sediment Control

The following mitigation measures will be implemented to protect stream banks and floodplains from erosion and minimize sediment introduction to watercourses. These measures will require regular inspection to confirm their effectiveness and need to be adaptively managed where required.

- Appropriate erosion and sediment control measures will be in place prior to the commencement of construction.
- Erosion and sediment control measures will be regularly inspected and maintained to ensure effectiveness throughout construction.

- Clearing and earthworks near watercourses will be conducted under favourable weather conditions and will be temporarily suspended during storm events.
- Whenever possible, construction work over soft floodplains will be conducted under frozen conditions to minimize rutting and erosion.
- Overburden will be stabilized and stored well above the high water mark.
- Disturbed areas will be stabilized through revegetation with native plant species or other appropriate means (e.g., erosion control blankets) following completion of works.
- Riprap placed below the high water mark will be clean and free of debris.
- All erosion and sediment control measures will remain in place until all disturbed area are revegetated.

6.2.2.4 Vegetation Removal

The following mitigation measures will be implemented to minimize erosion in riparian areas and prevent unnecessary clearing or alteration of riparian habitats:

- Vegetation will be retained as long as possible to minimize the time exposure of disturbed/bare soils to potential erosion.
- Clearing limits will be clearly marked prior to riparian vegetation removal to avoid unnecessary damage to or removal of vegetation.
- Erosion and sediment control measures will be in place prior to the start of clearing.
- Riparian vegetation clearing within the ROW will be limited to the removal of select vegetation that is required to maintain line of sight safety requirements (i.e., tress and tall shrubs). Low growing vegetation will be maintained.

6.2.2.5 Instream Work

The following measures will be implemented during in water work (i.e., below the high water mark):

- Instream construction activities conducted in fish bearing watercourse will be timed to avoid fish spawning and incubation periods.
- Instream construction will be conducted in isolation of flowing water to mitigate downstream sediment transfer.
- A fish salvage will be conducted within the isolated work area prior to the commencement of instream work.

- Construction vehicles and machinery will remain above the high water mark during instream construction activities.

6.2.2.6 Temporary Crossings

General

- Whenever possible, existing trails, roads and cut lines will be used as access to temporary crossings.
- Temporary crossings will be located within the 60 m cleared ASR ROW to avoid riparian impacts outside of the ROW.
- Placement and removal of temporary crossing structures will be timed to avoid high fish migration periods.
- Approaches will be stabilized as required to protect stream banks (e.g. swamp pads, logs)
- Temporary crossing structures will be removed when no longer required and the crossing site will be restored to its original conditions.

Fords

If fording is required to transport materials during the construction of the ASR, the following measures will be implemented:

- Fording in flowing waters will avoid periods of fish spawning, incubation and migration.
- Fording will avoid known fish spawning and rearing areas.

Ice Bridges and Snow Fills

If temporary ices bridges or snow fills are required to cross watercourses during construction of the ASR, the following measures will be implemented:

- Ice bridges will be constructed of clean water, ice and snow only and will not block naturally occurring flows.
- The withdrawl of water used in the construction of ice bridges will not exceed 10% of the instanaeous flow.
- When an ice bridge no longer required or the crossing season has ended, ice bridges will be notched at the centre to prevent the obstruction of fish movement. Notching will also encourage melting at the centre of the bridge, preventing channel erosion and flooding.

- Snow fills will be constructed of clean snow and will not restrict stream flows.
- When a snow fill is no longer required or the crossing season has ended, compact snow will be removed prior to freshet.

6.2.2.7 Concrete Work

To avoid water quality impact from accidental releases of uncured or partly cured concrete or concrete washwater, the following measures will be implemented:

- Uncured or partly cured concrete will be kept in isolation from watercourses.
- Any water that has contacted uncured concrete will be isolated from watercourses until it has reached a neutral pH.
- Equipment used in concrete work will be washed away from watercourses to prevent wash water from entering waterways.

6.2.2.8 Blasting

The following measures will be implemented to mitigate the accidental release of explosive materials into watercourses, erosion and sedimentation of streams and the potential lethal and sublethal effects to fish due to shockwaves:

- Explosive materials will be handled and stored in a manner to minimize accidental spills or releases into watercourses.
- Explosive materials will be stored a minimum of 100 m from the high water mark. Storage and transport containers will be regularly inspected and maintained prevent spills
- Crew members working with explosives will be trained in spill containment and clean-up procedures.
- Ammonium nitrate-fuel oil mixtures will not be used in or near watercourses.
- Blasting will not be conducted in watercourses.
- Explosives will be detonated at sufficient distance from the watercourse so that overpressure levels do not exceed 100 kPa at the land-water interface.

6.2.2.9 Access to Sensitive Areas

The following measures will be implemented to mitigate the disruption of sensitive areas due to increased access:

- Decommission and rehabilitate construction access roads and winter roads

- Prohibit unnecessary access to sensitive areas by work crews.
- Restrict access to major watercourse crossings along ASR using measures such as slope treatment and fencing.

6.2.3 Post-Construction

Post-construction mitigation measures will be implemented to ensure long term stability of watercourse crossing areas:

- Stream crossings will be inspected following the first storm event and first freshet to ensure that there are no visible signs of bank and channel instability.
- Disturbed areas will be re-vegetated following completion of works.
- Stream crossings will be inspected to ensure that adequate levels of vegetation has established in disturbed areas adjacent to watercourses.

6.2.4 Operation and Maintenance

Mitigation measures related to operation and maintenance activities are discussed in the following sections.

6.2.4.1 Bridge Maintenance

Debris Removal

- Unless considered an emergency work, debris removal will be timed to avoid periods of fish spawning, incubation and migration.
- Debris removal will be conducted by machinery operating from shore (above the high water mark) or by hand.

Protective Coatings

- Removal and application of protective coatings will be conducted in a way that prevents deleterious substances (e.g., paint, paint flakes, blasting abrasives, solvents, etc.) from entering the watercourse (e.g. use of barges or shrouding).
- Paints, solvents and other deleterious substances will be stored and mixed on land (i.e., not on bridge decks) to prevent accidental releases into watercourses.
- Equipment will be cleaned where wash water will not enter the watercourse.

- Waste materials (e.g., paint flakes, abrasives, etc.) will be properly contained and disposed.

Structural Repairs

- In water work will be timed to avoid periods of fish spawning, incubation and migration.
- Appropriate erosion and sediment control measures will be implemented prior to commencement of repair work and will be regularly inspected to ensure their effectiveness.
- Repairs and reinforcements will be conducted in a manner that prevents bridge materials from entering the watercourse.
- Waste materials will be stabilized and/or disposed of in an appropriate manner that prevents entry into the watercourse.
- Disturbed areas will be restored and re-vegetated to mitigate erosion and sediment introduction into the watercourse.

6.2.4.2 Vegetation Management

- Vegetation management required to maintain line of sight safety requirements within the ROW will include the removal of trees and tall shrubs. Low growing vegetation will be retained.
- Mitigation measures related to deleterious substances and maintenance vehicles and equipment will follow those described in sections 6.2.2.1 and 6.2.2.2.
- Slash or debris piles should be stabilized and stored above the high water mark until disposal.

6.2.5 Site-Specific Mitigation

Site-specific mitigation measures are presented in Table 6 below.

Table 6. Site-specific mitigation options for watercourse crossing on the Little Grand Rapids FN to Pauingassi FN All Season Road Project.

Crossing	Watercourse	Crossing Structure	Sensitivity	Mitigation
2	Unnamed Fishing Lake Tributary	Culvert	Potential Northern Pike spawning and rearing area downstream of crossing site.	• In water construction will avoid spawning and incubation periods for spring spawning fish (April 1-June 15) • In water work will be conducted in isolation of flowing water to mitigate sediment transfer to downstream habitats.
7	Fishing to Family Lake Channel	Multi span bridge	Sloping bedrock shorelines provide little buffer for spills increasing the risk of accidental spills entering the watercourse. Fish-bearing watercourse; in water work could potentially disrupt fish during sensitive periods including spawning and egg incubation.	• Ensure appropriate fueling/hazardous chemical handling procedures and buffers will be implemented (i.e., spill kits located at refuelling sites located a minimum of 100 m away from a waterbody). • In water activity, including construction of instream piers or placement of rip rap below the high water mark will avoid spawning and incubation periods in spring (April1-June 15), summer (May 1-June 30). • In water work will be conducted in isolation of flowing water to mitigate sediment transfer to downstream habitats.
8	Unnamed Family Lake Tributary	Culvert	Potential Northern Pike spawning area downstream of crossing site.	• In water construction will avoid spawning and incubation periods for spring spawning fish (April 1-June 15) • In water work will be conducted in isolation of flowing water to mitigate sediment transfer to downstream habitats.

Table 6. Continued.

Crossing	Watercourse	Crossing Structure	Sensitivity	Mitigation
9	Root Creek	Clear span bridge	Spawning area immediately downstream from the crossing. Fish-bearing watercourse; potential disruption of fish during spawning and incubation. Areas of bedrock shorelines provide little buffer for spills, increasing the risk of accidental spills entering the watercourse.	• Establish marshaling area well away from the watercourse. • If a temporary crossing is required, place upstream from the proposed bridge site (i.e., away spawning areas). • In water activity will avoid spawning and incubation periods for spring (April 1-June 15). • Ensure appropriate fueling/hazardous chemical handling procedures and buffers will be implemented (i.e., spill kits located at refuelling sites located a minimum of 100 m away from a waterbody).
12	Unnamed Tributary	Culvert	Potential Northern Pike spawning area downstream of crossing site.	• In water construction will avoid spawning and incubation periods for spring spawning fish (April 1-June 15) • In water work will be conducted in isolation of flowing water to mitigate sediment transfer to downstream habitats.

6.3 NET HABITAT CHANGE

Fish habitat was identified at eight of the 13 crossing locations. Permanent habitat loss and alternation will occur at each site through the footprint of the road in the riparian area, alteration of riparian vegetation within the ROW and through the placement of instream structures at crossings (culverts and bridge pier). However, because the risk of causing serious harm to fish was assessed as Low at all sites, specific values for habitat change are not presented.

6.4 RESIDUAL EFFECTS

The predicted effects of the Project following the application of prescribed mitigation were assessed following the framework "Reference Guide for the Canadian Environmental Assessment Act" including the identification of adverse environmental effects. These residual adverse effects are described in Table 7.

Following the application of proven mitigation measures as outline in section 6.2, the adverse residual effects expected to result from the Project include: the introduction of total suspended solids to streams; the alteration or destruction of riparian habitats and; the destruction of instream habitat.

Table 7. Summary of adverse residual effects for watercourse crossings on the Little Grand Rapids FN to Pauingassi FN All Season Road Project.

Potential Effect	Project Phase	Residual Effect	Assessment Criteria[1]
Project may cause erosion and sedimentation of streams from disturbed banks, right-of-way runoff and instream works.	Construction	Temporary increase in TSS.	Magnitude: High Geographic Extent: Moderate Duration: Low Frequency: Low Permanency: Low Ecological Context: Low
Project will result in the alternation or destruction of riparian habitat.	Construction, Operation	Loss of riparian habitat and its contribution to fish habitat.	Magnitude: Moderate Geographic Extent: Low Duration: Moderate Frequency: Low Permanency: Moderate Ecological Context: Moderate
Project will result in the destruction of instream habitat.	Construction, Operation	Loss of instream fish habitat.	Magnitude: High Geographic Extent: Low Duration: Moderate Frequency: Low Permanency: Moderate Ecological Context: Moderate

[1]Effects Assessment Criteria following *Canadian Environmental Assessment Act* (see Appendix 3).

7.0 INSPECTION AND MONITORING

The following sections outline inspection and monitoring programs related to the aquatic environment. Inspection and monitoring is described for each stage of construction (pre-construction, construction and post-construction) in relation to activities conducted at or near watercourses.

7.1 INSPECTION

Regular site inspections are conducted to ensure that appropriate construction best management practices and mitigation measures are implemented, adequately maintained, and effective. Site observations and conditions are documented using pre-determined checklists and photographs. Where non-compliance is observed or new issues arise, recommendations for corrective actions are provided by the inspector.

7.1.1 Pre-Construction

Where appropriate, environmental protection measures should be in place prior to the commencement of construction. Table 8 provides a list of pre-construction inspection requirements.

7.1.2 Construction

To be effective, environmental protection measures must be adequately maintained throughout the construction phase. Protection measures must be regularly assessed to confirm that they continue to function as intended as construction progresses and site conditions change. Table 9 provides a list of items to be inspected throughout the construction phase at sites at or near watercourses. Inspections should be conducted on a weekly basis, with additional inspections for erosion and sediment control conducted during and/or immediately after significant rain events.

Table 8. Pre-construction inspection requirements for construction sites located at or near watercourses.

PRE-CONSTRUCTION INSPECTION
Deleterious Substances Storage and Spill Prevention
• Spill clean-up kits are present on site.
• Storage and waste containers, including fuel, are located a minimum of 100 m from the high water mark.
• Storage and waste containers are intact/sealed and clearly labelled.
• Waste containers are of sufficient volume for materials requiring disposal.
• Secondary containment is present where necessary.
Construction Equipment and Machinery
• Designated vehicle/equipment maintenance and wash down areas are located a minimum of 100 m from the high water mark.
• Designated vehicle/equipment fuelling areas are located a minimum of 100 m from the high water mark.
• All construction vehicles and equipment are clean and free of leaks.
Erosion and Sediment Control (ESC)
• Appropriate ESC measures are in place prior to construction.
• Extra ESC materials are on site and available for immediate use (e.g., silt fencing, polyethylene sheeting)
Sensitive Areas
• Construction limits and/or any sensitive areas are clearly marked prior to construction
• Clearing limits are clearly marked prior to vegetation removal near watercourses

Table 9. Inspection requirements for construction sites located at or near watercourses.

CONSTRUCTION INSPECTION
Deleterious Substances Storage and Spill Prevention
• Spill clean-up kits are present on site.
• Hazardous waste is being removed from the site regularly.
• All required signage/labels on storage and waste containers are clear and intact.
• Waste containers are intact/sealed.
• Secondary containment is functioning as intended.
• No visible signs of spills/leaks in or near watercourses.
Construction Equipment and Machinery
• Construction vehicles and equipment are free of leaks.
• Equipment and vehicles are being maintained and refuelled a minimum of 100 m from the high water mark.
Erosion and Sediment Control (ESC)
• Visible evidence of erosion (e.g., washouts, rilling, slumping).
• Visual inspection of water quality (turbidity) (e.g., sediment plume visible in nearby watercourses; site run off is visibly turbid)
• Existing drainage is adequately managing site run off (e.g., runoff is directed away from surfaces that are susceptible to erosion)
• Stockpiled materials (e.g., overburden, soil piles) are stored away from watercourses and adequately protected.
• ESC measures have been properly installed.
• ESC measures have been adequately maintained and functioning as intended (eg., no excessive sediment accumulation behind silt fencing and or check dams; Interceptor/diversion ditches are intact with no visible signs of channel erosion)
Sensitive Areas
• Construction limits and any sensitive areas have been identified and are clearly marked (e.g., soft floodplains, unstable banks).
• Clearing limits are clearly marked prior to vegetation removal.
• Riparian clearing has been conducted within the designated area. No vegetation damage or removal outside clearing limits.
Working In/Near Watercourses
• All heavy equipment remains above the high water mark.
• During instream works downstream flows are maintained at all times.
• Pump intakes used in fish bearing water courses are adequately screened.
• Pumps are discharged onto a non-erodible surface, such as geotextile or rock apron.

7.1.3 Post-Construction

Post-Construction inspections are conducted to ensure that the site has been adequately restored and that the watercourse, including banks and approaches are physically stable.

Table 10. Post-construction inspection requirements for sites located at or near watercourses.

POST CONSTRUCTION INSPECTION
Deleterious Substances
• All waste (hazardous and non-hazardous) has been removed from site.
• No visible spills.
Construction vehicles, equipment and materials
• All construction equipment and materials have been removed
• All temporary stream crossings or diversions have been removed.
Remediation
• Disturbed areas and slopes have been adequately restored and stabilized (rip rap, seeding, plantings, etc.)
• Crossing sites are physically stable; no visible signs of channel or bank erosion, slumping, etc.[1]
• Vegetation growth/survival in seeded/planted areas

1 – physical stability assessments should be conducted following completion of site remediation, after first storm event, and after first spring freshet.

7.2 MONITORING

Monitoring will be conducted during each construction phase to ensure that environmental protection and mitigation measures are performing as intended and to identify where adaptive management is required.

7.2.1 Pre-construction

TSS and turbidity sampling will be conducted prior to construction to establish a TSS-turbidity relationship for the project area. This relationship will facilitate use of turbidity as a proxy for TSS allowing for rapid onsite assessment of potential water quality impacts during the construction phase of the Project.

7.2.2 Construction

A potential effect of ASR crossing construction is the degradation of water quality due to the introduction of sediment and other deleterious substances. These potential effects are of particular concern during instream construction activities. Water quality will be monitored

during in water work that is conducted in streams that provide or are directly connected to fish habitat.

7.2.2.1 Turbidity Monitoring

The primary potential impacts from instream construction activities are sediment re-suspension and erosion in relation to the disturbance to the streambed and bank, and alterations to channel hydraulics. The primary indicator for these impacts is total suspended solids (TSS), with turbidity used as a surrogate for rapid on-site monitoring.

A turbidity monitoring program will be conducted during instream construction activities to document the spatial extent and magnitude of impacts to turbidity/TSS levels. Turbidity monitoring will use an upstream-downstream approach. Data collected at downstream sites will be compared to upstream reference sites (i.e., the background conditions) to quantify the effects of construction on TSS/turbidity and facilitate comparison of increases to MWQSOGs for the protection of aquatic life (MWS 2011).

Monitoring will consist of regular *in situ* turbidity measurements at transects and periodic measurements in the plume.

Transect Monitoring

Transect monitoring will be conducted before, during and after instream activities. A minimum of three transects will be established as follows:

- one transect upstream of the stream crossings (Transect 1), as close as feasible but distant enough so as to avoid any potential effects of construction (i.e., upstream of the cleared RoW);
- one transect downstream of the stream crossings (Transect 2), as close a practical considering safety and other considerations, such as construction activities (i.e., within the mixing zone to the extent possible); and
- one transect located at the end of the mixing zone (Transect 3), precise locations of transects will be subject to access and safety considerations.

Precise locations of transects will be determined based on site specific conditions at the time of instream construction (e.g., stream discharge, length of the mixing zone), but will cover a reach that is sufficiently large to determine the effects in the initial zone of dilution and downstream areas. Stream size may warrant establishment of additional transects located further downstream. Depending on site conditions, turbidity loggers may be deployed in the streams during construction to assist in data collection (e.g., at locations that are not readily accessible).

The number of sampling sites at each transect will be dependent upon the wetted width at the time of monitoring, but typically three sites are established per transect: left quarter channel, mid-channel, and right quarter channel. If turbidity data indicate that MWQSOGs for the protection of aquatic life are being exceeded, corrective actions will be undertaken and plume monitoring will be initiated.

The frequency of transect monitoring will be adapted to reflect the duration and nature of instream activities, and will target collection of data during both periods of peak TSS levels as well as more typical conditions.

Plume Monitoring

Plume monitoring will be conducted to estimate the downstream extent and magnitude of any sediment plume. Approximately three transects (or less, depending on conditions), will be established within the mixing zone. The number and location of transects will be determined at the time of monitoring. Laboratory TSS samples and turbidity measurements will be collected across each transect.

The frequency of plume monitoring will be determined based on the duration and intensity of the plume and nature of instream activities.

TSS-Turbidity Relationship

TSS will be measured in the laboratory and turbidity will also be measured *in situ*. A relationship between TSS and turbidity will be developed to facilitate the use of more frequent *in situ* measurements of turbidity to estimate TSS concentrations.

7.2.2.2 Cofferdam Dewatering Monitoring

Dewatering of coffer dams can result in discharges of water with excessively high TSS (e.g., at culvert placements) or pH values (at pier placements due to contact with concrete). All water pumped from coffer dams will be monitoring to determine if it meets MWQSOGs. Should monitoring results indicate that guidelines are exceeded, appropriate mitigation measures will be implemented to treat the water before it re-enters the watercourse.

7.2.3 Post-Construction

No post-construction monitoring is proposed.

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Appendix 1. Water quality parameters measured in surface waters of Family Lake, Manitoba (MCWS 2013).

			Alkalinity				Nitrogen			Phosphorous								
Sample Location	Site ID	Sample Date	Total (CaCO3) (mg/L)	Bicarbonate (HCO_3) (mg/L)	Carbonate (CO_3) (mg/L)	Hydroxide (OH) (mg/L)	Total Ammonia (mg/L N)	Dissolved Nitrate/ nitrite (mg/L N)	Total Kjeldahl (mg/L)	Dissolved P (mg/L)	Total P (mg/L)	Turbidity (NTU)	True Colour (TCU)	Laboratory pH (pH units)	Laboratory Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Biochemical Oxygen Demand (mg/L)	*E. coli* (CFU/100 mL)
MWQSOGs			-	-	-	-	*2.6-15.4**	*2.93*	-	-	*0.025*	-	-	*6.5-9.0*	-	*6.0-6.5* [1]	-	*200* [2]
Family Lake D/S Little Grand Rapids Community	MB05RDS016	05/09/2013	30	36	<12	<6.8	<0.01	0.013	0.34	0.0043	0.018	1.67	52.1	7.69	54	8.3	<6	10
Family Lake D/S of Rapids	MB05RDS017	05/09/2013	30	36	<12	<6.8	<0.01	0.025	0.35	0.0038	0.012	1.29	52.5	7.66	54	**5.8**	<6	<10
Family Lake 100 Meters South of Manitoba Natural Resources Yard	MB05RDS018	05/09/2013	30	36	<12	<6.8	<0.01	0.038	0.35	0.0042	0.014	1.67	50.7	7.67	54	8.6	<6	<10

			Productivity		Total Metals and Major Ions												
Sample Location	Site ID	Sample Date	*In situ* Temperature (^oC)	Chlorophyll *a* (µg/L)	Secchi Disk Depth (m)	Hardness as CaCO3 (mg/L)	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Cesium mg/L	Chloride-Dissolved (mg/L)	Chromium mg/L
MWQSOGs			-	-	-	-	*0.1*	-	*0.15*	-	-	-	*1.50*	*0.00010-0.00055**	-	-	-	*0.0029-0.609**
Family Lake D/S Little Grand Rapids Community	MB05RDS016	05/09/2013	19.3	4.96	1.5	26.6	0.0722	<0.0002	0.00068	0.00637	<0.0002	<0.0002	<0.01	<0.00001	7.28	<0.0001	0.2	<0.001
Family Lake D/S of Rapids	MB05RDS017	05/09/2013	19.2	2.29	>1.0	26.1	0.0511	<0.0002	0.00051	0.00597	<0.0002	<0.0002	<0.01	<0.00001	7.22	<0.0001	<0.2	<0.001
Family Lake 100 Meters South of Manitoba Natural Resources Yard	MB05RDS018	05/09/2013	19.1	4.58	1.21	26.5	0.0591	<0.0002	0.00051	0.00594	<0.0002	<0.0002	<0.01	<0.00001	7.25	<0.0001	<0.2	<0.001

			Total Metals and Major Ions														
Sample Location	Site ID	Sample Date	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium (mg/L)	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Phosphorus mg/L	Potassium mg/L	Rubidium mg/L	Selenium mg/L
MWQSOGs			-	*0.00296-0.00402**	*0.3*	*0.00059-0.0151**	-	-	-	*0.000026*	*0.073*	*0.0167-0.153**	-	-	-	*0.001*
Family Lake D/S Little Grand Rapids Community	MB05RDS016	05/09/2013	<0.0002	0.00065	0.18	<0.00009	0.00118	2.05	0.0105	<0.00002	<0.0002	<0.002	<0.1	0.579	0.00162	<0.001
Family Lake D/S of Rapids	MB05RDS017	05/09/2013	<0.0002	0.00056	0.15	<0.00009	0.00103	1.96	0.0080	<0.00002	<0.0002	<0.002	<0.1	0.565	0.00157	<0.001
Family Lake 100 Meters South of Manitoba Natural Resources Yard	MB05RDS018	05/09/2013	<0.0002	0.00059	0.15	<0.00009	0.00111	2.03	0.0066	<0.00002	<0.0002	<0.002	<0.1	0.562	0.00160	<0.001

			Total Metals and Major Ions														
Sample Location	Site ID	Sample Date	Silicon (mg/L)	Silver mg/L	Sodium mg/L	Strontium mg/L	Sulphate- Dissolved (mg/L)	Tellurium mg/L	Thallium mg/L	Thorium (mg/L)	Tin mg/L	Titanium mg/L	Tungsten mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L
MWQSOGs			-	*0.0001*	-	-	-	-	*0.0008*	-	-	-	-	*0.015*	-	*0.0384-0.0390**	-
Family Lake D/S Little Grand Rapids Community	MB05RDS016	05/09/2013	1.51	<0.0001	0.966	0.0161	0.71	<0.0002	<0.0001	<0.0001	<0.0002	0.00198	<0.0001	0.00011	0.00036	0.0025	<0.0004
Family Lake D/S of Rapids	MB05RDS017	05/09/2013	1.42	<0.0001	0.941	0.0157	0.70	<0.0002	<0.0001	<0.0001	<0.0002	0.00102	<0.0001	0.00011	0.0003	<0.002	<0.0004
Family Lake 100 Meters South of Manitoba Natural Resources Yard	MB05RDS018	05/09/2013	1.45	<0.0001	0.938	0.0158	0.70	<0.0002	<0.0001	<0.0001	<0.0002	0.00142	<0.0001	0.00011	0.00041	<0.002	<0.0004

* - site specific guideline calculated
1 – the open-water guideline for dissolved oxygen for the protection of cool-water and cold-water species. 2 – recreational guideline

Appendix 2. Substrate verification data collected by Ponar grabs during side scan sonar surveys at Site 7 – Fishing to Family Lake Channel.

	UTM		SUBSTRATE TYPE								
SITE REPLICATE	EASTING	NORTHING	CLAY	SILT	SAND	GRAVEL	COBBLE	COBBLE/ BOULDER	BOULDER	BOULDER/ BEDROCK	COMMENT
1	331044	5770841	-	-	-	-	-	100	-	-	
2	331223	5770568	95	-	5	-	-	-	-	-	
3	331178	5770676	-	-	100	-	-	-	-	-	
4	331215	5770689	-	10	90	-	-	-	-	-	
5	331151	5770681	-	-	100	-	-	-	-	-	
6	331091	5770678	-	-	-	-	100	-	-	-	
7	331083	5770771	-	-	100	-	-	-	-	-	
8	331029	5770781	-	-	100	-	-	-	-	-	
9	330955	5770784	-	-	-	-	-	-	-	Likely	no grab
10	330929	5770823	-	-	-	50	50	-	-	-	
11	331113	5770680	-	-	-	-	100	-	-	-	
12	331098	5770577	-	-	100	-	-	-	-	-	
13	331137	5770493	-	-	-	-	-	-	100	-	no grab
14	331126	5770389	-	-	-	100	-	-	-	-	
15	331189	5770395	-	-	-	-	-	-	-	Likely	no grab
16	331244	5770366	-	-	90	10	-	-	-	-	
17	331288	5770317	-	5	95	-	-	-	-	-	
18	331254	5770224	-	5	90	5	-	-	-	-	
19	331255	5770123	-	-	-	-	-	-	-	100	
20	331148	5770170	-	-	-	-	-	-	-	Likely	no grab
21	331050	5770114	-	-	-	100	-	-	-	-	
22	331076	5770033	-	-	-	-	-	-	-	Likely	no grab
23	331153	5770635	-	-	-	100	-	-	-	-	
24	331160	5770669	-	-	100	-	-	-	-	-	
25	331158	5770690	-	-	100	-	-	-	-	-	
26	331127	5770680	-	-	-	-	100	-	-	-	

Appendix 3. Effects assessment criteria following CEAA.

Criterion	Low	Moderate	High
Magnitude (of the effect)	• 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 guideline values.
Geographic Extent (of the effect)	• Effect is limited to the project site/footprint.	• Effect extends into areas beyond the project site/footprint boundary.	• Effect is trans-boundary in nature.
Duration (of the effect)	• 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 operational life of the project.
Frequency (of conditions causing the effect)	• Conditions or phenomena causing the effect occur infrequently (i.e. < once per year).	• Conditions or phenomena causing the effect occur at regular intervals although infrequent intervals (i.e. < once per month).	• Conditions or phenomena causing the effect occur at regular and frequent intervals (i.e. > once per month).
Permanence (of effect)	• Effect is readily reversible over a short period of time (i.e. one growing season).	• Effect is not readily reversible during the life of the project.	• Effect is permanent.
Ecological Context (of effect)	• 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.

Appendix 4. Size and abundance data for fish captured during the stream crossing assessment surveys, fall 2013.

Site	Watercourse	Sample Date	Gear Type[1]	Species	n[2]	Fork Length (mm)
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	173
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	140
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	333
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	115
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	110
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	99
7	Fishing to Family Lake Channel	27-Sept-13	GN	Yellow Perch	1	62
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	101
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	283
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	250
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	200
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	282
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	189
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	249
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	298
7	Fishing to Family Lake Channel	27-Sept-13	GN	Yellow Perch	1	189
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	410
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	340
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	405
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	341
7	Fishing to Family Lake Channel	27-Sept-13	GN	Sauger	1	369
7	Fishing to Family Lake Channel	27-Sept-13	GN	Walleye	1	439
7	Fishing to Family Lake Channel	27-Sept-13	GN	White Sucker	1	481
7	Fishing to Family Lake Channel	27-Sept-13	GN	White Sucker	1	462
7	Fishing to Family Lake Channel	27-Sept-13	GN	White Sucker	1	461
9	Root Creek	29-Sept-13	EF	Burbot	1	219
9	Root Creek	29-Sept-13	EF	Burbot	1	154
9	Root Creek	29-Sept-13	EF	White Sucker	1	95
9	Root Creek	29-Sept-13	EF	Spottail Shiner	1	-
9	Root Creek	29-Sept-13	EF	Burbot	1	156
9	Root Creek	29-Sept-13	EF	Burbot	1	161
9	Root Creek	29-Sept-13	EF	Northern Pearl Dace	7	-
9	Root Creek	29-Sept-13	EF	Johnny Darter	1	-

1 – EF = backpack electrofisher; GN = gill net
2 = n = # of fish captured.

Appendix 5. Stream Crossing Assessment Summaries

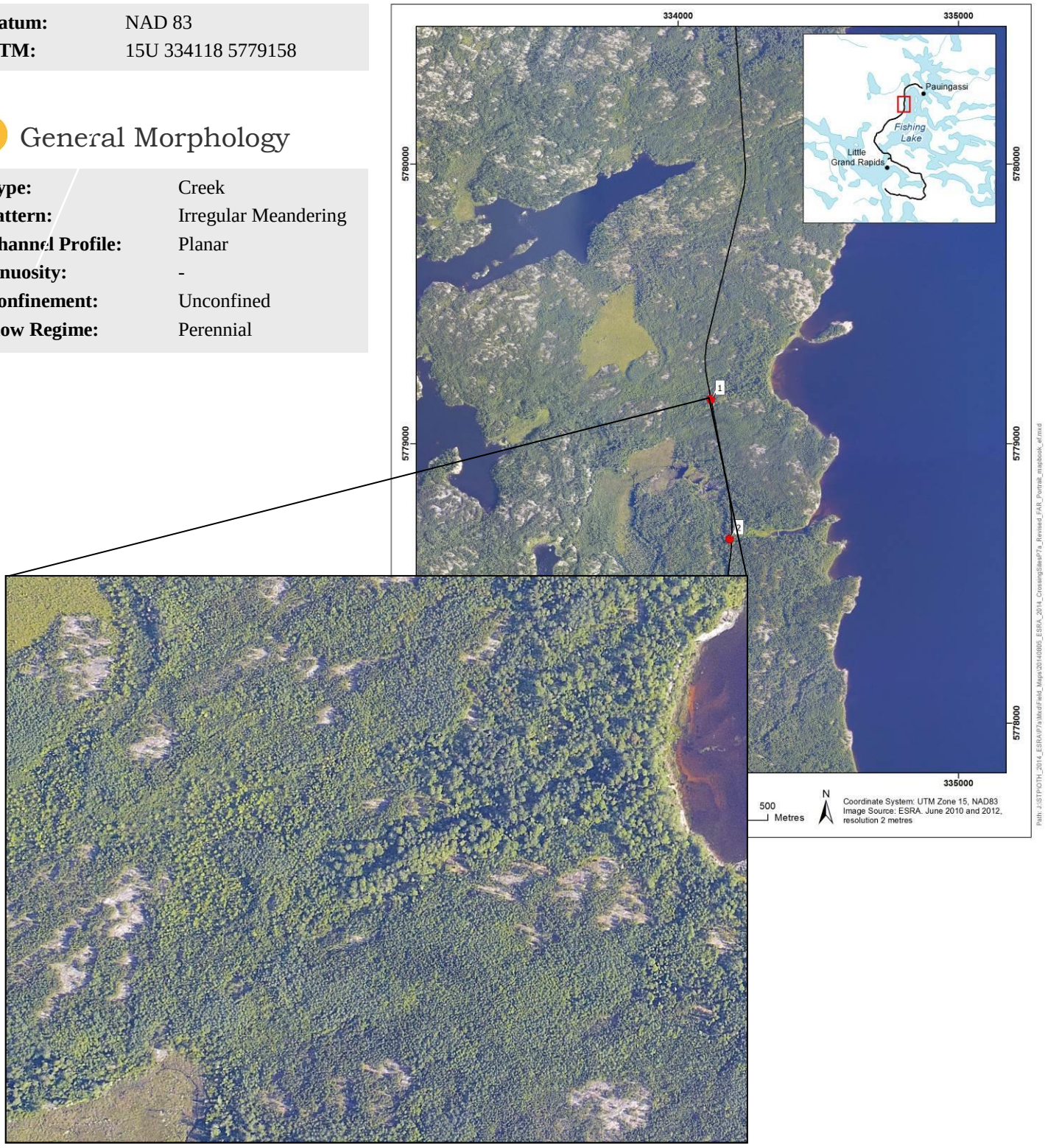
Site 1 Unnamed Fishing Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 334118 5779158

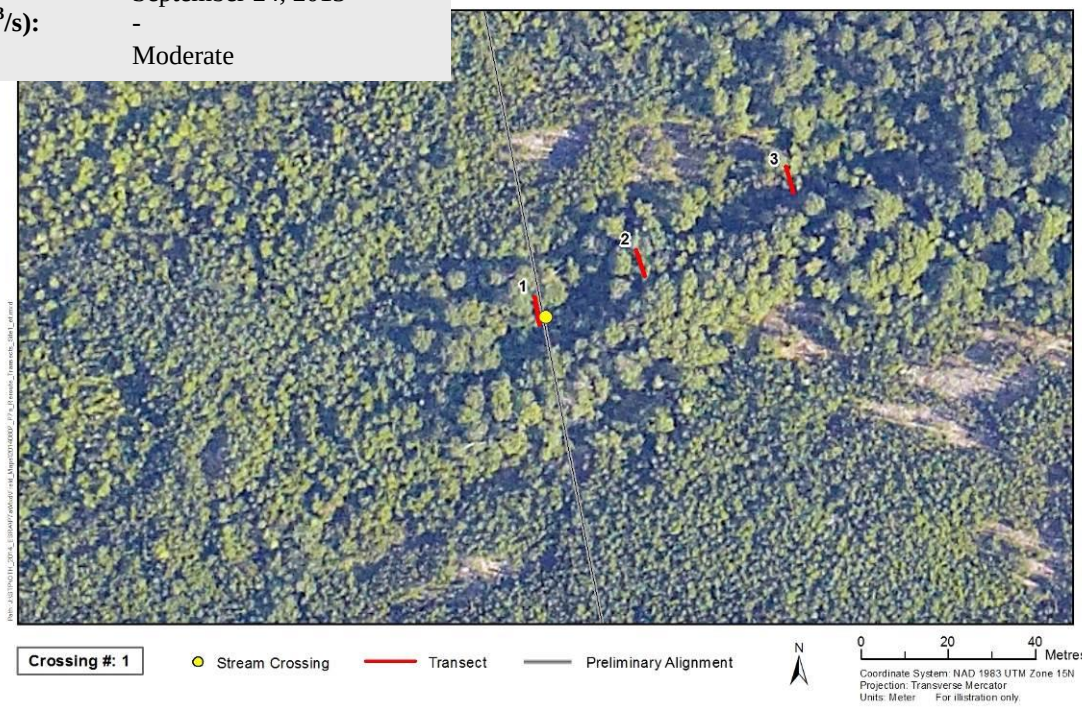
General Morphology

Type:	Creek
Pattern:	Irregular Meandering
Channel Profile:	Planar
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial



Site Conditions

Survey Date: September 24, 2013
Discharge (m^3/s): -
Stage: Moderate



+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	25 DS	65 DS	-	-
Channel and Flow					
Channel Width (m)	1.2	0.64	1.1	-	-
Wetted Width (m)	0.9	0.64	0.57	-	-
Depth at 25% (m)	0.08	0.05	0.09	-	-
Depth at 50% (m)	0.00	0.08	0.11	-	-
Depth at 75% (m)	0.03	0.09	0.07	-	-
Maximum Depth (m)	0.08	0.09	0.11	-	-
Gradient (%)	-	5	-	-	-
Banks					
Left Bank Height (m)	0.25	0.10	-	-	-
Right Bank Height (m)	0.09	0.15	-	-	-
Left Bank Shape	sloping	sloping	sloping	-	-
Right Bank Shape	sloping	sloping	sloping	-	-
Left Bank Materials	organics	organics	organics	-	-
Right Bank Materials	organics	organics	organics	-	-
Left Bank Stability	high	high	high	-	-
Right Bank Stability	high	high	high	-	-
Substrate Type and Distribution (%)					
Fines	100	100	100	-	-
Small Gravel	-	-	-	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	-	-	-	-	-
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	21.3	23.0	15.6	-	-
Right Bank	16.2	12.8	1.4	-	-
Riparian Distance (m)					
Left Bank	21.3	17.0	15.6	-	-
Right Bank	16.2	12.8	1.4	-	-
Riparian Vegetation Type[a]					
	DEC	MIX	GRA	-	-
Canopy Cover (%)					
	0	0	0	-	-

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	100	-	-
Pool	100	80	-	-	-
Rapid	-	-	-	-	-
Riffle	-	20	-	-	-
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Riffle
Temperature (°C):	11.71
pH:	5.42
Turbidity (NTU):	1.89
Specific Conductance (µS/cm):	30
DO (mg/L):	7.63

Downstream view of the channel at the crossing site.

Undefined channel 40 m US from the crossing site.

Subsurface flow 26 m downstream from the crossing site.

Absence of a defined channel at the creek mouth. Flow disperses through vegetation.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	-	15
Cover Composition (% of Total)		
Large Woody Debris	-	50
Overhanging Vegetation	-	20
Instream Vegetation	-	30
Pool	-	-
Boulder	-	-
Undercut Bank	-	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Low	Low
Rearing	Low	Low
Overwinter	None	None
Migration	None	None
Large Bodied Fish		
Spawning	None	None
Rearing	None	None
Overwinter	None	None
Migration	None	None

Comments
The creek is a first order stream that flows to Family Lake. The channel is defined intermittently; poorly defined sections and subsurface flows were identified in several areas downstream of the crossing. At the creek mouth, flows disperse through an area of sedges and there is no defined channel connection to Fishing Lake. Due to poor connectivity, the habitat is not expected to support large bodied fish species.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 0.1
Distance to Major DS Waterbody (km): 0.2 (Fishing Lake)
Connectivity: No

Comments
The habitat consists of an intermittent channel with poor connectivity to downstream receiving waters. This type of habitat is common within the region. There are no unique habitat features at or near the crossing location.

+ Fishery

Fishery Area: Fishing Lake

Fishery Users:

Commercial	None
Recreational	Family Lake Lodge
Aboriginal	Pauingassi First Nation

Comments
The unnamed watercourse flows to Fishing Lake, a waterbody that supports several recreational and Aboriginal fisheries. Due to the absence of a defined channel connection to Fishing Lake, the stream does not directly support these fisheries.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	No	Fish use of the immediate crossing area is unlikely due to the presence of a barrier (subsurface flow) downstream from the crossing. Downstream areas provide marginal habitat for forage fish.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within the footprint of the culvert Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within small boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The crossing area does not provide direct habitat for fish that are part of or support a CRA fishery. Based on poor connectivity the contribution of the habitat to downstream CRA fisheries is likely minimal. Habitat impacts are expected to result in no measureable effect to local CRA fish populations.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Serious harm to fish is not expected as the habitat does not support fish that are part of or support a CRA fishery.

Net Habitat Change

Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	36 m^2	0 m^2	-36 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (1.2 m).

Site 2 Unnamed Fishing Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 334185 5778658

General Morphology

Type:	Creek
Pattern:	Meandering
Channel Profile:	Notched
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial

Site Conditions

Survey Date: September 24, 2013
Discharge (m^3/s): 0.0009
Stage: Low

+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	25 US	75 US	25 DS	85 DS
Channel and Flow					
Channel Width (m)	1.3	0.60	1.06	1.38	2.35
Wetted Width (m)	0.75	0.60	0.97	1.03	2.14
Depth at 25% (m)	0.12	0.14	0.15	0.002	0.08
Depth at 50% (m)	0.14	0.10	0.09	0.11	0.05
Depth at 75% (m)	0.13	0.08	0.21	0.10	0.06
Maximum Depth (m)	0.14	0.14	0.21	0.11	0.08
Gradient (%)	-	-	-	-	-
Banks					
Left Bank Height (m)	0.25	0.10	-	-	-
Right Bank Height (m)	0.39	0.15	-	-	-
Left Bank Shape	vertical	vertical	vertical	vertical	sloping
Right Bank Shape	vertical	vertical	vertical	vertical	vertical
Left Bank Materials	organics/boulder	organics/boulder	organics/boulder	organics	organics/boulder
Right Bank Materials	organics/boulder	organics/boulder	organics/boulder	organics	organics/boulder
Left Bank Stability	high	high	high	high	high
Right Bank Stability	high	high	high	high	high
Substrate Type and Distribution (%)					
Fines	50	50	50	100	60
Small Gravel	-	-	-	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	50	50	50	-	40
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	22.0	14.0	23.6	8.1	20.4
Right Bank	24.0	16.6	13.8	5.1	2.7
Riparian Distance (m)					
Left Bank	14.0	7.3	14.5	4.2	11.6
Right Bank	24.0	15.0	23.9	13.2	2.7
Riparian Vegetation Type[a]	DEC	DEC	DEC	DEC	GRA
Canopy Cover (%)	15	5	10	5	0

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	-	100	-
Pool	-	90	75	-	25
Rapid	-	-	-	-	-
Riffle	100	10	25	-	75
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Flat
Temperature (°C):	12.84
pH:	6.23
Turbidity (NTU):	6.36
Specific Conductance (µS/cm):	40
DO (mg/L):	9.82

Downstream view of channel at the crossing site.

Upstream view of channel at the crossing site.

Channel transitions from forest to broader grass floodplain 160 m downstream from the crossing (upstream view).

Downstream view at mouth of the creek.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	30	10
Cover Composition (% of Total)		
Large Woody Debris	25	40
Overhanging Vegetation	20	5
Instream Vegetation	-	5
Pool	-	-
Boulder	50	50
Undercut Bank	5	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Moderate	Moderate
Rearing	Moderate	Moderate
Overwinter	Low	Low
Migration	Low	Low
Large Bodied Fish		
Spawning	Low	High
Rearing	Low	Moderate
Overwinter	Low	Low
Migration	Low	Low

Comments

The crossing lies within a forested reach of the unnamed tributary and is fed by a large beaver dam impoundment located 150 m upstream from the alignment. The channel has riffle-pool morphology with a sand and boulder substrate. Approximately 160 m downstream from the crossing the creek transitions to a lower gradient channel dominated by fine substrates. Two beaver dams were identified in this downstream reach; however both were breached and are passable by fish. Large-bodied fish habitat is limited to the lower stream reach, near Fishing Lake. In this reach, floodplain and backwatering areas are suitable for spawning by Northern Pike when inundated in spring.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none; one forage fish observed

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 0.2
Distance to Major DS Waterbody (km): 0.4 (Fishing Lake)
Connectivity: Yes - Likely

Comments
The proposed alignment crosses a forested stream reach that provides riffle-pool habitat with a boulder/sand substrate. Suitable habitat for CRA species (Northern Pike) is limited to the lower stream reach. Habitat in both reaches is common in the area. There are no unique features at or near the crossing location.

+ Fishery

Fishery Area: Fishing Lake

Fishery Users:

Commercial	None[a]
Recreational	Fishing Lake Lodge
Aboriginal	Pauingassi First Nation

Comments
The unnamed watercourse is a tributary of Fishing Lake. Fishing Lake supports both recreational and Aboriginal fisheries, such as Walleye and Northern Pike. The lower reach of the creek is suitable for spawning by Northern Pike; however suitable habitat is limited in area and is not considered critical or limiting.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	Yes	Suitable Northern Pike habitat is present in the lower reach of the stream.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within the footprint of the culvert Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within small boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The habitat at and upstream of the immediate crossing area is expected to support only forage fish species and likely contributes minimally to downstream fisheries. Habitat impacts are expected to result in no measureable effect to local CRA fish populations as suitable habitat for relevant fish is located outside of the project right-of-way.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of direct habitat for CRA fishery species within the project footprint, culvert construction and operation is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	39 m^2	0 m^2	-39 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (1.3 m).

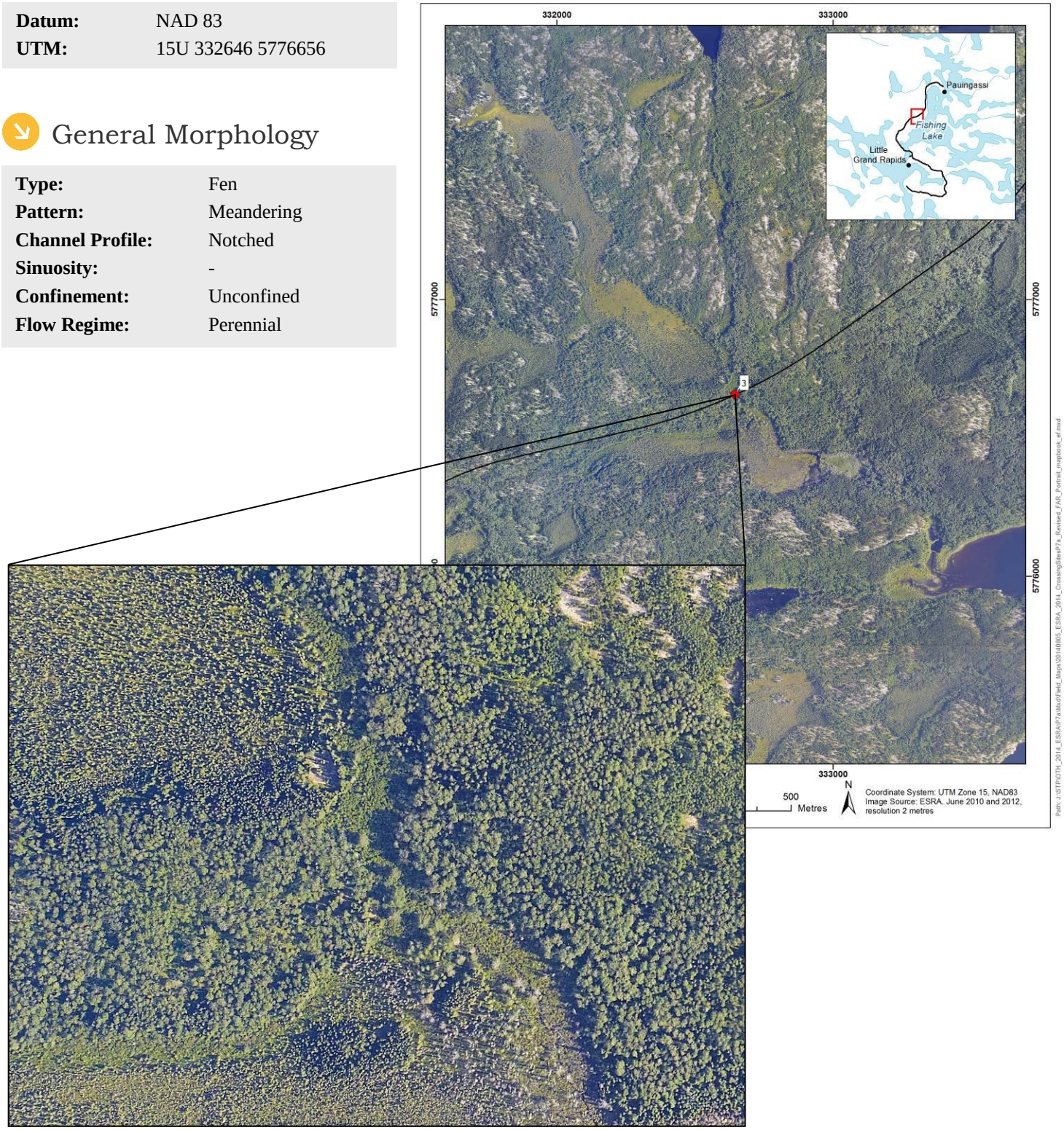
Site 3 Unnamed Fishing Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 332646 5776656

General Morphology

Type:	Fen
Pattern:	Meandering
Channel Profile:	Notched
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial



Site Conditions

Survey Date: September 25, 2013
Discharge (m^3/s): -
Stage: Moderate

+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	600 DS	430 DS	-	-	-
Channel and Flow					
Channel Width (m)	1.75	1.0	-	-	-
Wetted Width (m)	1.05	1.0	-	-	-
Depth at 25% (m)	0.06	0.08	-	-	-
Depth at 50% (m)	0.07	0.13	-	-	-
Depth at 75% (m)	0.05	0.08	-	-	-
Maximum Depth (m)	0.07	0.13	-	-	-
Gradient (%)	-	-	-	-	-
Banks					
Left Bank Height (m)	0.32	0.2	-	-	-
Right Bank Height (m)	0.3	0.15	-	-	-
Left Bank Shape	sloping	vertical	-	-	-
Right Bank Shape	vertical	vertical	-	-	-
Left Bank Materials	boulder/organics	organics	-	-	-
Right Bank Materials	boulder/organics	organics	-	-	-
Left Bank Stability	high	high	-	-	-
Right Bank Stability	high	high	-	-	-
Substrate Type and Distribution (%)					
Fines	30	100	-	-	-
Small Gravel	10	-	-	-	-
Large Gravel	10	-	-	-	-
Cobble	40	-	-	-	-
Boulder	10	-	-	-	-
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	17.2	49	-	-	-
Right Bank	19.3	24	-	-	-
Riparian Distance (m)					
Left Bank	4.5	49	-	-	-
Right Bank	12.0	24	-	-	-
Riparian Vegetation Type[a]					
	MIX	SHR	-	-	-
Canopy Cover (%)					
	<1	0	-	-	-

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	100	-	-	-
Pool	25	-	-	-	-
Rapid	-	-	-	-	-
Riffle	75	-	-	-	-
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Pool
Temperature (°C):	11.97
pH:	5.00
Turbidity (NTU):	2.10
Specific Conductance (µS/cm):	29
DO (mg/L):	1.15

Aerial view of the crossing site. The site lacks a continuous defined channel.

Downstream view of beaver impoundment and dam located 390 m downstream from crossing.

Upstream view of beaver dam and large impoundment approximately 390 m downstream from the crossing site.

Narrow channel within a broad grass floodplain at Transect 2 located 430 m downstream from crossing.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	-	25
Cover Composition (% of Total)		
Large Woody Debris	-	20
Overhanging Vegetation	-	50
Instream Vegetation	-	20
Pool	-	-
Boulder	-	10
Undercut Bank	-	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Low	Low
Rearing	Low	Low
Overwinter	Low	Low
Migration	Low	Low
Large Bodied Fish		
Spawning	Low	Low
Rearing	Low	Low
Overwinter	Low	Low
Migration	Low	None

Comments
The crossing sites lies within fen and has been heavily impacted by beaver dams. The crossing is poorly connected to fish bearing waters due to the absence of a well-defined continuous channel at the crossing, the presence of a large beaver dam 390 m downstream from the crossing, and absence of defined channel immediately downstream from the dam. A defined, continuous channel with marginal habitat suitable for forage fish species was identified well outside the proposed ROW, 420 m downstream from the crossing. Fish use is expected to be limited to forage fish species tolerant of low dissolved oxygen levels.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 0.5
Distance to Major DS Waterbody (km): 1.2 (Fishing Lake)
Connectivity: No

Comments
The crossing is located on a low gradient stream that has been heavily impacted by beaver activity. The habitat consists of flat, pool and riffle areas with fine substrates and is poorly connected to more extensive downstream habitats. This type of habitat is typical of small boreal streams within the region, comprising the majority of small stream habitat.

+ Fishery

Fishery Area: Fishing Lake

Fishery Users:

Commercial	None[a]
Recreational	Fishing Lake Lodge
Aboriginal	Pauingassi First Nation

Comments
The unnamed watercourse is a tributary of Fishing Lake. Fishing Lake supports both recreational and Aboriginal fisheries, such as Walleye and Northern Pike. The importance of the habitat to the Fishing Lake fishery is considered low; the site is not expected to support CRA species due to poor connectivity to Fishing Lake.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	No	The stream provides marginal habiat for forage fish species.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within footprint of the culvert. Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The habitat is expected to support only forage fish species. The habitat is marginal and likely contributes minimally to downstream CRA fishery populations. Consequently, habitat impacts are expected to result in no measureable effect to downstream fisheries.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of direct habitat for CRA fishery species, culvert construction and operation is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	52.5 m^2	0 m^2	-52.5 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (1.75 m).

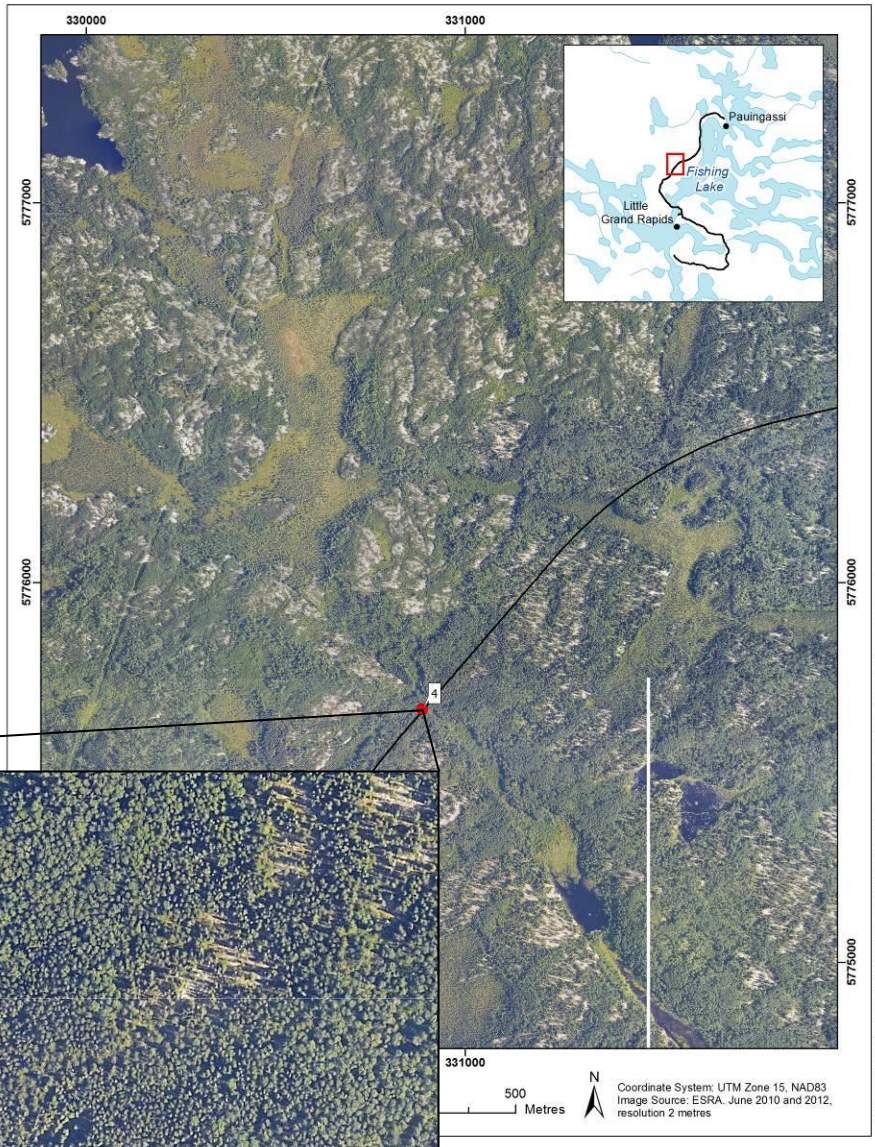
Site 4 Unnamed Drainage

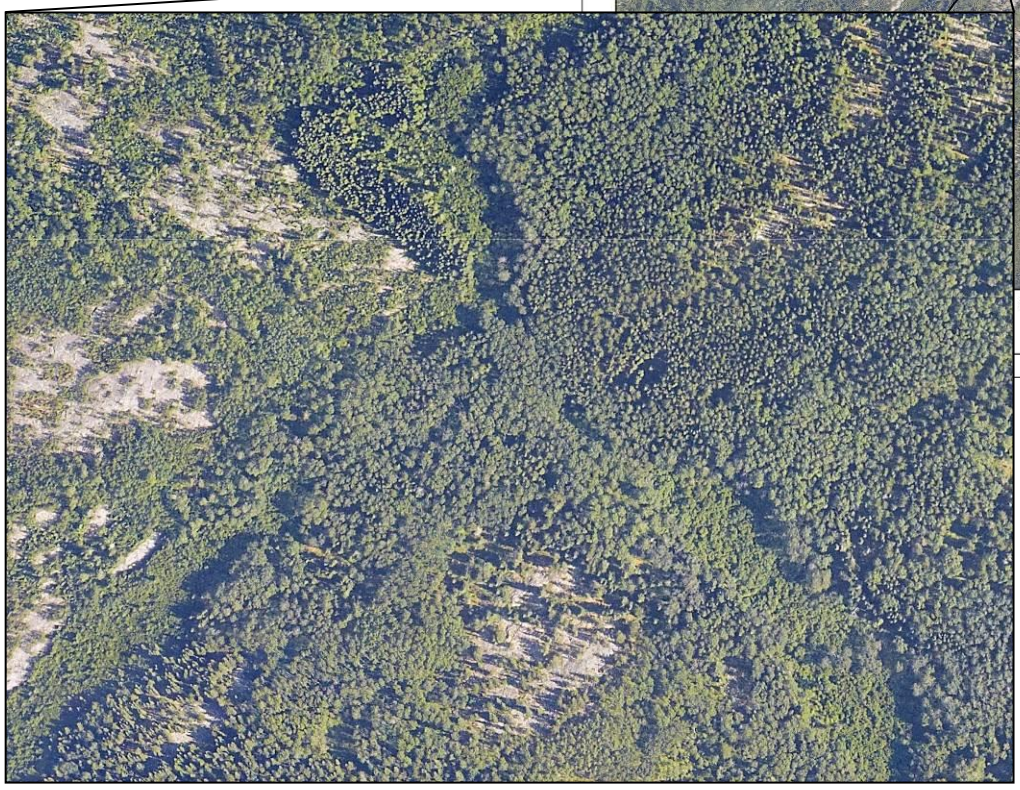
Location

Datum:	NAD 83
UTM:	15U 330887 5775666

General Morphology

Type:	-
Pattern:	-
Confinement:	-
Flow Regime:	-
US Drainage Area (km^2):	0.07
Distance to Major DS Waterbody (km):	2.0 (Fishing L.)
Connectivity:	No





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Fish Habitat Classification

+ Fish Habitat

Fish Habitat Present	No
Fish Habitat Classification	No Fish Habitat

Comments
The crossing site is located near the headwaters of a small drainage that flows to Fishing Lake. There is no visible channel at the crossing site. Downstream investigation confirmed the lack of a defined channel connection to Fishing Lake.

The site is classified as No Fish Habitat based on the lack of a channel or defined connection to fish-bearing waters.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:

a – pers. comm. ESRA

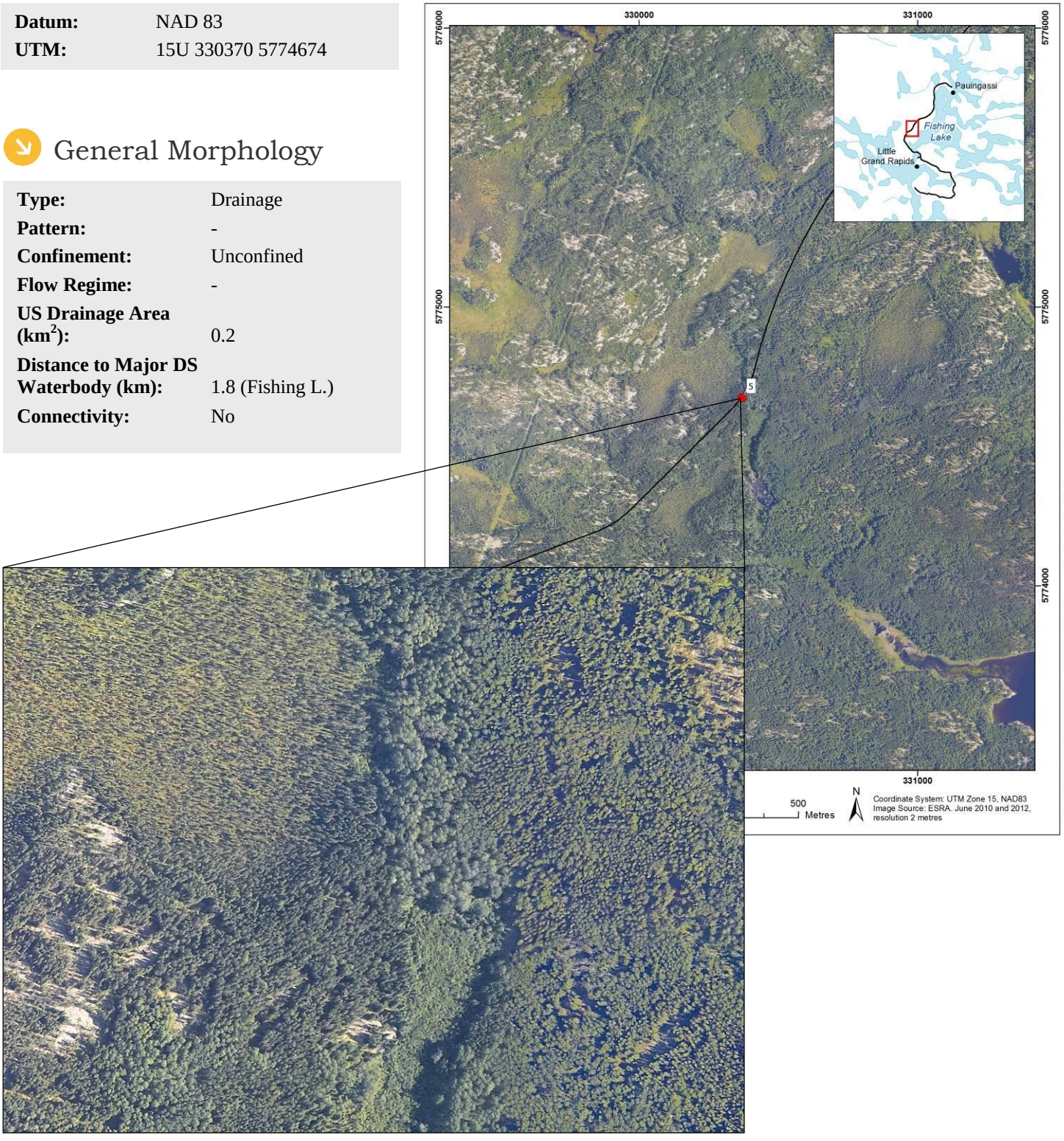
Site 5 Unnamed Fishing Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 330370 5774674

General Morphology

Type:	Drainage
Pattern:	-
Confinement:	Unconfined
Flow Regime:	-
US Drainage Area (km^2):	0.2
Distance to Major DS Waterbody (km):	1.8 (Fishing L.)
Connectivity:	No



Fish Habitat Classification

+ Fish Habitat

Fish Habitat Present	No
Fish Habitat Classification	No Fish Habitat

Comments
The crossing site is located near the headwaters of a small drainage that flows to Fishing Lake. The watercourse has been heavily impacted by beaver activity. The crossing is located within a low lying area and there is no visible channel. A visible channel was identified approximately 850 m downstream from the crossing.

The crossing site is classified as No Fish Habitat based on the lack of a channel or defined connection to fish-bearing waters.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:

a – pers. comm. ESRA

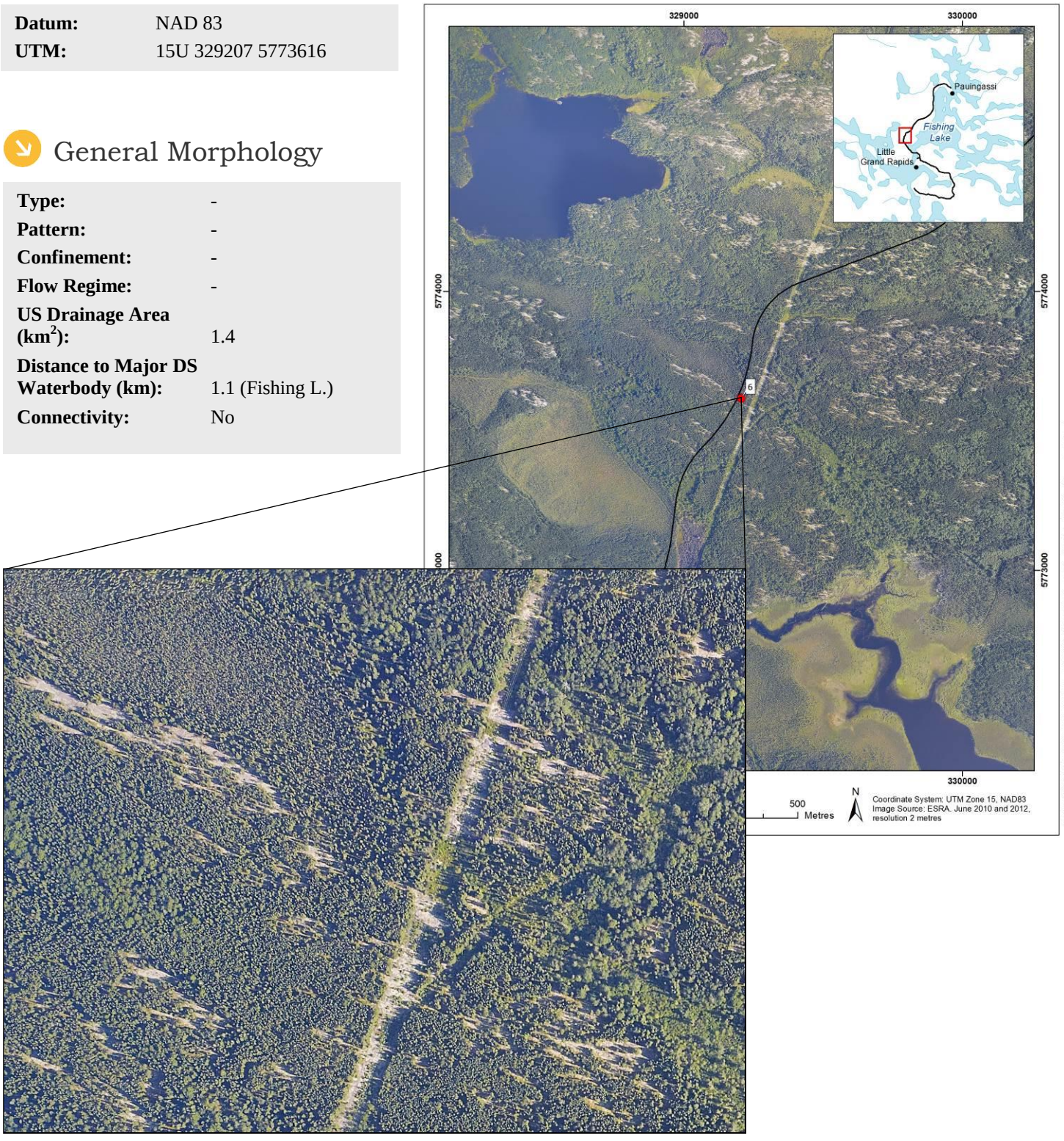
Site 6 Unnamed Drainage

Location

Datum:	NAD 83
UTM:	15U 329207 5773616

General Morphology

Type:	-
Pattern:	-
Confinement:	-
Flow Regime:	-
US Drainage Area (km^2):	1.4
Distance to Major DS Waterbody (km):	1.1 (Fishing L.)
Connectivity:	No



North/South Consultants Inc.
Aquatic Environment Specialists

Fish Habitat Classification

+ Fish Habitat

Fish Habitat Present	No
Fish Habitat Classification	No Fish Habitat

Comments
The CANVEC hydrographic mapping dataset indicates that the crossing is located at the headwaters of a small drainage that flows to Fishing Lake. There was no channel identified at the crossing site.

The crossing site is classified as No Fish Habitat based on lack of a defined channel.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:

a – pers. comm. ESRA

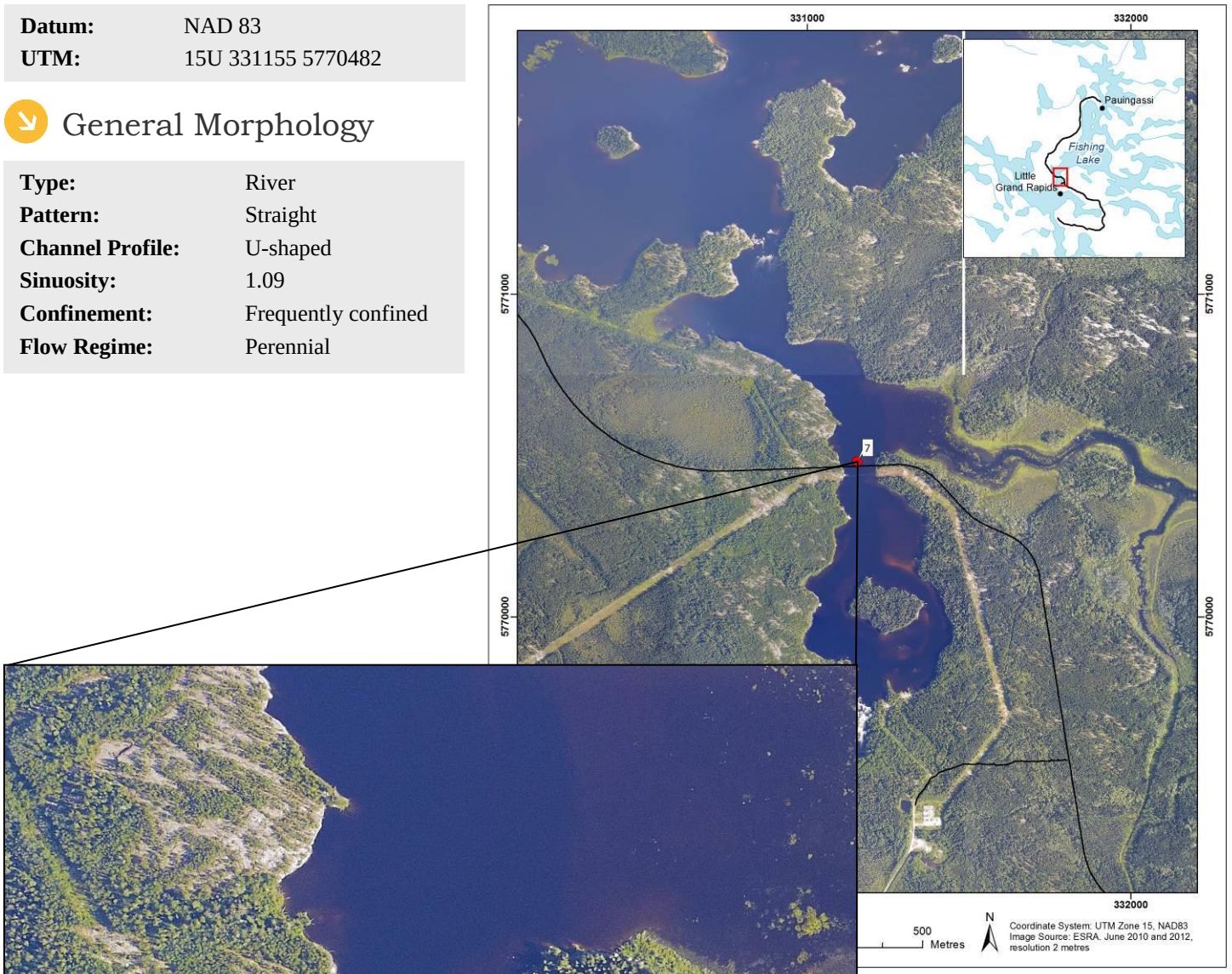
Site 7 Fishing to Family Lake Channel

Location

Datum:	NAD 83
UTM:	15U 331155 5770482

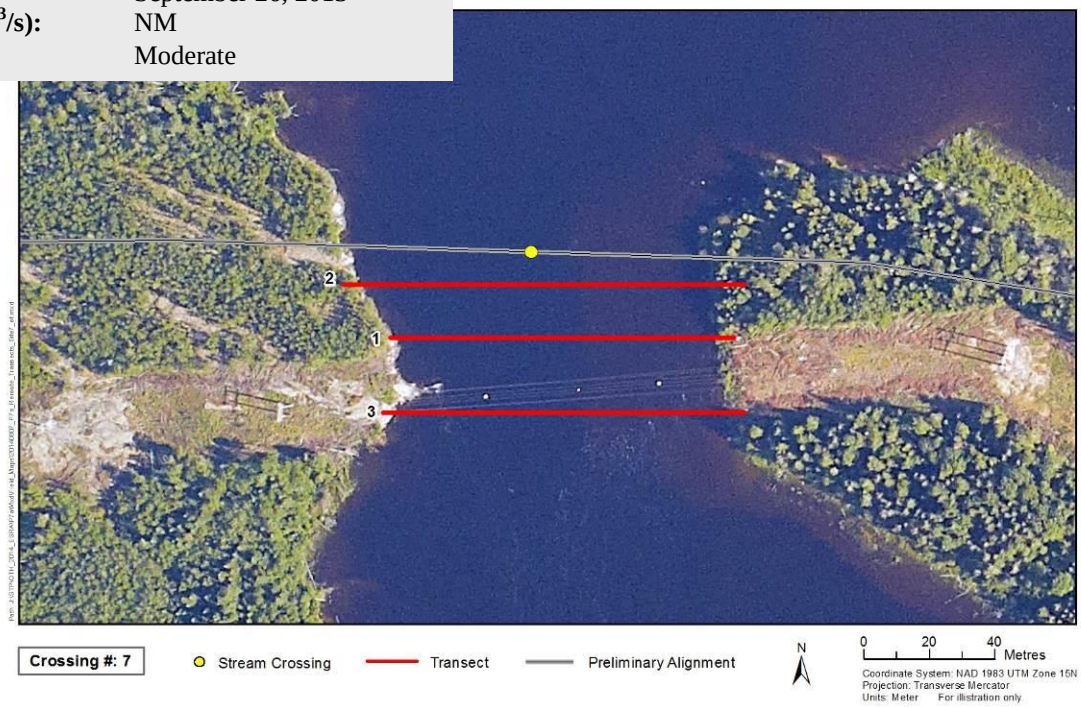
General Morphology

Type:	River
Pattern:	Straight
Channel Profile:	U-shaped
Sinuosity:	1.09
Confinement:	Frequently confined
Flow Regime:	Perennial



Site Conditions

Survey Date: September 26, 2013
Discharge (m^3/s): NM
Stage: Moderate



+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a,b] (m)	0	25 US	25 DS	-	-
Channel and Flow					
Channel Width (m)	101	120	102	-	-
Wetted Width (m)	97	114	101	-	-
Depth at 25% (m)	-	-	-	-	-
Depth at 50% (m)	-	-	-	-	-
Depth at 75% (m)	-	-	-	-	-
Maximum Depth (m)	-	-	-	-	-
Gradient (%)	-	-	-	-	-
Banks					
Left Bank Height (m)	1.2	1.7	2.3	-	-
Right Bank Height (m)	2.6	1.1	3.0	-	-
Left Bank Shape	sloping	sloping	sloping	-	-
Right Bank Shape	sloping	vertical	sloping	-	-
Left Bank Materials	organic	boulder/organic	organic	-	-
Right Bank Materials	bedrock	bedrock	bedrock	-	
Left Bank Stability	high	high	high	-	-
Right Bank Stability	high	high	high	-	-
Substrate Type and Distribution (%)					
Fines	-	-	-	-	-
Small Gravel	-	-	-	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	-	-	-	-	-
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing.
b – based on distance from flagged crossing site.

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	4.35	2.38	0	-	-
Right Bank	0	0	0	-	-
Riparian Distance (m)					
Left Bank	0	0	0	-	-
Right Bank	3.1	1.74	3.4	-	-
Riparian Vegetation Type[a]					
	SHR	SHR	SHR	-	-
Canopy Cover (%)					
	0	0	0	-	-

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	-	-	-
Pool	-	-	75	-	-
Rapid	-	-	-	-	-
Riffle	-	-	25	-	-
Run	100	100	-	-	-
Backwater	-	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Run
Temperature (°C):	14.80
pH:	6.97
Turbidity (NTU):	1.02
Specific Conductance (µS/cm):	49
DO (mg/L):	9.14

Downstream view of the crossing from Transect 2 (25 m upstream).

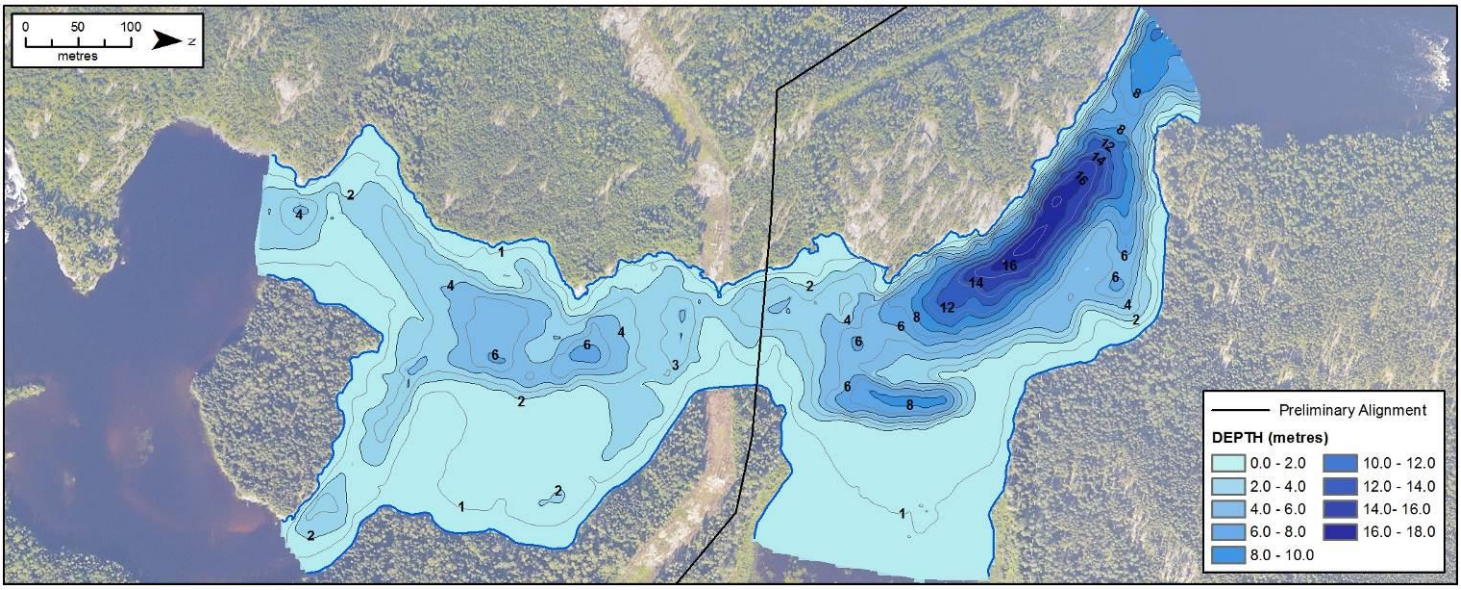
Cross channel (east) view of the crossing site.

Upstream view of west bank from crossing site.

Cross channel (west) view of the crossing site.

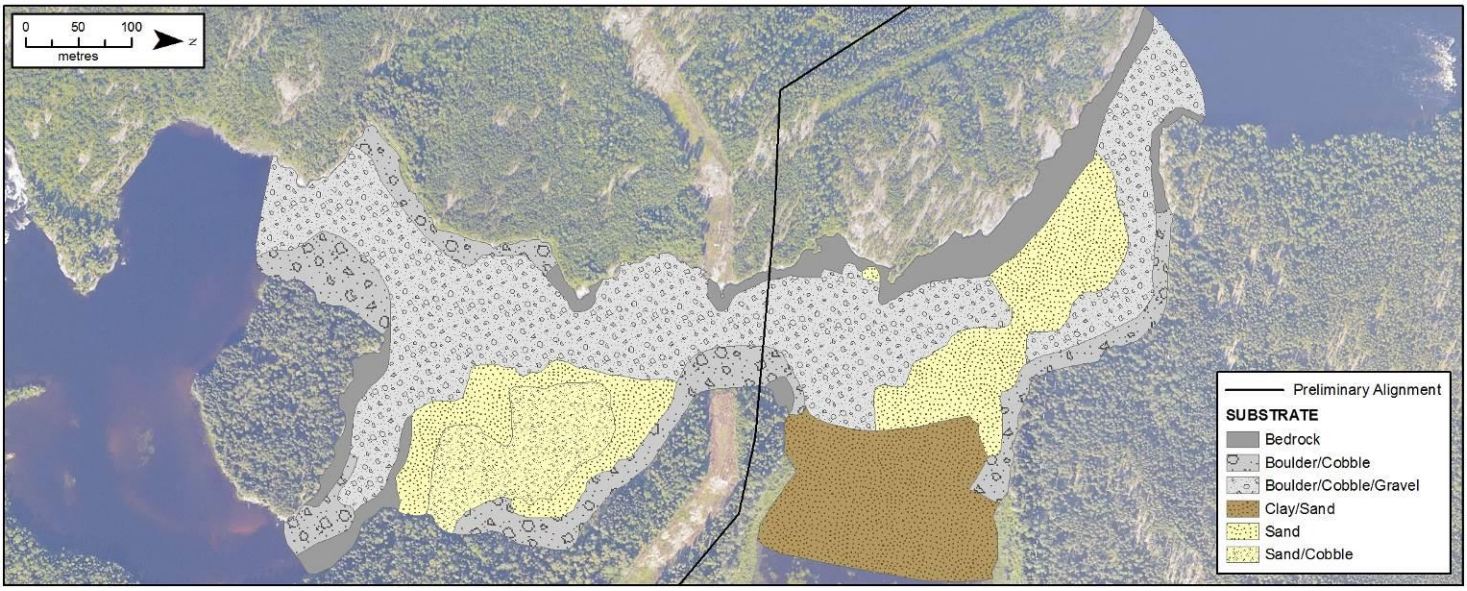
Site Conditions Continued

+ Bathymetric Map



Note: This map is intended for fish habitat assessments. It should not be used for navigation or design purposes.

+ Substrate Map



Note: This is a generalized substrate map, intended for fish habitat assessment. It should not be used for navigation or design purposes.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	10	5
Cover Composition (% of Total)		
Large Woody Debris	-	-
Overhanging Vegetation	-	-
Instream Vegetation	25	25
Pool	-	-
Boulder	75	75
Undercut Bank	-	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	High	High
Rearing	High	High
Overwinter	High	High
Migration	Low	Low
Large Bodied Fish		
Spawning	High	High
Rearing	High	High
Overwinter	High	High
Migration	Moderate	Moderate

Comments
The channel connecting Fishing and Family lakes is a major perennial watercourse that provides important fish habitat for a diverse fish community. The crossing area provides a variety of habitat types including: high velocity run habitat with sand, gravel and/or rocky substrates suitable for spawning by Walleye and spawning and feeding by suckers; shallow, low velocity areas with soft substrates and extensive macrophyte beds suitable for spawning and rearing by Northern Pike, Yellow Perch and forage fish species; and deep holes (16-18 m) with sand and cobble substrates for suitable for overwintering.

+ Fish Sampling Data

Methods: gillnetting

Fish Species Captured: Sauger, Walleye, Yellow Perch, White Sucker

Existing Information: Bulloch et al. (2002), COSEWIC (2006), North/South Consultants (2010), and/or Stewart and Watkinson (2004) reported: Black Crappie, Blacknose Shiner, Black Bullhead, Brook Stickleback, Brown Bullhead, Carp, Channel Catfish, Cisco, Emerald Shiner, Fathead Minnow, Freshwater Drum, Golden Shiner, Johnny Darter, Lake Sturgeon, Lake Whitefish, Longnose Dace, Mimic Shiner, Mooneye, Ninespine Stickleback, Northern Pike, River Darter, Rock Bass, Sauger, Silver Redhorse, Shorthead Redhorse, Spottail Shiner, Tadpole Madtom, Troutperch, Walleye, Weed Shiner, White Bass, White Sucker, and Yellow Perch.

Mussel Presence

+ Mussel Sampling Data

Methods: bathyscope, ponar
Mussel Species Captured: Fatmucket
Existing Information: None

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 15 893
Distance to Major DS Waterbody (km): 2.2 (Family L.)
Connectivity: Yes

Comments
At the crossing site provides high velocity run habitat with coarse substrates. This type of habitat is typical of larger rivers in the area and is not considered unique. The habitat is not considered critical or limiting to CRA fishery species.

+ Fishery

Fishery Area: Fishing Lake and Family Lake

Fishery Users:

Commercial	None[a]
Recreational	Little Grand Rapids Lodge, Fishing Lake Lodge
Aboriginal	Little Grand Rapids First Nation, Pauingassi First Nation

Comments
The watercourse connects Family and Fishing lakes. These waterbodies support both recreational and Aboriginal fisheries, including Walleye and Northern Pike. Habitat near the crossing supports a variety of life requisites for CRA fish; however this type of habitat is common within the area and is not considered critical.

Information Sources:
a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Multi-span bridge[a]
Diameter (mm)	-
Length (m)	TBD
Number of Barrels	-
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	Yes	The watercourse is known to support a variety of CRA fishery species. The immediate crossing area is expected to support a range of life requisites including spawning, rearing, and feeding for species such as suckers and Walleye.
Species at Risk Present	No	

+ Impacts to Fish and Fish Habitat

Type	Multi-span bridge construction and operation
Minor Impact List	No
Residual Impact	Channel infilling from two instream piers Habitat alteration from rip rap placement at base of each pier

Attribute	Rating	Comment
Extent of Impact	Low	Infilling and riprap placement will be limited to the footprint and immediate base of the piers, respectively.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within large river systems in the region. The east side Lake Winnipeg area is largely undeveloped and the habitat within the river remains intact.
Impact on Relevant Fish	Low	The habitat supports a range of life requisites of affected species and is not considered critical or limiting. Fish are expected to fulfill their life requisites using similar habitats located outside of the footprint of the piers. Negative impacts to fish populations from rip rap placement are unlikely as it provides a similar substrate to current conditions. Habitat impacts are expected to result in no measureable effect to local fish populations.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of critical or limiting habitat, bridge construction is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

Type of Structure: Multi-span Bridge				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	323.0 m^2	0 m^2	323.0 m^2
Instream Destruction	Footprint[2]	11.68 m^2	0 m^2	-11.68 m^2

1 – Bridge design was unavailable at the time of assessment. Area calculated as the area rip rap armouring around the two piers and was estimated based on AECOM design drawings provided in Plans PR 304 to Berens River All Season Road Alignment Tender No. B5 Pigeon River Bridge, issued October 3, 2013.

2 – Bridge design was unavailable at the time of assessment. Habitat loss is estimated using the the area of 2 piers from the Pigeon River bridge design (based on AECOM design drawings provided in Plans PR 304 to Berens River All Season Road Alignment Tender No. B5 Pigeon River Bridge, issued October 03, 2013).

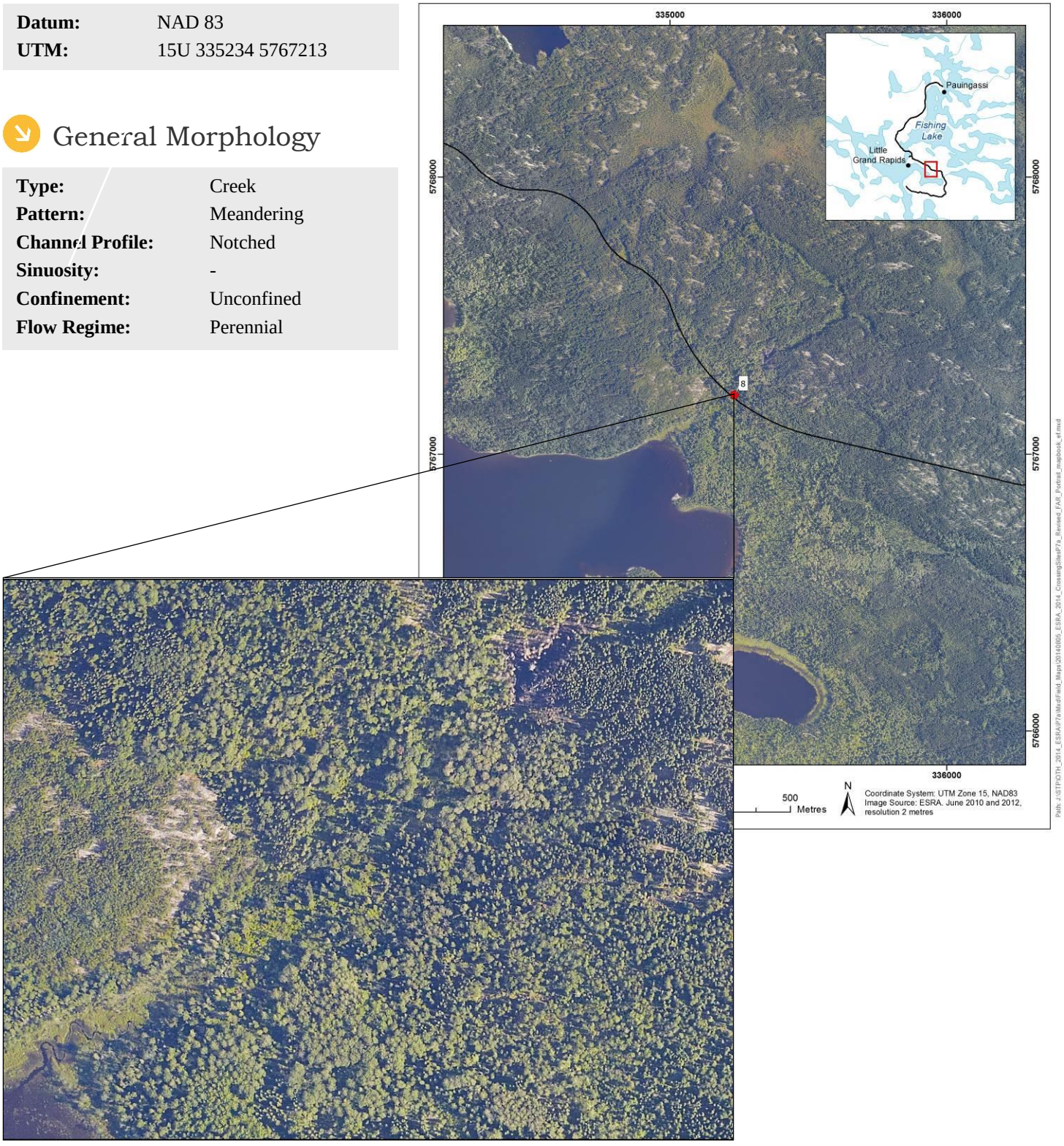
Site 8 Unnamed Family Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 335234 5767213

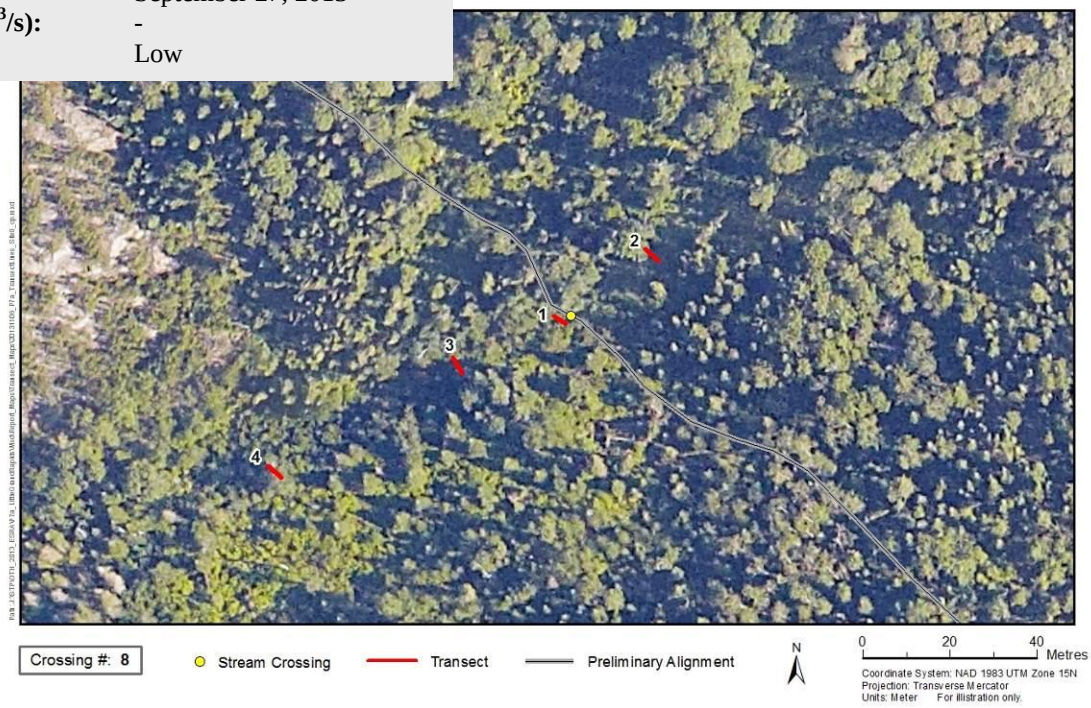
General Morphology

Type:	Creek
Pattern:	Meandering
Channel Profile:	Notched
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial



Site Conditions

Survey Date: September 27, 2013
Discharge (m^3/s): -
Stage: Low



+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	25 US	25 DS	75 DS	-
Channel and Flow					
Channel Width (m)	0.75	1.03	0.70	1.16	-
Wetted Width (m)	0.68	0.60	0.52	1.08	-
Depth at 25% (m)	0.15	0.08	0.26	0.29	-
Depth at 50% (m)	0.18	0.14	0.21	0.21	-
Depth at 75% (m)	0.20	0.17	0.18	0.23	-
Maximum Depth (m)	0.20	0.17	0.26	0.29	-
Gradient (%)	-	-	-	-	-
Banks					
Left Bank Height (m)	0.48	0.57	0.44	0.13	-
Right Bank Height (m)	0.36	0.44	0.42	0.12	-
Left Bank Shape	vertical	vertical	vertical	vertical	-
Right Bank Shape	vertical	vertical	vertical	vertical	-
Left Bank Materials	organic	organic	organic	organic	-
Right Bank Materials	organic	organic	organic	organic	-
Left Bank Stability	high	high	high	high	-
Right Bank Stability	high	high	high	high	-
Substrate Type and Distribution (%)					
Fines	50 (sand)	90 (sand)	50 (sand)	100 (sand)	-
Small Gravel	50	10	50	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	-	-	-	-	-
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	-	13.7	14.2	17.8	-
Right Bank	-	7.3	11.3	30	-
Riparian Distance (m)					
Left Bank	3.5	4.1	1.5	17.8	-
Right Bank	1.5	0.8	2.2	30	-
Riparian Vegetation Type[a]					
	SHR	GRA	SHR	CON	-
Canopy Cover (%)					
	10	0	0	10	-

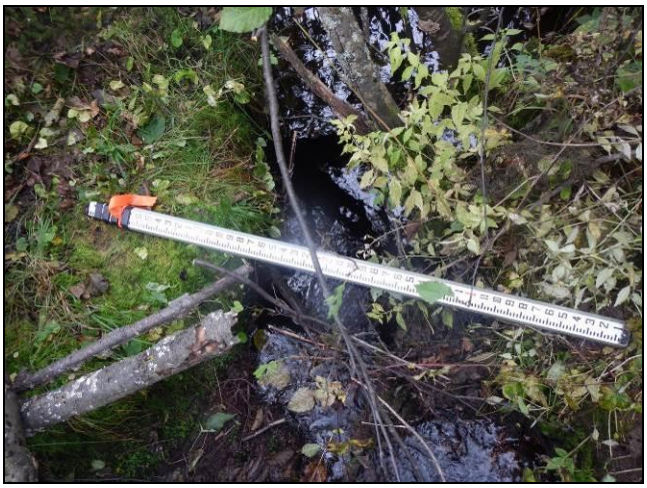
a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	100	100	-
Pool	50	70	-	-	-
Rapid	-	-	-	-	-
Riffle	50	30	-	-	-
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Flat
Temperature (°C):	10.29
pH:	4.85
Turbidity (NTU):	26.7
Specific Conductance (µS/cm):	29
DO (mg/L):	6.95



Narrow channel at the crossing site.

Downstream view of channel at the crossing site.

Upstream view of the channel at Transect 3 (25 m downstream from crossing site).

Downstream view of beaver impoundment, 195 m downstream from the crossing site, and channel connection to Family Lake.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	10	15
Cover Composition (% of Total)		
Large Woody Debris	50	50
Overhanging Vegetation	25	50
Instream Vegetation	-	-
Pool	-	-
Boulder	20	-
Undercut Bank	5	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Moderate	High
Rearing	Moderate	High
Overwinter	Low	Moderate
Migration	Low	Low
Large Bodied Fish		
Spawning	Low	Moderate
Rearing	Low	Low
Overwinter	None	Low
Migration	Low	None

Comments

The crossing is located on a first order stream with downstream connectivity to Family Lake. Upstream, the channel is intermittently defined with a 15 m section of subsurface flow identified approximately 90 m upstream from the crossing. A continuous channel begins at 80 m upstream from the crossing and consists of riffle-pool habitat with sand and gravel substrates. The habitat is suitable for forage fish species; however fish passage to the reach may be impeded by a large beaver dam (1.25 m height) located 195 m downstream from the crossing. Downstream from the dam, the channel lies within a broad saturated sedge/grass floodplain. During freshet, inundated floodplain vegetation in this lower reach may be suitable for spawning by Northern Pike. Deeper areas of the beaver dam impoundment may provide overwintering areas for some forage fish species.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 1.5
Distance to Major DS Waterbody (km): 0.4 (Family Lake)
Connectivity: Yes - Likely

Comments
The crossing is located on the upper reach of a small tributary stream of Family Lake. The habitat consists of flat, pool and riffle areas with sand/gravel substrates. This type of small stream habitat is common within the area.

+ Fishery

Fishery Area: Family Lake

Fishery Users:

Commercial	None[a]
Recreational	Little Grand Rapids Lodge
Aboriginal	Little Grand Rapids First Nation

Comments
The unnamed watercourse is a tributary of Family Lake. Family Lake supports both recreational and Aboriginal fisheries, including Walleye and Northern Pike. The importance of the habitat to the Family Lake fishery is considered low; habitat at and upstream of the culvert site is considered marginal habitat for forage fish and is not expected to support CRA species.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	Yes	Potential Northern Pike habitat is present in lower reach of the creek, outside the footprint of the crossing and proposed right-of-way.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within footprint of the culvert. Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The habitat at and upstream of the immediate crossing area is expected to support only forage fish species. The habitat is marginal and likely contributes minimally to downstream CRA fishery populations. Habitat impacts are expected to result in no measureable effect to downstream fisheries as suitable habitat for relevant fish (e.g., Northern Pike) is located outside of the project footprint.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of direct habitat for CRA fishery species within the project footprint, culvert construction and operation is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	22.5 m^2	0 m^2	-22.5 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (0.75 m).

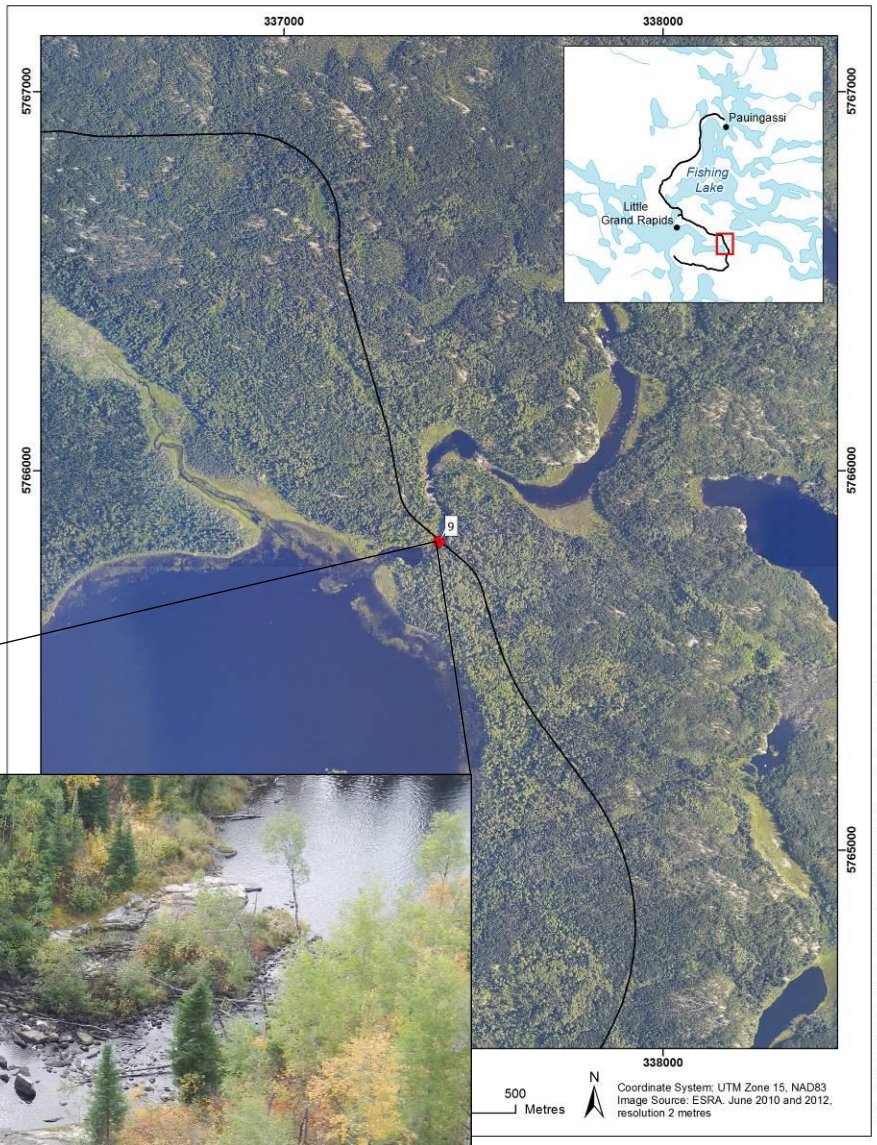
Site 9 Root Creek

Location

Datum:	NAD 83
UTM:	15U 337409 5765812

General Morphology

Type:	Creek
Pattern:	Meandering
Channel Profile:	Notched
Sinuosity:	1.3
Confinement:	Occasionally
Flow Regime:	Perennial



Site Conditions

Survey Date: September 28 & 29, 2013
Discharge (m^3/s): 0.185
Stage: Low

+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	25 US	70 US	25 DS	75 DS
Channel and Flow					
Channel Width (m)	13.8	28.9	14.7	25.9	47
Wetted Width (m)	12.3	25.4	11.4	25.5	48
Depth at 25% (m)	0.28	0.17	0.05	0.15	1.28
Depth at 50% (m)	0.43	0.22	0.30	0.25	-
Depth at 75% (m)	0.65	0.22	0.50	0.35	1.0
Maximum Depth (m)	0.74	0.22	0.50	0.72	-
Gradient (%)	-	3	-	5	-
Banks					
Left Bank Height (m)	0.46	0.29	0.30	0.71	0.45
Right Bank Height (m)	0.51	1.0	0.72	0.47	0.64
Left Bank Shape	vertical	vertical	sloping	vertical	vertical
Right Bank Shape	vertical	sloping	sloping	sloping	vertical
Left Bank Materials[2]	boulder/bedrock	boulder/organic	boulder/organic	bedrock	organic
Right Bank Materials[2]	boulder/bedrock/organic	boulder/organic	boulder/organic	boulder/organic	bedrock
Left Bank Stability	high	high	high	high	high
Right Bank Stability	high	high	high	high	high
Substrate Type and Distribution (%)					
Fines	-	-	-	-	40
Small Gravel	-	-	-	-	10
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	50	100	100	95	40
Bedrock	50	-	-	5	10

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	3.2	2.9	10.0	6.6	9.1
Right Bank	3.4	12.2	5.0	7.8	10.6
Riparian Distance (m)					
Left Bank	1.7	2.0	2.2	1.7	6.2
Right Bank	2.1	0.5	3.8	1.3	5.2
Riparian Vegetation Type[a]	MIX	SHR	SHR	SHR	GRA
Canopy Cover (%)	0	0	0	0	0

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	-	-	-
Pool	40	70	5	40	100
Rapid	-	-	-	-	-
Riffle	5	-	65	45	-
Boulder Garden	5	30	25	15	-
Chute	50	-	-	-	-

+ Water Quality Data

Sample Date:	Sept 30, 2013
Habitat:	Riffle
Temperature (°C):	13.33
pH:	6.76
Turbidity (NTU):	0.61
Specific Conductance (µS/cm):	40
DO (mg/L):	9.72

Upstream view from crossing.

Cross channel view (east) at crossing site.

Upstream view from Transect 4 (25 m downstream) showing the crossing site, and downstream chute and plunge pool.

Downstream view from Transect 5 (75 m downstream) toward connection to Root Lake.

Site Conditions Continued

Upstream view from Transect 3 (25 m upstream), showing transition from boulder garden/riffle habitat (foreground) to bedrock channel and second chute (background).

Upstream view of beaver dam (foreground;) and transition to broader and deeper channel within a grass floodplain.

+ Cover

	US	DS
Total Cover Available (%)	20	5
Cover Composition (% of Total)		
Large Woody Debris	5	-
Overhanging Vegetation	<1	-
Instream Vegetation	-	5
Pool	-	5
Boulder	95	90
Undercut Bank	-	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

	US	DS
Forage Fish		
Spawning	High	High
Rearing	High	High
Overwinter	Moderate	High
Migration	Low	Low
Large Bodied Fish		
Spawning	High	High
Rearing	High	High
Overwinter	Moderate	Moderate
Migration	Low	Low

Comments
The crossing is located at the top of a bedrock chute which is considered a barrier to fish passage. A second smaller chute (100 m upstream) and beaver dam (150 m upstream) may also impede fish passage. Rocky substrates below the chute are suitable for spawning by Walleye and suckers. The plunge pool and riffles with boulder substrates provide rearing and feeding habitat for juvenile suckers and Burbot. Areas of instream vegetation near the creek mouth may be used for spawning and rearing by Northern Pike. Similar pike habitat is present upstream of the crossing, near Douglas Lake.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: Burbot, Spottail Shiner, White Sucker, Johnny Darter, Pearl Dace

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: bathyscope

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 0.4
Distance to Major DS Waterbody (km): 0.2 (Root Lake)
Connectivity: Yes

Comments
The crossing site consists of pool, riffle, boulder garden and chute habitat, with boulder and bedrock substrates. The chute and downstream plunge pool are unique features within the area; however in terms of productivity of CRA fishery species, the spawning and rearing habitat is not considered limiting in the region.

+ Fishery

Fishery Area: Root Creek, Root Lake and Family Lake

Fishery Users:
Commercial None[a]
Recreational Little Grand Rapids Lodge
Aboriginal Little Grand Rapids First Nation

Comments
Root Creek is a tributary of Root Lake and has downstream connectivity to Family Lake. These waterbodies support both recreational and Aboriginal fisheries, including Walleye and Northern Pike. Little Grand Rapids community members fish at the crossing site, downstream of the chute.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Clearspan Bridge[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:

a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	Yes	The watercourse provides suitable habitat for Walleye, suckers and Northern Pike.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Clearspan bridge construction and operation
Minor Impact List	Yes
Residual Impact	No residual impact to fish or fish habitat is expected with the implementation of avoidance and mitigation.

Attribute	Rating	Comment
Extent of Impact	N/A	-
Duration of Impact	N/A	-
Availability & Condition	N/A	-
Impact on Relevant Fish	N/A	-

+ Risk of Serious Harm to Fish

Risk Rating: LOW – Minor Impact List

Qualification: DFO authorization is not required for activities listed as a minor impact provided that measures to avoid harm are implemented.

Net Habitat Change

Type of Structure: Clearspan Bridge

The crossing is a clearspan bridge design; no net habitat change is expected.

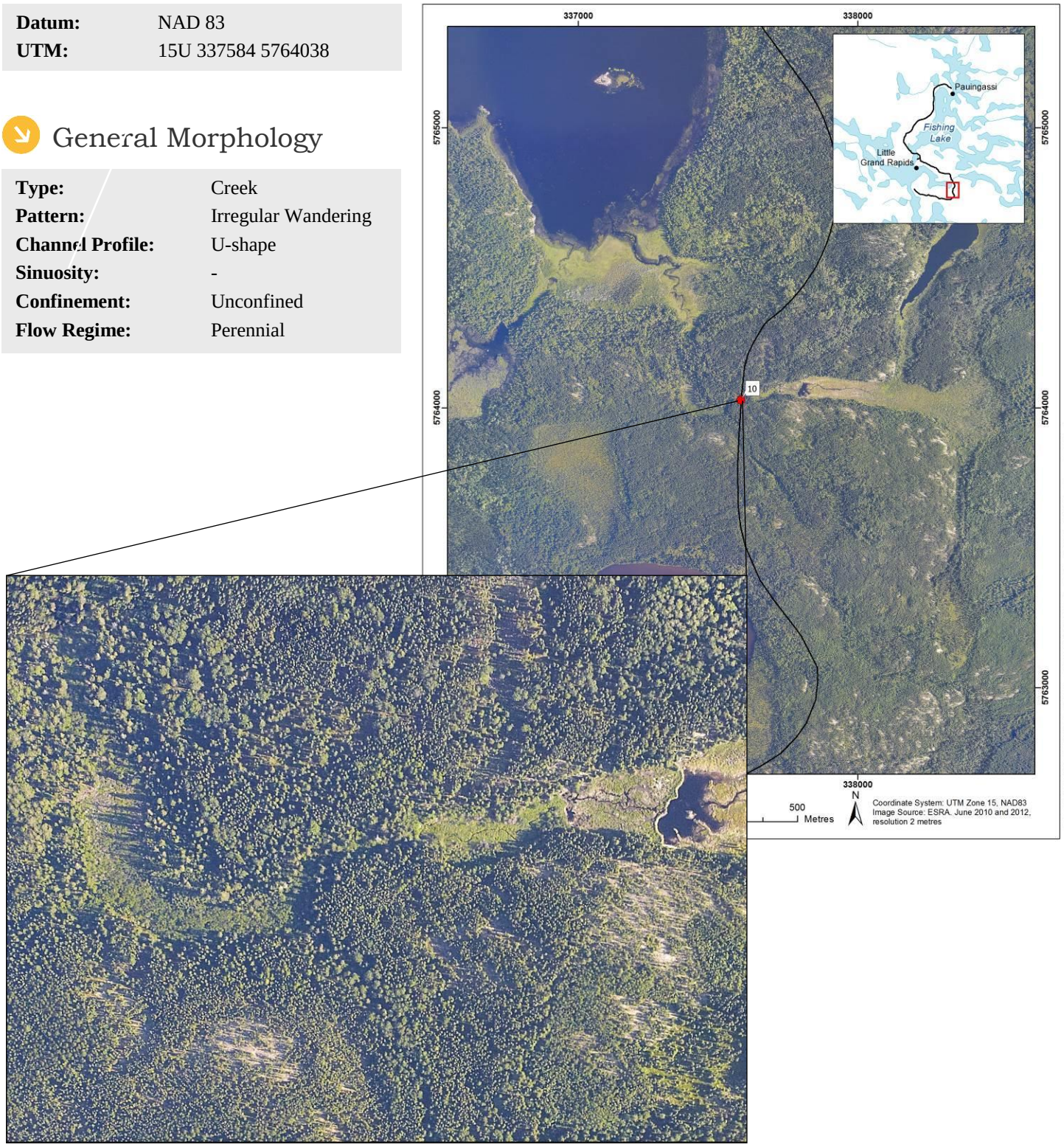
Site 10 Unnamed Root Lake Tributary

Location

Datum:	NAD 83
UTM:	15U 337584 5764038

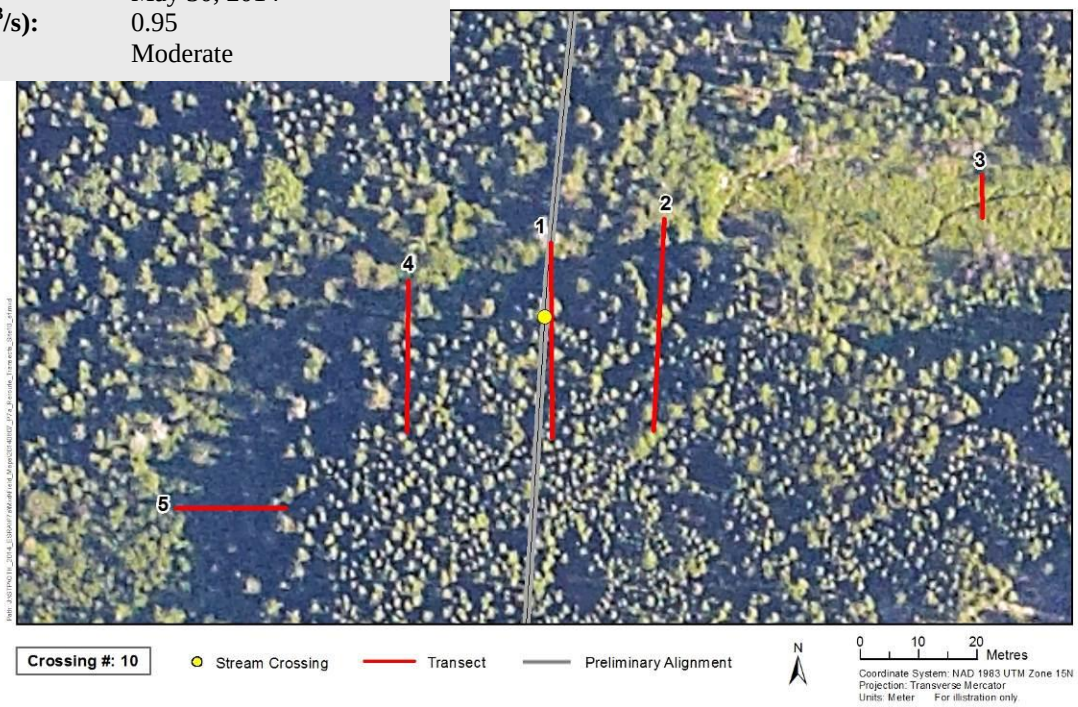
General Morphology

Type:	Creek
Pattern:	Irregular Wandering
Channel Profile:	U-shape
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial



Site Conditions

Survey Date: May 30, 2014
Discharge (m^3/s): 0.95
Stage: Moderate



+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	20 US	75 US	25 DS	75 DS
Channel and Flow					
Channel Width (m)	1.33	3.05	0.87	1.14	1.35
Wetted Width (m)	1.43	3.25	0.87	0.95	1.35
Depth at 25% (m)	0.31	0.32	0.51	0.30	0.38
Depth at 50% (m)	0.26	0.28	0.47	0.19	0.49
Depth at 75% (m)	0.21	0.11	0.53	0.43	0.45
Maximum Depth (m)	0.32	0.37	0.55	0.49	0.52
Gradient (%)	-	-	-	3.5	-
Banks					
Left Bank Height (m)	0.33	0.25	0.13	0.26	0.33
Right Bank Height (m)	0.42	0.12	0.13	0.33	0.31
Left Bank Shape	vertical	vertical	vertical	vertical	vertical
Right Bank Shape	vertical	vertical	vertical	vertical	vertical
Left Bank Materials	organic/sand	organic	organic	organic	organic/sand
Right Bank Materials	organic/sand	organic	organic	bould/organic	bould/organic
Left Bank Stability	high	high	high	high	high
Right Bank Stability	high	high	high	high	high
Substrate Type and Distribution (%)					
Fines	20	90	100	5	20
Small Gravel	-	-	-	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	80	10	-	95	80
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	8.3	5.6	11.7	2.8	10.4
Right Bank	3.7	14.5	25.2	10.5	10.4
Riparian Distance (m)					
Left Bank	8.3	5.6	11.7	7.0	10.5
Right Bank	5.7	6.1	22.4	10.5	10.4
Riparian Vegetation Type[a]	DEC	MIX	GRA	DEC	DEC
Canopy Cover (%)	25	15	0	20	15

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	-	-	-
Pool	10	20	-	5	-
Rapid	-	-	-	-	-
Riffle	90	80	100	95	100
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	-
Habitat:	-
Temperature (°C):	-
pH:	-
Turbidity (NTU):	-
Specific Conductance (µS/cm):	-
DO (mg/L):	-

Upstream view of the channel at the crossing site.

Downstream view of channel at the crossing site.

Upstream view at 25 m upstream from the crossing. Open canopy stream reach in an historic beaver impoundment.

Creek transitions to a mud-bottom, lower gradient channel, approximately 120 m downstream from the crossing.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	20	30
Cover Composition (% of Total)		
Large Woody Debris	10	40
Overhanging Vegetation	10	30
Instream Vegetation	75	-
Pool	-	-
Boulder	2	20
Undercut Bank	3	10
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Moderate	High
Rearing	Moderate	High
Overwinter	Low	Low
Migration	Low	Low
Large Bodied Fish		
Spawning	Low	Low
Rearing	Low	Low
Overwinter	None	None
Migration	None	None

Comments
The crossing is located on forested reach of the creek and consists of riffle-pool habitat with boulder/fine substrates and moderate levels of instream cover. Approximately 25 m upstream from the crossing, the creek transitions to an open-canopy reach within a grass floodplain, created by a historic beaver dam and impoundment. Beaver activity is evident in upstream areas; two intact dams were identified upstream of the crossing. Although no dams were found downstream, a small bedrock chute located 425 m downstream of the crossing may preclude fish passage to the crossing site. The crossing area is not expected to support large-bodied fish species. Fish use is limited to forage fish species.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 3.8
Distance to Major DS Waterbody (km): 2.1 (Root Lake)
Connectivity: Yes - Likely

Comments
The habitat is a small forested stream reach with riffle-pool areas and boulder/fine substrates. This type of small stream habitat is common in the area.

+ Fishery

Fishery Area: Family Lake, Root Lake

Fishery Users:

Commercial	None[a]
Recreational	Little Grand Rapids Lodge
Aboriginal	Little Grand Rapids First Nation

Comments
The unnamed watercourse is a tributary of Root Lake. Both Root and Family lakes support both recreational and Aboriginal fisheries, including Walleye and Northern Pike. The habitat is not expected to support CRA fishery species; consequently, it is of low importance to the productivity of the fishery.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	No	The reach provides habitat for forage fish species; large-bodied fish use is not expected.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within footprint of the culvert. Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The habitat is expected to support only forage fish species and likely contributes minimally to downstream CRA fishery populations. Habitat impacts are expected to result in no measureable effect to downstream fisheries.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of direct habitat for CRA fishery species, culvert construction and operation is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

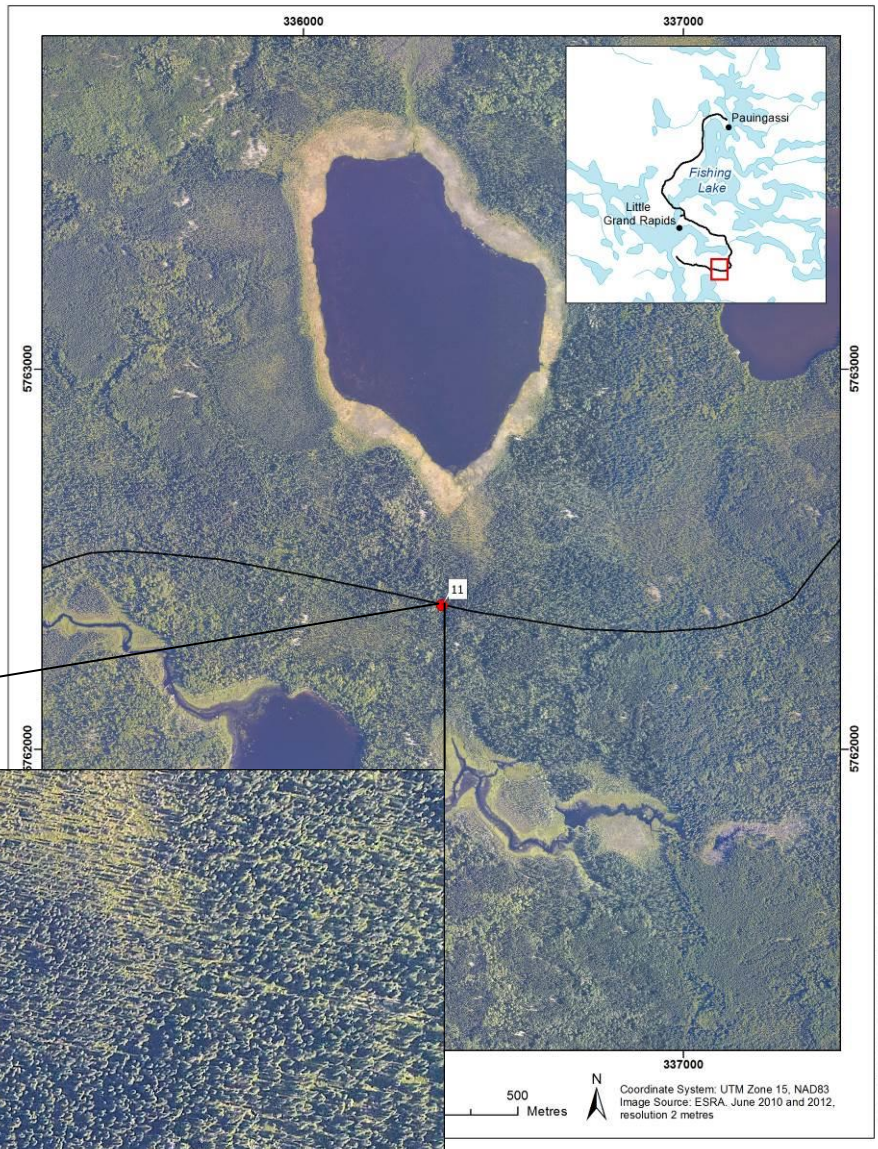
Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	26.6 m^2	0 m^2	-26.6 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (1.33 m).

Site 11 Unnamed Drainage

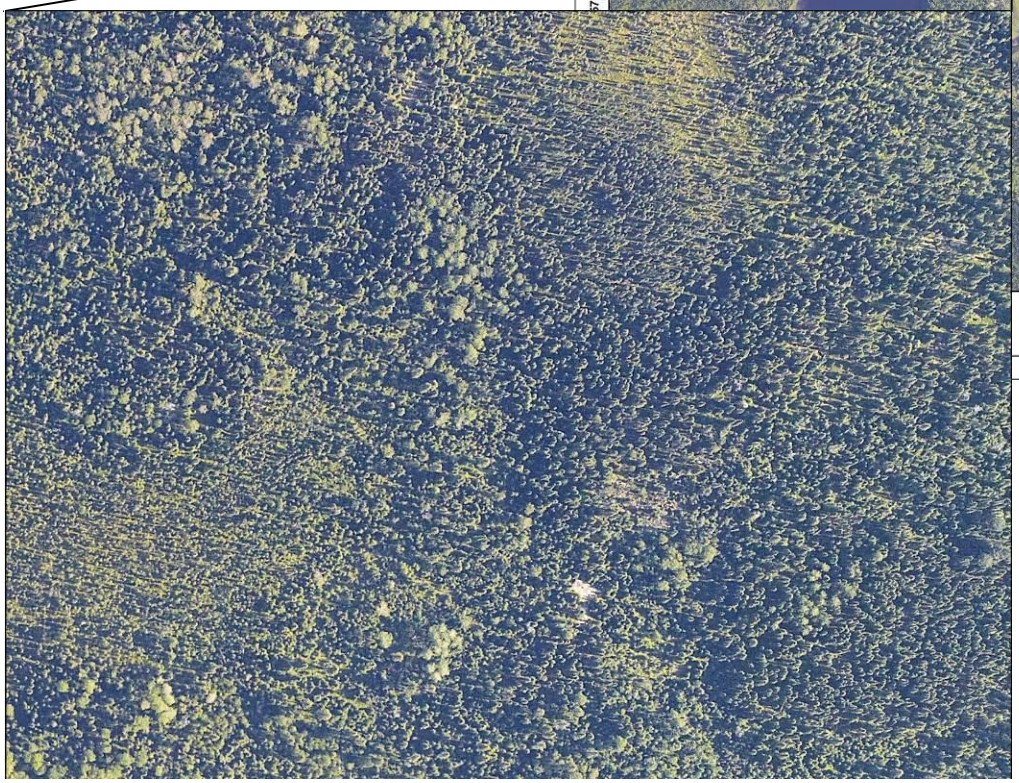
Location

Datum:	NAD 83
UTM:	15U 336365 5762379



General Morphology

Type:	Drainage
Pattern:	-
Confinement:	-
Flow Regime:	-
US Drainage Area (km^2):	2.1
Distance to Major DS Waterbody (km):	0.55 (Family Lake)
Connectivity:	No



Fish Habitat Classification

+ Fish Habitat

Fish Habitat Present	No
Fish Habitat Classification	No Fish Habitat

Comments
The crossing is located on a small drainage connecting two lakes. There was no visible channel at the crossing site. Further investigation indicated the absence of a defined channel connection to both the feeding and receiving lakes.

The crossing site is classified as No Fish Habitat based on the absence of a defined channel and connection to overwintering habitats.

Absence of a defined channel connection to upstream lake.

Absence of a defined channel connection to receiving lake.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:

a – pers. comm. ESRA

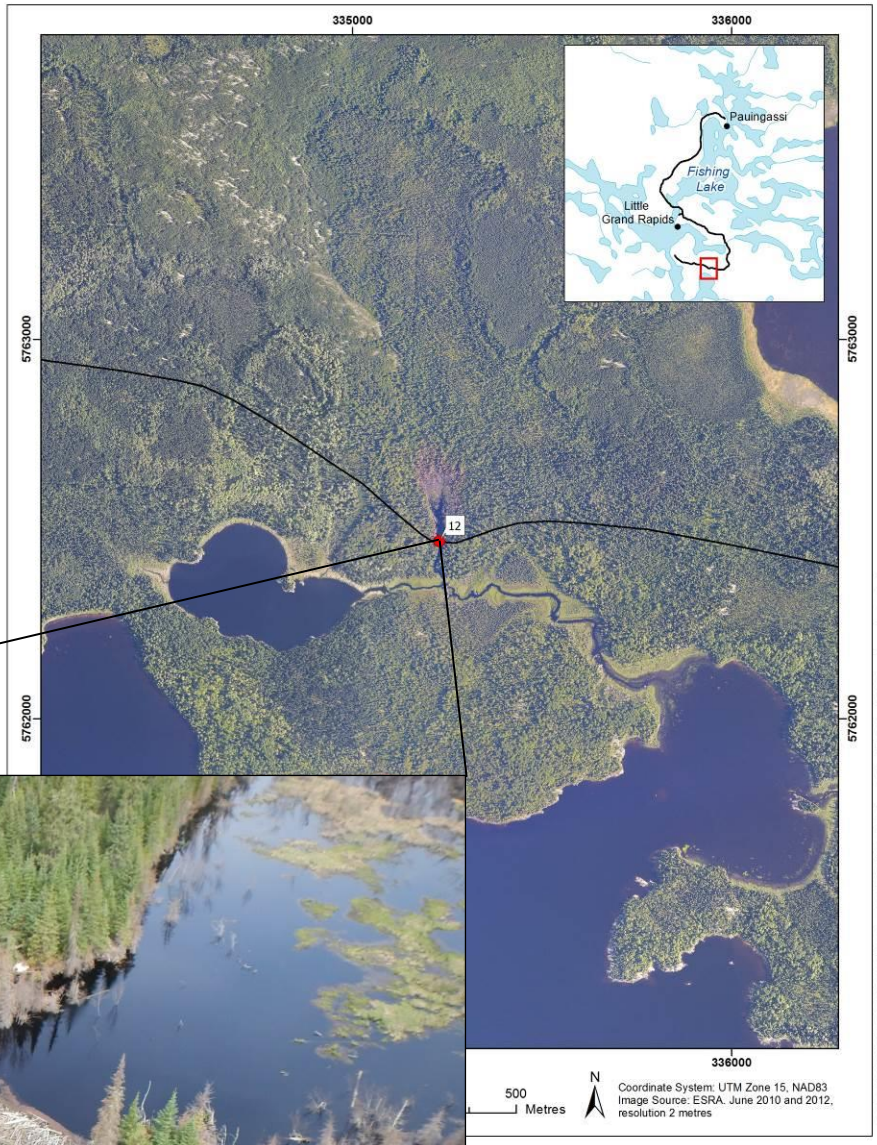
Site 12 Unnamed Creek

Location

Datum:	NAD 83
UTM:	15U 337584 5764038

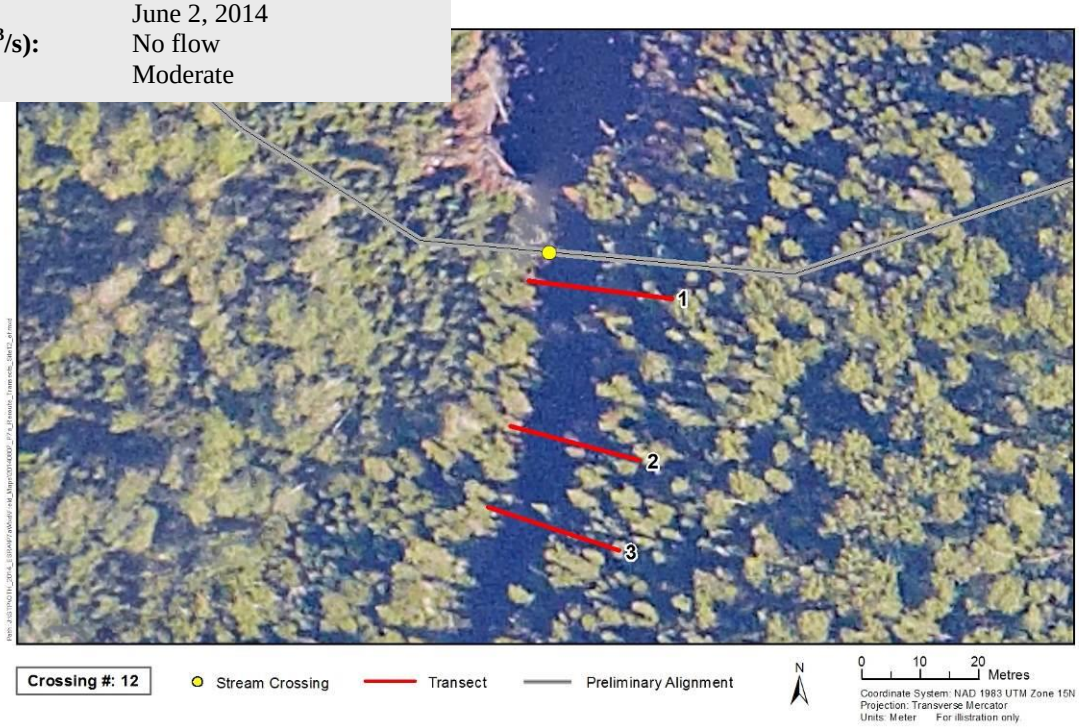
General Morphology

Type:	Creek
Pattern:	Straight
Channel Profile:	-
Sinuosity:	-
Confinement:	Unconfined
Flow Regime:	Perennial



Site Conditions

Survey Date: June 2, 2014
Discharge (m^3/s): No flow
Stage: Moderate



+ Physical Channel Data

Transect	**1**	**2**	**3**	**4**	**5**
Distance from Crossing[a] (m)	0	25 DS	55 DS	-	-
Channel and Flow					
Channel Width (m)	flood	10.3	5.8	-	
Wetted Width (m)	~22	8.9	4.9	-	-
Depth at 25% (m)	1.16	0.49	0.25	-	-
Depth at 50% (m)	-	0.26	0.16	-	-
Depth at 75% (m)	-	0.42	0.13	-	-
Maximum Depth (m)	-	0.49	0.32	-	-
Gradient (%)	-	-	1	-	-
Banks					
Left Bank Height (m)	flood	0.58	0.51	-	-
Right Bank Height (m)	flood	0.58	0.44	-	-
Left Bank Shape	-	vertical	vertical	-	-
Right Bank Shape	-	slope	slope	-	-
Left Bank Materials	-	organic/bould	organic	-	-
Right Bank Materials	-	organic	organic	-	-
Left Bank Stability	-	moderate	high	-	-
Right Bank Stability	-	moderate	high	-	-
Substrate Type and Distribution (%)					
Fines	100	100	100	-	-
Small Gravel	-	-	-	-	-
Large Gravel	-	-	-	-	-
Cobble	-	-	-	-	-
Boulder	-	-	-	-	-
Bedrock	-	-	-	-	-

a – US = upstream from crossing; DS = downstream from crossing

Site Conditions Continued

+ Riparian Area/Floodplain

Transect	1	2	3	4	5
Floodplain Distance (m)					
Left Bank	NM	3.2	6.0	-	-
Right Bank	NM	9.5	6.1	-	-
Riparian Distance (m)					
Left Bank	NM	3.2	6.0	-	-
Right Bank	NM	9.5	6.1	-	-
Riparian Vegetation Type[a]					
	CON	None	GRA	-	-
Canopy Cover (%)					
	0	15	0	-	-

a – GRA = grass; SHR = Shrub; DEC = deciduous; CON = coniferous; MIX = mixed

+ Habitat Type

Transect	1	2	3	4	5
Flat	-	-	-	-	-
Pool	100	100	100	-	-
Rapid	-	-	-	-	-
Riffle	-	-	-	-	-
Run	-	-	-	-	-
Impoundment	-	-	-	-	-

+ Water Quality Data

Sample Date:	June 2, 2014
Habitat:	pool
Temperature (°C):	15.48
pH:	4.69
Turbidity (NTU):	8.66
Specific Conductance (µS/cm):	40
DO (mg/L):	-

Cross channel view at the crossing site (right bank view).

Upstream view of the crossing site.

Upstream view of beaver dam located 15 m downstream of the crossing.

Downstream view of the confluence with an unnamed Family Lake tributary.

Site Conditions Continued

+ Cover

	US	DS
Total Cover Available (%)	60	5
Cover Composition (% of Total)		
Large Woody Debris	5	5
Overhanging Vegetation	-	-
Instream Vegetation	-	45
Pool	95	50
Boulder	-	-
Undercut Bank	-	-
Surface Turbulence	-	-
Turbidity	-	-

Fish Presence

+ Fish Habitat Potential

Forage Fish	**US**	**DS**
Spawning	Moderate	Moderate
Rearing	Moderate	Moderate
Overwinter	Moderate	Low
Migration	Low	Low
Large Bodied Fish		
Spawning	Low	Moderate
Rearing	Low	Low
Overwinter	Low	None
Migration	Low	Low

Comments

The crossing is located on small creek with downstream connectivity to an unnamed tributary of Family Lake. Habitat at the crossing site consists of a beaver impoundment with depths greater than 1 m. Due to a second dam, flooding extends to approximately 400 m upstream of the crossing.

Habitat within the creek is considered marginal. Fish use is expected to be largely limited to forage fish species. Potential habitat use by CRA fishery species is limited to areas near the confluence with the unnamed Family Lake tributary. This area consists of low gradient, low flow habitat with instream vegetation along channel margins which may be suitable for spawning by Northern Pike.

+ Fish Sampling Data

Methods: electrofishing

Fish Species Captured: none

Existing Information: none

Mussel Presence

+ Mussel Sampling Data

Methods: Not sampled; unsuitable habitat.

Mussel Species Captured: -

Existing Information: -

Regional Context

+ Habitat

Upstream Drainage Area (km^2): 0.03
Distance to Major DS Waterbody (km): 0.36 (Family Lake)
Connectivity: Yes - Unlikely

Comments
The low gradient, soft bottom stream habitat provided by the unnamed creek is typical of boreal streams. This type of habitat is common in the area. There are no unique features at or near the crossing location.

+ Fishery

Fishery Area: Family Lake

Fishery Users:

Commercial	None[a]
Recreational	Little Grand Rapids Lodge
Aboriginal	Little Grand Rapids First Nation

Comments
The unnamed watercourse is connected to Family Lake via an unnamed tributary. Family Lake supports both recreational and Aboriginal fisheries, including Walleye and Northern Pike.

Information Sources:

a – Manitoba Conservation (2014)

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	Yes

Information Sources:
a – pers. comm. ESRA.

Risk Assessment

+ Preliminary Considerations

Attribute	Rating	Comments
Supports a CRA Fishery	Yes	Potential Northern Pike habitat is present in lower reach of the creek, outside the footprint of the crossing and proposed right-of-way.
Supports Species at Risk	No	No known species at risk.

+ Impacts to Fish and Fish Habitat

Type	Culvert construction and operation
Minor Impact List	No
Residual Impact	Channel infilling within footprint of the culvert. Habitat alteration from rip rap placement at culvert inlet and outlet

Attribute	Rating	Comment
Extent of Impact	Low	The infill of the stream bed and rip rap placement is restricted to the culvert site.
Duration of Impact	High	The infill and rip rap will be in place for approximately 50 years.
Availability & Condition	Low	The affected habitat is common and widespread within boreal streams in the region. The east side Lake Winnipeg area is relatively undeveloped and small stream habitats remain largely intact.
Impact on Relevant Fish	Low	The habitat at and upstream of the immediate crossing area is expected to support only forage fish species and likely contributes minimally to downstream CRA fishery populations. Habitat impacts are expected to result in no measureable effect to local CRA fish populations (eg., Northern Pike) as suitable habitat for relevant fish is located outside of the project right-of-way.

+ Risk of Serious Harm to Fish

Risk Rating: LOW

Qualification: Based on the small area of impact, abundance of similar habitat within the system, and absence of direct habitat for CRA fishery species within the project footprint, culvert construction and operation is expected to have no measureable impact on the productivity of local fish populations.

Net Habitat Change

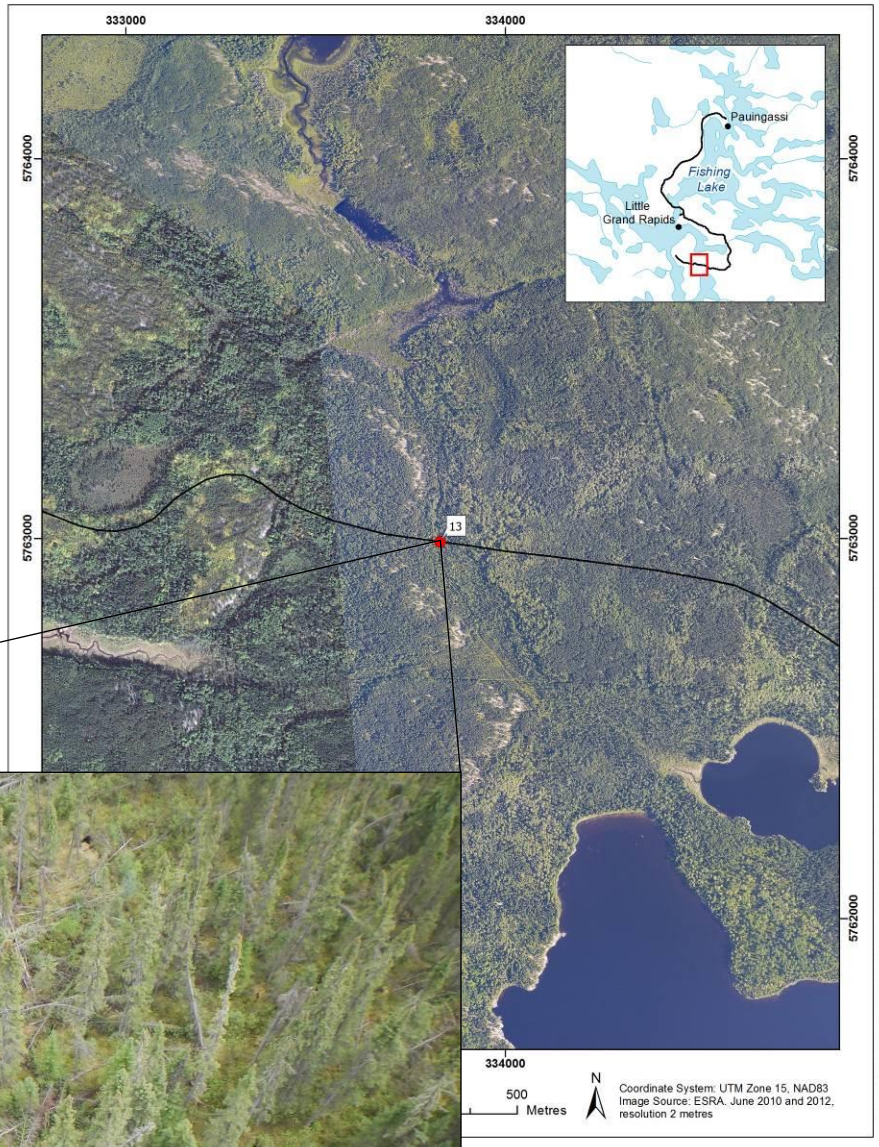
Type of Structure: Culvert				
Effect	**Pathway of Effect**	**Proposed Area Affected**	**Existing Area Affected**	**Loss/Gain**
Instream Alteration	None[1]	0 m^2	0 m^2	0 m^2
Instream Destruction	Footprint[2]	660 m^2	0 m^2	-660 m^2

1 – Any habitat alterations due to rip rap included in footprint (i.e., destruction)
2 – Culvert design unavailable at the time of assessment. Area estimated based on the length of culvert crossings constructed as part of the Provincial Road 304 to Berens River All Season Road Project (30 m) and the channel width at the crossing (22 m).

Site 13 Unnamed Drainage

Location

Datum:	NAD 83
UTM:	15U 333830 5762990



General Morphology

Type:	-
Pattern:	-
Confinement:	-
Flow Regime:	-
US Drainage Area (km^2):	0.49
Distance to Major DS Waterbody (km):	2.39 (Family Lake)
Connectivity:	No

Fish Habitat Classification

+ Fish Habitat

Fish Habitat Present	No
Fish Habitat Classification	No Fish Habitat

Comments
The crossing is located in a low lying area forested area. The ground is saturated a with water accumulation in small depressions however there was no evidence of a defined channel near the crossing. A small continuous channel was identified approximately 780 m downstream from the crossing during aerial surveys.

The crossing site is classified as No Fish Habitat based on the absence of a defined channel at and near the crossing.

Crossing Information

+ Proposed Crossing

Type	Culvert[a]
Diameter (mm)	TBD
Length (m)	TBD
Number of Barrels	TBD
Provision of Fish Passage	No

Information Sources:

a – pers. comm. ESRA