



APPENDIX I-5

2013 AQUATICS BASELINE: PINWOOD RIVER / HIGHWAY 600 CROSSING



October 10, 2013
TC111504

Mr. Kyle Stanfield, P.Eng
Director, Environment & Sustainability
New Gold Inc.
1111 Victoria Avenue East
Thunder Bay, ON
P7C 1B7

Dear Mr. Stanfield,

AMEC Environment & Infrastructure is pleased to submit the attached Fish and Fish Habitat Existing Conditions for Highway 600 Realignment, Township of Chapple.

The Fish and Fish Habitat Existing Conditions for Highway 600 Realignment, Township of Chapple supplements baseline studies conducted previously by Klohn Crippen Berger and AMEC over the period of 2008 to 2013 with a particular focus on the area of potential crossing of the realignment of Provincial Highway 600.

We greatly appreciate the opportunity to provide support for your Rainy River Project. Should you have any questions regarding the study, please do not hesitate to contact us.

Yours Sincerely,

AMEC Environment & Infrastructure,
a division of AMEC Americas Limited

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Aquatic Ecologist

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Senior Associate Geoscientist
Head, Environmental Management



RAINY RIVER

**RAINY RIVER RESOURCES LTD.
RAINY RIVER PROJECT**

**FISH AND FISH HABITAT EXISTING CONDITIONS FOR
HIGHWAY 600 REALIGNMENT
TOWNSHIP OF CHAPPLE**

Submitted to:

**Rainy River Resources Ltd.
1111 Victoria Avenue East
Thunder Bay, Ontario
P7C 1B7**

Submitted by:

**AMEC Environment & Infrastructure
a Division of AMEC Americas Limited
160 Traders Blvd., Suite 110
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**October 2013
TC111504**



EXECUTIVE SUMMARY

Rainy River Resources Ltd. (RRR) has been exploring the Rainy River Project (RRP) situated on private lands in the Township of Chapple, approximately 65 kilometres (km) northwest of Fort Frances in northwestern Ontario (Figure 1-1). The proposed RRP is a 20,000 tonnes per day gold mine that would entail the realignment of approximately 11 km of Provincial Highway 600 including a single crossing of the Pinewood River west of the project site. To date, a specific location for this crossing has not been identified through the design process. However, the proposed crossing location is expected to be situated at a point within a 1 km section of the Pinewood River.

This report provides a summary of existing aquatic habitat conditions from both secondary source information and recent field investigations. The Pinewood River at the crossing location provides direct fish habitat and has a flow regime of permanent as classified in the *Environmental Guide for Fish and Fish Habitat* (MTO 2009). Nevertheless, during 2012 field investigations, AMEC field staff observed flow conditions of zero in some sections of the Pinewood River, which are further influenced by beaver activity.

The Pinewood River supports a general fish community of 34 documented species that are made up of a combination of both coolwater (e.g., Northern Pike, Walleye and White Sucker) and warmwater (e.g., Shorthead Redhorse, Fathead Minnow and Mimic Shiner) fish. In general, the upper reaches of the river mainly support small-bodied baitfish while the lower reaches support larger-bodied species. At the crossing study area, the fish species sensitivity is considered to be moderate, largely due to the presence of Northern Pike, while the habitat sensitivity is classified as low, reflecting the common and widespread nature of the habitat.

Correspondence with the Ministry of Natural Resources (MNR), a review of historical records and recent sampling efforts have confirmed that Lake Sturgeon (*Acipenser fulvescens*) (listed as Threatened, in the Project area, under Ontario's *Endangered Species Act*) occur within the Pinewood River system. Sampling efforts conducted by AMEC field staff and the MNR have yielded three adult Lake Sturgeon in 2013, approximately 20 km downstream from the proposed crossing location. As a result, it was concluded that the range of Lake Sturgeon in this system falls outside the study reach and is unlikely to be affected by realignment / crossing works and *Endangered Species Act* Permits relating to aquatic Species at Risk (SAR) are not anticipated.



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1.0 INTRODUCTION

Rainy River Resources Ltd. (RRR) has been exploring the Rainy River Project (RRP) situated on private lands in the Township of Chapple, approximately 65 kilometres (km) northwest of Fort Frances in northwestern Ontario (Figure 1-1). The RRP is a proposed 20,000 tonnes per day gold mine that would entail the realignment of approximately 11 km of gravel-surfaced Provincial Highway 600, south and west of the project site (Figure 1-2), in order to facilitate the development of the open pit and associated stockpiles. The Universal Transverse Mercator coordinates for the centroid of the proposed open pit are at 425660E, 5409700N (NAD 83 Zone 15). The RRP site and surrounding lands are dominantly privately held, with RRR holding a very large private land package. The approximate 11 km realignment follows a height of land and existing roadways and as a result requires only a single water crossing of the Pinewood River as shown in Figure 1-3.

AMEC Environment & Infrastructure, a Division of AMEC Americas Limited (AMEC) was retained by RRR to provide an assessment of the fish and fish habitat conditions present along the proposed realignment and specifically in the 1 km section of the Pinewood River where the new crossing will be located. Although the final location of crossing was not delineated at the time of assessment, the investigation of fish and fish habitat conditions was inclusive of approximately 500 metres (m) upstream and 500 m downstream of the general crossing area. This *Fish and Fish Habitat Existing Conditions Report* has been prepared as per the Environmental Reference for Highway Design, which is part of the Environmental Standards and Practices for MTO Projects.

The RRP is located within the Late Achaean Rainy River Greenstone Belt which forms part of the western Wabigoon Sub-Province, located in the Superior Province of the Canadian Shield. The terrain in the general vicinity of the RRP site transitions from upland, bedrock controlled pond areas to the northeast, to lower-lying, gently undulating terrain to the southwest. The Pinewood River system, which drains most of the Project site area, is associated with a broad floodplain. Lands more proximal to the RRP site area are typically gently rolling to flat, with wetlands occurring in low-lying contributing watersheds and rounded bedrock outcrops and subcrops occurring in upland areas. The site area occurs within the western portion of the Great Lakes St. Lawrence Forest Region in the area between Lake Superior and Lake of the Woods; but is near to the Boreal Forest and Prairie regions and therefore exhibits some transitional characteristics. Wetlands are present due to the pervasive clay till substrates and subdued topography that characterize much of the area, combined with extensive beaver activity.

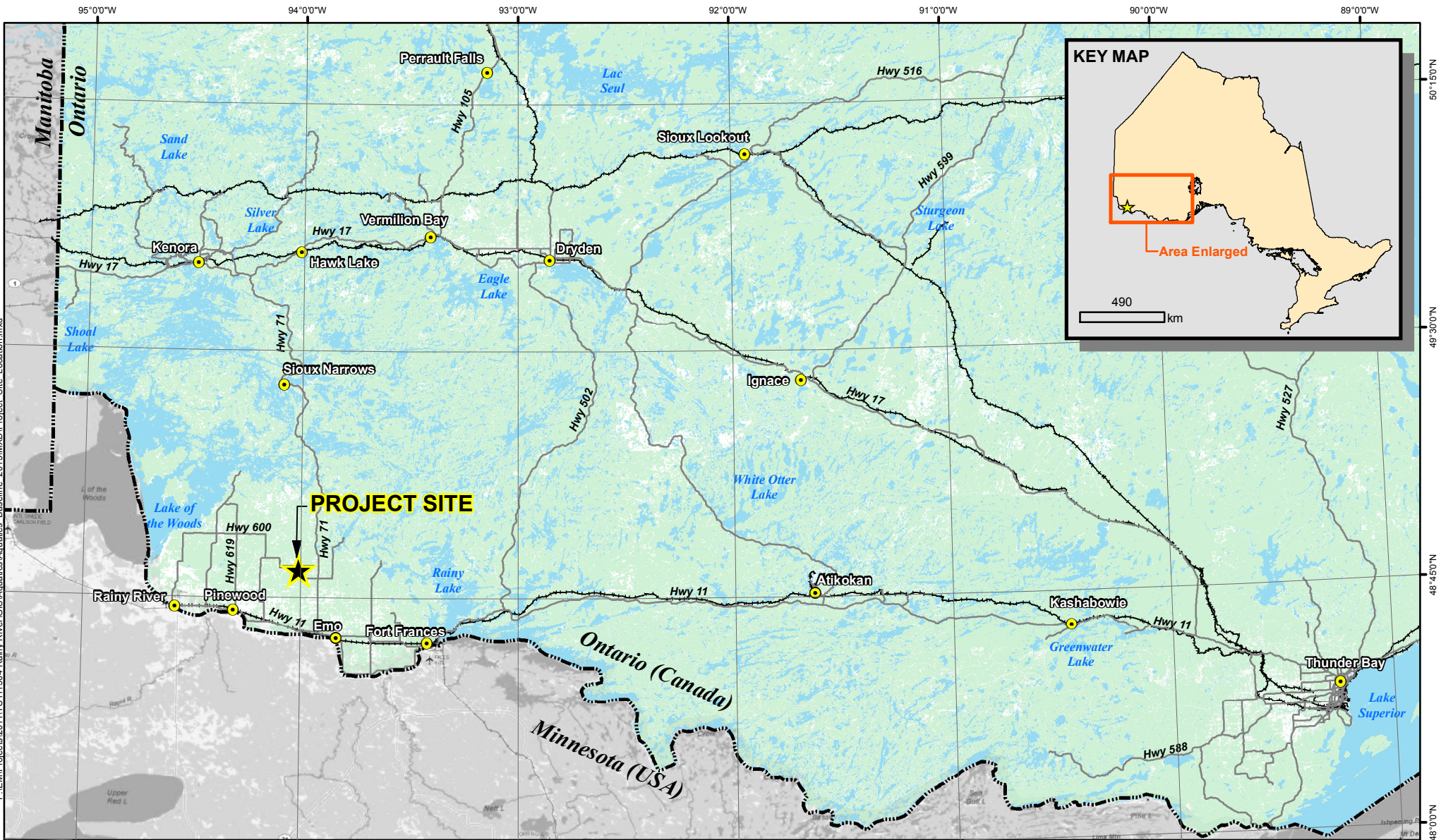
Land uses within the area mainly reflect low-density rural and some local agricultural and forestry and limited agricultural practices. The area is intersected by a well-developed network of both Provincial and Municipal access roads as well as private roads crossing privately held lands.

The assessment of existing conditions for this fish and fish habitat report included a review of secondary sources including recent aquatic resource baseline reports (AMEC 2012, 2013) for



the RRP study area, which were then supplemented with site specific inventory assessments conducted in the summer of 2012 and the spring of 2013 at the proposed new crossing location.

The assessment resulted in the determination that the single crossing of the Pinewood River represents warmwater to coolwater fish assemblage, permanent flow regimes and typical habitat conditions considered common and widespread within the system. As such, the overall habitat and species sensitivities have been classified as low and moderate respectively. Lake Sturgeon, classified provincially as Threatened, were not present within the study area but have been identified recently within the mid to lower reaches of the Pinewood River. As such, additional consideration is warranted in the development of erosion and sediment control and construction mitigation measures to ensure no downstream impacts to Lake Sturgeon occur.



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LEGEND

- Project Site
- Regional Communities
- Provincial / National Border
- Regional Road / Highway
- Railway

NOTES:
 - Ontario base data extracted from Land Information Ontario (MNR) data warehouse.
 - Base data outside of Ontario extracted from ESRI DeLorme World Basemap



RAINY RIVER PROJECT

Project Location

Datum: NAD83
 Projection: UTM Zone 15N



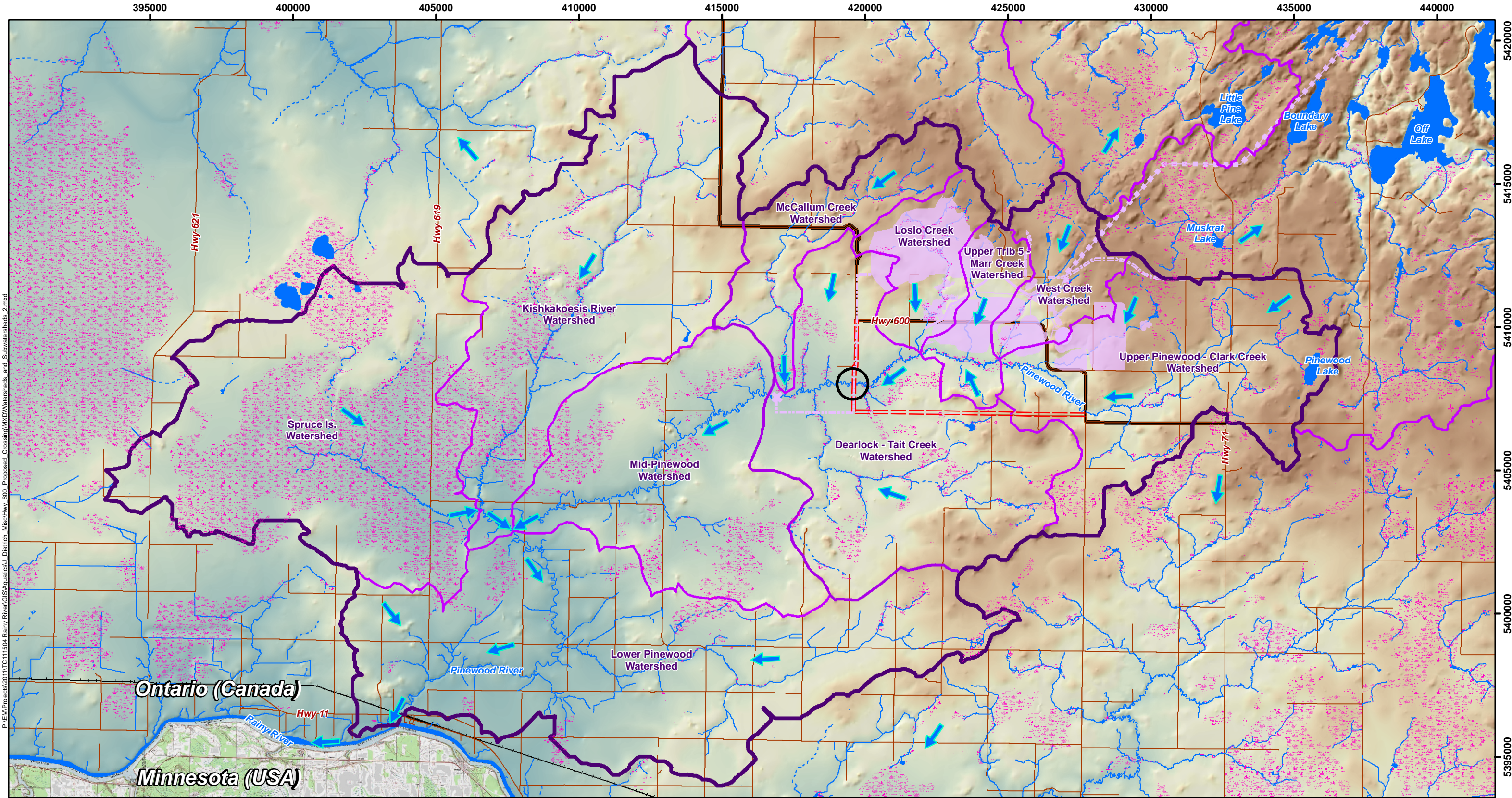
PROJECT N^o: TC111504

FIGURE: 1-1

SCALE: 1:1,800,000

DATE: October 2013

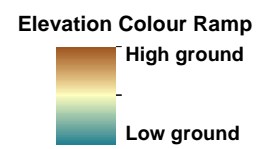




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LEGEND

- Existing Highway 600 Through Project Area
- Regional Road / Highway
- Railway
- Highway 600 Re-alignment Crossing
- Proposed Highway 600 Re-alignment
- Approximate Principal RRP Facilities
- Low-Lying Wetland Area
- Waterbody
- Permanent Watercourse
- Intermittent (Intermittent Watercourse)
- General Surface Flow Direction



- Pinewood River Watershed (approx. 57,450 ha)
- Main Project Area Watershed (approx. 20,700 ha)
- Subwatershed Areas (Labelled on map)

- Upper Trib 5 - Marr Cr. approx. 1,230 ha
- Loslo Cr. approx. 1,620 ha
- West Cr. approx. 1,635 ha
- McCallum Cr. approx. 2,490 ha
- Upper Pinewood - Clark Cr. approx. 6,130 ha
- Mid-Pinewood approx. 6,530 ha
- Dearlock - Tait Cr. approx. 7,600 ha
- Kishkakoosis R. approx. 9,200 ha
- Spruce Is. approx. 9,580 ha
- Lower Pinewood approx. 11,435 ha

NOTES:

- Road data extracted from Land Information Ontario, Ontario Road Network, MNR
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse, Queen's Printer for Ontario, 2011-2012
- Base data outside of Ontario extracted from ESRI USGS Topographic maps
- Watershed delineations are approximate and are derived from MNR Ontario Digital Elevation Model and Quaternary Watershed boundaries

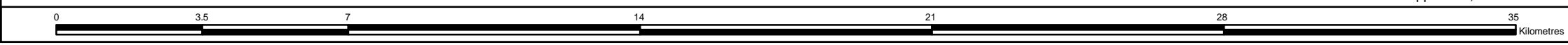
Datum: NAD83
Projection: UTM Zone 15N



RAINY RIVER PROJECT

Site Location

PROJECT N ^o : TC111504	FIGURE: 1-2
SCALE: 1:127,000	DATE: October 2013



419400

419500

419600

419700

419800

419900

5408200





5408100

5408000

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LEGEND

-  2013 Aquatic Assessment Boundary (1 km reach containing proposed crossing)
-  2012 Aquatic Assessment Boundary
-  2013 Aquatic Assessment Chainage
-  Flow Direction

Notes:
- Aerial imagery provided by RRR
scene date is summer 2011



RAINY RIVER PROJECT

**Location of Works for
Pinewood River Crossing**

Datum: NAD83
Projection: UTM Zone 15N



PROJECT N^o: TC111504

FIGURE: 1-3

SCALE: 1:1,500

DATE: October 2013



2.0 CONSTRAINTS AND OPPORTUNITIES

2.1 Species at Risk

The section of the Pinewood River where the crossing and associated works are to occur is considered typical of the area and represents common and widespread habitat that supports a general fish community of warm water and coolwater qualities.

Lake Sturgeon, classified provincially as Threatened in the Project area, are known to inhabit the Rainy River system. During spring 2013 sampling programs, three adult Lake Sturgeon were identified within the Pinewood River approximately 20 km downstream of the study area. The geographical extent of upstream migration based on capture has not been provided by the MNR to date, however, is assumed to be considerably downstream of the potential Highway 600 realignment crossing.

There are no other federally or provincially listed aquatic Species at Risk (SAR) that were identified during baseline studies within the general Project area (for a detailed description of past sampling methodologies refer to KCB 2011, AMEC 2012 and AMEC 2013). As such, *Endangered Species Act* Permits relating to aquatic SAR are not anticipated.

Changes in the status and associated habitat regulations for provincial SAR are constantly evolving, as is the data on population distribution for many monitored species. Ongoing communication with the MNR is recommended to ensure that any newly regulated SAR or new areas of occupancy for a given SAR are considered in future stages of design and construction.

2.2 Designated Significant Natural Areas

A query of the Natural Heritage Information Centre (MNR 2011) was conducted in February 2011 for SAR occurrences in the 10 km by 10 km blocks overlapping the regional study area (i.e., blocks 15VQ10, 15VQ11, 15VQ20, 15VQ21, 15VQ30, 15VQ31, 15VQ32). There are no Areas of Natural and Scientific Interest or Provincially Significant Wetlands within or proximal to the RRP site and the proposed crossing location (KCB 2011).

3.0 BACKGROUND DATA COLLECTION

Secondary source information was reviewed for fish and fish habitats within the study area. In particular, baseline reports completed by Klohn Crippen Berger between 2008-2010 (Klohn Crippen Berger 2011), AMEC between 2011 and 2013 (AMEC 2012, 2013) as well as communication with MNR personnel aided in the assembly of general community information for the Pinewood River. Detailed information as it pertains to the habitat and fish community, within the 1 km segment of the Pinewood River where the proposed crossing will be located, was based on AMEC field studies (2011-2013). Moreover, fish community inventories were assessed by AMEC field staff (between 2011 and 2013) and cross-referenced with previous baseline studies (Klohn Crippen Berger 2011) and MNR reports to ensure completeness and consistency.

3.1 Resident Fish and Fish Habitat (Background Information)

Based on habitat type criteria, delineated and described as part of the 2011 Aquatic Baseline Report (AMEC 2012), the Pinewood River watercourse can be described by nine discrete categories or “habitat types”. However, within the area of interest, the Pinewood River can be described by only two of these categories (Habitat Types 1 and 2).

While these habitat types are very similar to each other, in that they both have comparable morphology, riparian features and substrate composition, they differ in that Type 1 possess a reduced floodplain, with a treed valley located closer to the channel margins relative to Type 2 habitats. Both habitat types primarily consisted of a relatively deep and wide channel mostly comprised of flat morphology with some pools. Although both Habitat Types 1 and 2 showed some similarity with regard to channel dimension, substrate and cover availability, Habitat Type 1 had narrower floodplains with moderate entrenchment and forested riparian vegetation extending close to the channel edge. Habitat Type 1 aquatic vegetation was dominated by Red-head Pondweed and Hornwort.

Habitat Type 2 had a slightly wider floodplain (maximum 50 m) dominated by sedge species, Speckled Alder and willow species. Mixed forest was available within the valley at a greater distance from the channel margins. Aquatic vegetation in Habitat Type 2 was dominated by Yellow Cowlily, Broadleaf Arrowhead, Tape Grass and Hornwort. Substrate throughout both habitat types was relatively uniform and dominated by silt / muck, sand, clay and detritus mixed with some presence of larger substrate particles (gravel and boulder). Mixed forest species associated with both Habitat Types 1 and 2 included: Black Spruce, Larch, Balsam Poplar, White Elm and White Birch. Detailed conditions within the 1 km crossing location reach are provided in Section 5.0.

MNR watercourse sensitivity rankings are assigned based on the relative rarity of both fish and habitat. Sensitivity rankings assist in directing planning, design and construction considerations with respect to the potential Harmful Alteration, Disruption or Destruction (HADD) of fish habitat under the policies of the *Federal Fisheries Act*. To date, watercourse sensitivities have not been



directly assigned by the MNR for the Pinewood River. However, aquatic resource baseline data collections conducted by the MNR in partnership with the Rainy River First Nations in 1997 (MNR 2012); KCB in 2009 and 2010 (KCB 2011); and by AMEC in 2011 (AMEC 2012) and 2012 (AMEC 2013) have been used to provide a comprehensive species list for the Pinewood River system (Table 3-1). It should be noted that many of the species identified in Table 3-1 have not been captured at the immediate site location as it represents a much smaller channel than the lower reaches of the river. For example, Lake Sturgeon, Walleye (*Sander vitreus*), Sauger (*Sander canadensis*), Smallmouth Bass (*Micropterus dolomieu*) were not captured in the upper reaches of the Pinewood River near the proposed crossing. A more precise and locally focused list of species captured at the crossing is provided in Section 5.0.

Based on the secondary source data and the onsite investigations, the species and habitat sensitivities associated with the Pinewood River crossing location are classified as low and moderate respectively. MNR management objectives for the Pinewood River at this location are to manage baitfish populations and their habitat in a manner that respects the ecological value of baitfish within aquatic communities and economic value of baitfish to society (MNR 2013).

Table 3-1: Fish Species Found within the Pinewood River System

Family	Common Name	Scientific Name
Sport Fish Species		
<i>Esocidae</i>	Northern Pike	<i>Esox lucius</i> ^{1,2}
<i>Percidae</i>	Walleye	<i>Sander vitreus</i> ²
Non Sport Fish Species		
<i>Acipenseridae</i>	Lake Sturgeon	<i>Acipenser fulvescens</i> ^{2,3}
<i>Catostomidae</i>	White Sucker	<i>Catostomus commersonii</i> ^{1,2}
	Shorthead Redhorse	<i>Moxostoma macrolepidotum</i> ^{1,2}
<i>Centrarchidae</i>	Black Crappie	<i>Pomoxis nigromaculatus</i> ^{2,3}
	Pumpkinseed	<i>Lepomis gibbosus</i> ²
	Rock Bass	<i>Ambloplites rupestris</i> ^{2,3}
	Smallmouth Bass	<i>Micropterus dolomieu</i> ^{2,3}
<i>Cyprinidae</i>	Blackchin Shiner	<i>Notropis heterodon</i> ²
	Blacknose Dace	<i>Rhinichthys atratulus</i> ²
	Brassy Minnow	<i>Hybognathus hankinsoni</i> ^{1,2}
	Common Shiner	<i>Luxilus cornutus</i> ^{1,2}
	Creek Chub	<i>Semotilus atromaculatus</i> ^{1,2}
	Emerald Shiner	<i>Notropis atherinoides</i> ^{1,2}
	Fathead Minnow	<i>Pimephales promelas</i> ²
	Finescale Dace	<i>Phoxinus neogaeus</i> ³
	Golden Shiner	<i>Notemigonus crysoleucas</i> ^{1,2}
	Hornyhead Chub	<i>Nocomis biguttatus</i> ^{2,3}
	Lake Chub	<i>Couesius plumbeus</i> ^{1,2}
	Mimic Shiner	<i>Notropis volcellus</i> ^{1,2}
	Northern Pearl Dace	<i>Margariscus margarita</i> ²
	Northern Redbelly Dace	<i>Phoxinus eos</i> ^{1,2}
	Spottail Shiner	<i>Notropis hudsonius</i> ^{1,2}
<i>Gasterosteiformes</i>	Brook Stickleback	<i>Culaea inconstans</i> ^{1,2}
<i>Ictaluridae</i>	Brown Bullhead	<i>Ameiurus nebulosus</i> ^{1,2}
<i>Percidae</i>	Blackside Darter	<i>Percina maculate</i> ²
	Iowa Darter	<i>Etheostoma exile</i> ³
	Johnny Darter	<i>Etheostoma nigrum</i> ²
	Log Perch	<i>Percina caprodes</i> ^{2,3}
	Sauger	<i>Sander canadensis</i> ²
	Yellow Perch	<i>Perca flavescens</i> ^{2,3}
<i>Percopsidae</i>	Trout-perch	<i>Percopsis omiscomaycus</i> ^{2,3}
<i>Umbridae</i>	Central Mudminnow	<i>Umbra limi</i> ^{1,2}

1. Determined by Klohn Crippen Berger
2. Determined by AMEC
3. Reported by MNR

4.0 FIELD INVESTIGATIONS

Previous 2012 baseline sampling efforts at station PIN-9 occurred within the Pinewood River in close proximity to the proposed crossing location (AMEC 2013). At this time, two 'Areas of Investigation' were conducted by following methods described in the MTO *Environmental Guide for Fish and Fish Habitat* (MTO 2009). Additionally, a general fish community assessment was conducted throughout the Pinewood River using gillnets, minnow traps, seine and dip nets, angling, backpack electrofishing and boat electrofishing. A photographic record of summer 2012 site visits are provided in Appendix B, with completed habitat data field record forms in Appendix C.

To augment the secondary source information and the 2012 study, an additional fish habitat field inventory was undertaken on May 22, 2013 within the identified 1 km section of river where the new crossing will be located, and specifically at several potential crossing points termed "Areas of Investigation". Field conditions were assessed following methods described in the MTO *Environmental Guide for Fish and Fish Habitat* (MTO 2009). In particular, detailed channel profiles were completed within the 'Areas of Investigation' (Appendices A, D) as well as an additional profile being completed at the most downstream boundary of study reach. 'Areas of Investigation' were all 100 m in length and were made up of a 40 m upstream and a 60 m downstream 'Zone of Detailed Assessment'. Within each 'Zone of Detailed Assessment', AMEC field crew members assessed the site based on morphology, surrounding land use, bank stability, riparian vegetation and enhancement opportunities. An additional 3 channel profiles were completed along the 1 km study reach to further assess the general channel morphology of the reach. A photographic record of the spring 2013 condition is provided in Appendix A with completed habitat data field record forms provided in Appendix D.

5.0 EXISTING FISH AND FISH HABITAT

5.1 General Description

The upper Pinewood River, where the Highway 600 realignment crossing is proposed, provides direct fish habitat and supports a community of warmwater and coolwater species (Table 5-2). Northern Pike are the only sport fish expected to reside within the study area, although several other large bodied sport fish, including a provincially Threatened population of Lake Sturgeon, are known to be present in downstream reaches of the river (see Section 3.0).

The aquatic ecosystem conditions are summarized in the following sections with key biophysical parameters provided in Tables 5-1 and 5-2. Photographic plates that document the existing conditions are provided in Appendix A and B, while field notes outlining habitat conditions are provided in Appendix C and D.

5.2 Origin and Flow

The Pinewood River watershed covers an approximate area of 461 km², originating at the outlet of Pinewood Lake, flowing westward for approximately 75 km (path of flow) before draining into the Rainy River. At the crossing location itself, the river has a watershed in the order of 110 km² and the flow status of the watercourse is classified as permanent despite periods of intermittency in dry conditions. The Pinewood River receives drainage from several tributaries (including municipal drains) upstream of the crossing location including, tributaries within the Dearlock-Tait Creek watershed, Loslo Creek (Cowser Drain), Upper Tributary 5, Marr Creek, West Creek, Blackhawk Creek (not shown) and Clark Creek (Teeple Drain; Figure 1-2).

5.3 Community and Fisheries Classifications

The Pinewood River directly supports fish habitat. During the 2012 and 2013 sampling periods, gillnet, minnow trap, seine and dip net, angling, backpack electrofishing and boat electrofishing methods were conducted and identified the presence of coolwater and warmwater fish species (as per thermal tolerances). Species listed in Table 5-2 are known or assumed to be present due to their capture within close proximity to or within the section proposed for crossing of Highway 600. Other fish species listed in Table 3-1 which were not included in Table 5-2 represent species that were captured within the lower reaches of the Pinewood River or in smaller tributaries of the greater Pinewood River system throughout sampling events from 1997 to 2013.

5.4 Fisheries Limitations

Fisheries passage may be limited during periods of extreme low flow. While there were no apparent permanent fish barriers within the study reach, low water conditions could lead to some reduction in available habitat. Zero flow conditions have been observed within the Pinewood River during 2012 in some sections which are further influenced by beaver activity.

Beaver activity within the Pinewood River system may create partial fish barriers to fish movement. Such obstructions to movement are temporary and cyclic, sometimes resulting in fish population fragmentation. Beaver dams were not observed within the section of study during field reconnaissance.

5.5 General Morphology and Habitat Conditions

Habitat within this study area was homogenous. At the time of sampling, the river was experiencing flood conditions, as water levels exceeded bankfull measurements, resulting in 100% of the sampling reach being classified as a flat. While bankfull measurements could not be directly measured, due to flood conditions, analysis of the channel profile allowed bankfull widths and depths to be calculated and then confirmed against previous summer data in adjacent sections of the river. At chainage 0+510, wetted width and depth were found to be 15.15 m and 1.37 m, respectively, while bankfull width and mean depth were 10.18 m and 1.83 m, respectively. At the upstream-most point of the sampling reach (chainage 0+000), wetted width was measured to be 21.30 m, while the mean wetted depth was found to be 1.00 m. Furthermore, the bankfull width was calculated to be 12.34 m, with a mean depth of 1.59 m. Comparatively, at the most downstream point of the sampling reach (chainage 1+000), the wetted width was measured to be slightly narrower (16.30 m), while the mean wetted depth was found to be deeper (1.39 m). Lastly, the bankfull width at chainage 1+00 was calculated to be slightly wider (12.11 m), with a deeper mean depth (1.84 m). The precise location of the aquatic assessment chainages is illustrated in Figure 5-1 and a table summarizing key habitat characteristics is provided in Appendix F.

Within the study reach, the Pinewood River flows through riparian features that are made up of mixed forest (~80%), graminoid / sedge floodplain (~10%) and agricultural fields (~10%) (AMEC 2013). In particular, vegetation in the riparian zone was dominated by Richardson's Pondweed, Coontail, Alder / Willow thickets, Black Spruce and Red Osier Dogwood (AMEC 2012). Moreover, this segment was characterized by having moderately narrow floodplains and entrenchment (banks 1:2 to 1:1 ratio), a moderate sinuous flow path, low gradient (0.05 to 1%), with forested riparian vegetation extending close to the channel edge (AMEC 2013). Substrate was composed of silt / muck (20 to 40%), sand (20 to 40%), clay (10 to 20%), detritus (5 to 15%), gravel (5 to 10%) and boulders (2 to 5%) (AMEC 2012).

Table 5-1: Water Quality Results Summary Table

Watercourse	Season (DD/MM/YY)	Chainage / Sampling Location ID	Water Temperature (°C)	Air Temperature (°C)	Salinity (µS/cm)	Total Dissolved Solids (ppm)	pH
Pinewood River	Spring (22/05/13)	(0+000)	8.3	12 ¹	112	84	6.80
	Spring (22/05/13)	PIN-9	9.2	12 ¹	138	41	7.15
	Summer (12/07/12)	PIN-9	23.6	23 ¹	363	485	6.85
	Summer (11/07/12)	0+400	29.1	32	548	-	-
	Summer (11/07/12)	0+200	28.1	36	456	215	8.10

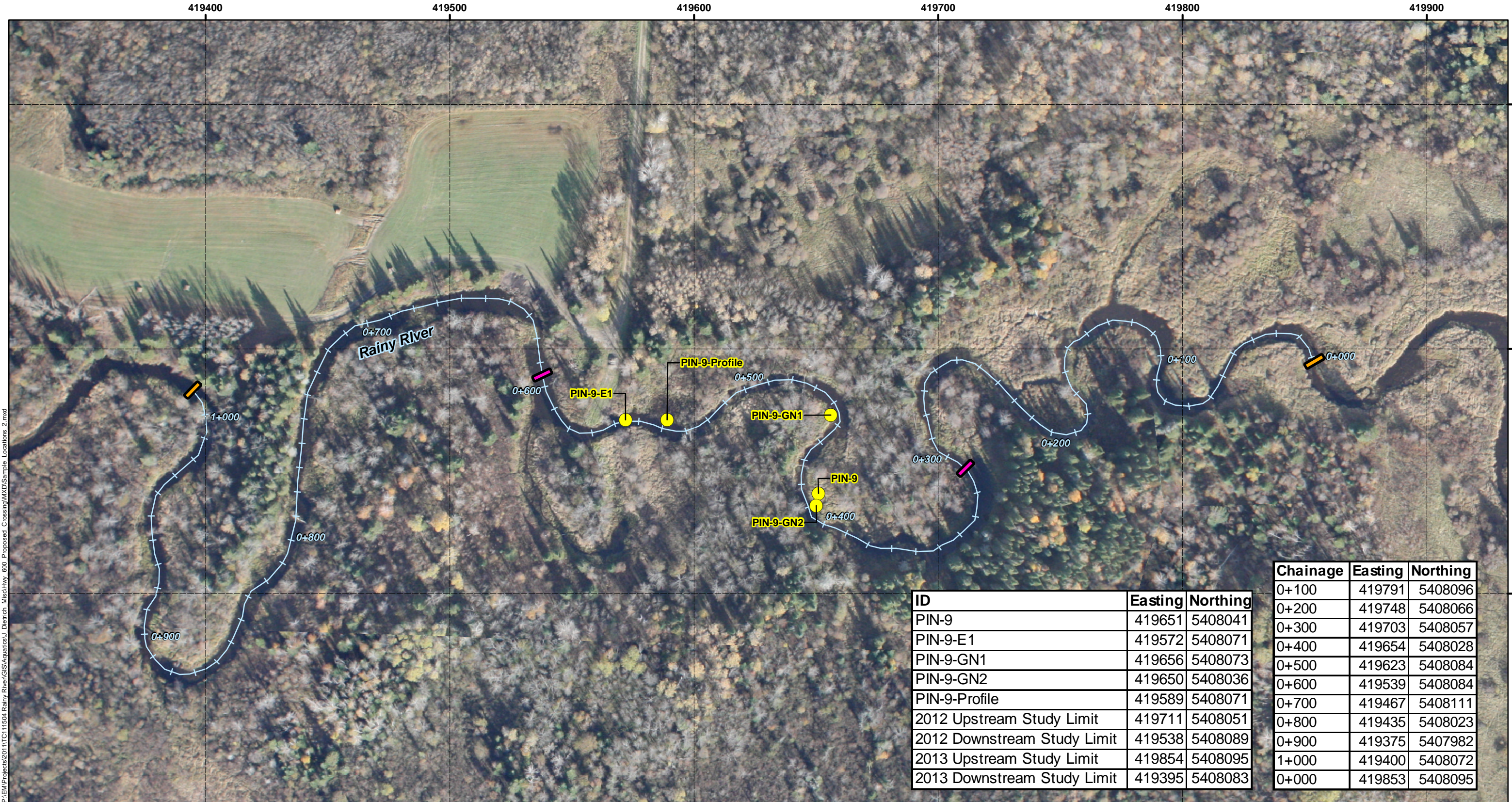
¹ Mean air temperature obtained from the National Climate Data Information Archive (Barwick Station - Climate ID: 6020559)

Table 5-2: Existing Fish and Fish Habitat Conditions of Entire Study Reach

Watercourse Name	Sampling Reach	Flow	Thermal Regime	Substrate Type (%)	Aquatic Vegetation	Supports a Fishery (Directly, Indirectly or No)	Fish Species Present	Fish Habitat Sensitivity
Pinewood River	0+000 – 1+000	Permanent	Coolwater / Warmwater	20-40 Silt/Muck 20-40 Sand 10-20 Clay 5-15 Detritus 5-10 Gravel 2-5 Boulder	Broad-leaved Arrowhead, Tapegrass, Richardson's Pondweed, Coontail	Directly	Northern Pike ¹ Creek Chub ¹ Brown Bullhead ¹ Brook Stickleback ¹ Common Shiner ¹ Central Mudminnow ¹ Pearl Dace ¹ Finescale Dace ¹ Northern Redbelly Dace ¹ Emerald Shiner ¹ White Sucker ²	Low-Moderate

¹ Potentially present based on previous studies of the upper Pinewood River by AMEC during 2011 and 2012 field sampling

² Determined by AMEC during 2013 field sampling



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ID	Easting	Northing
PIN-9	419651	5408041
PIN-9-E1	419572	5408071
PIN-9-GN1	419656	5408073
PIN-9-GN2	419650	5408036
PIN-9-Profile	419589	5408071
2012 Upstream Study Limit	419711	5408051
2012 Downstream Study Limit	419538	5408089
2013 Upstream Study Limit	419854	5408095
2013 Downstream Study Limit	419395	5408083

Chainage	Easting	Northing
0+100	419791	5408096
0+200	419748	5408066
0+300	419703	5408057
0+400	419654	5408028
0+500	419623	5408084
0+600	419539	5408084
0+700	419467	5408111
0+800	419435	5408023
0+900	419375	5407982
1+000	419400	5408072
0+000	419853	5408095

LEGEND

- 2013 Aquatic Assessment Boundary (1 km reach containing proposed crossing)
- 2012 Aquatic Assessment Boundary
- Aquatic Survey Location (Labelled with ID)
- 2013 Aquatic Assessment Chainage

Notes:
- Aerial imagery provided by RRR
scene date is summer 2011



RAINY RIVER PROJECT

**Area of Interest Boundaries for
Pinewood River Crossing**

Datum: NAD83
Projection: UTM Zone 15N

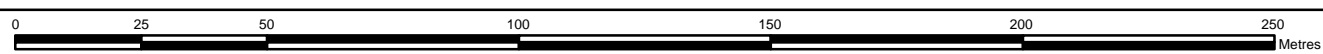


PROJECT N^o: TC111504

FIGURE: 5-1

SCALE: 1:1,500

DATE: October 2013



6.0 GENERAL ASSESSMENT OF POTENTIAL IMPACTS OF THE PROJECT

At present, the 11 km realignment of highway 600 will require a singular crossing of the Pinewood River. The crossing will consist of a multi-cell culvert or a spanning structure, designed in accordance with MTO standards through consultation with MTO. The standards will ensure that the structure will be sized to the appropriate storm event and will maintain existing velocities, depths and gradients preventing impediment to fish passage. Spanning structures are typically designed to limit works in the water. If culvert structures are selected, they are embedded with natural substrates within the culvert to maintain a natural corridor through the crossing. To date further specifics with regard to such applications and associated design are not available, further consideration of potential impacts and associated mitigation measures will be undertaken during successive design and study phases.

Providing that typical mitigation measures are incorporated into the crossing design and construction plan, these crossings do not usually result in harmful alterations of the watercourse and do not require an authorization from the Department of Fisheries and Oceans Canada (DFO). The final assessment of the design and confirmation that the works will not be harmful will be completed following the principles of the MTO / DFO / OMNR *Fisheries Protocol* (MTO / DFO / OMNR version 2, 2013 and as subsequently amended).

The proposed crossing of the Pinewood River will occur within a section of river providing direct fish habitat to coolwater and warmwater fish species. During the design and construction of the crossing structure, potential activities that could have negative implications on fish and fish habitat, within the Pinewood River, include:

- Land based activities such as: riparian vegetation clearing, grading, excavation and use of industrial equipment. While varying in severity, these activities increase the potential for higher water temperatures, contaminant and sediment concentrations as well as reductions in water clarity and changes to food supply.
- Water based activities such as: placement of material or structures in water, dredging, water extraction, release of organic debris, addition or removal of aquatic vegetation and alterations to natural flow regimes which can result in fish mortality, fish passage issues, changes in food supply, nutrient and sediment concentrations.

7.0 POTENTIAL ENHANCEMENT AND COMPENSATION MEASURES

Recommended design considerations including general mitigation measures for fish habitat effects and potential enhancement opportunities (should they be required) are as follows:

- All materials and equipment used shall be operated and stored in such a manner that prevents any deleterious substance from entering the water;
- Construction staging shall be considered such that spills into the drainage feature will be avoided or minimized with aid of secondary containment of petroleum products;
- Any stockpiled materials shall be stored and stabilized away from the water;
- Standard for erosion and sediment control measures will be applied which meet or exceed Ontario Provincial Standards and Specifications. The control measures shall be implemented prior to work and be maintained during construction and until disturbed areas have been effectively stabilized with permanent vegetation cover; as a minimum, the following standards will be followed:
 - Installation of heavy duty silt fencing; and
 - Dewatering discharge stations shall be located a minimum of 30 m from the channel edge in a vegetated area.
- The disturbance or removal of riparian vegetation shall be minimized;
- All disturbed areas of the work site shall be stabilized and re-vegetated promptly, and/or treated with appropriate erosion protection materials. In riparian and aquatic habitats, all temporarily disturbed areas will be reinstated to original condition, or better, upon completion of works; and
- Establishment of in-water timing constraints, sensitive to the coolwater and warmwater fish species native to the Pinewood River, to minimize stress to fish during sensitive life stages (i.e., spawning and hatching).

8.0 REFERENCES

- AMEC. 2013. Rainy River Resources Limited, Rainy River Gold Project, Aquatic Resources 2012 Baseline Investigation.
- AMEC. 2012. Rainy River Resources Limited, Rainy River Gold Project, Aquatic Resources 2011 Baseline Investigation.
- Klohn Crippen Berger. 2011. Rainy River Gold Project Baseline Report 2008 – 2010.
- Ministry of Natural Resources (MNR). 2011. Biodiversity Explorer: Natural Heritage Information Centre (NHIC) 2010 database. Accessed February 2011 from <https://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/mainSubmit.do>.
- Ministry of Natural Resources (MNR). 2012. Fort Frances District Office. Personal and e-mail communication.
- Ministry of Natural Resources (MNR). 2013. Pinewood River Watershed Fish Management Objectives. Fort Frances District – Northwest Region. April 2013.
- Ministry of Transportation Ontario (MTO). 2009. Environmental Guide for Fish and Fish Habitat. Ontario Ministry of Transportation.
- Ministry of Transportation Ontario (MTO). 2000. Class Environmental Assessment for Provincial Transportation Facilities.
- Ministry of Transportation (MTO), Department of Fisheries and Oceans Canada (DFO) and Ministry of Natural Resources (MNR). 2013. MTO / DFO / OMNR Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings - Version 2.

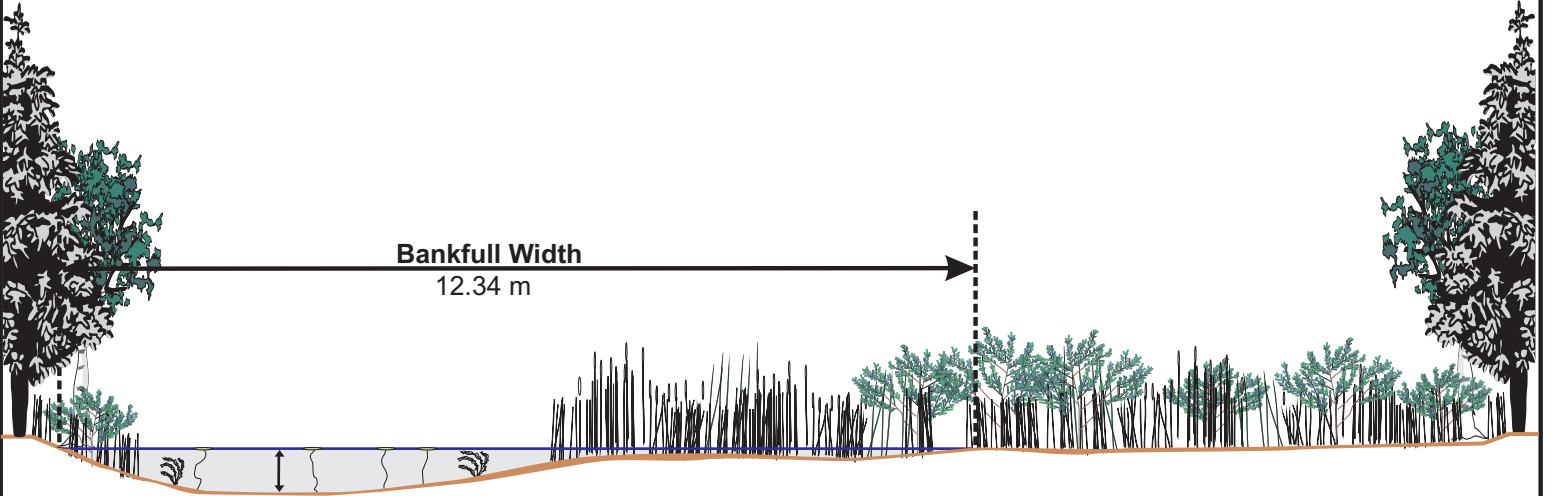


APPENDIX A

SPRING PHOTO AND PROFILE RECORDS (As Observed at Spring Freshet / Flood Conditions)

Pinewood River (0+000)

Bankfull Width
12.34 m



Bankfull Depths 0.83 m - 2.35 m



Pinewood River: (0+000) - Downstream Left Bank



Pinewood River: (0+000) - Downstream Right Bank

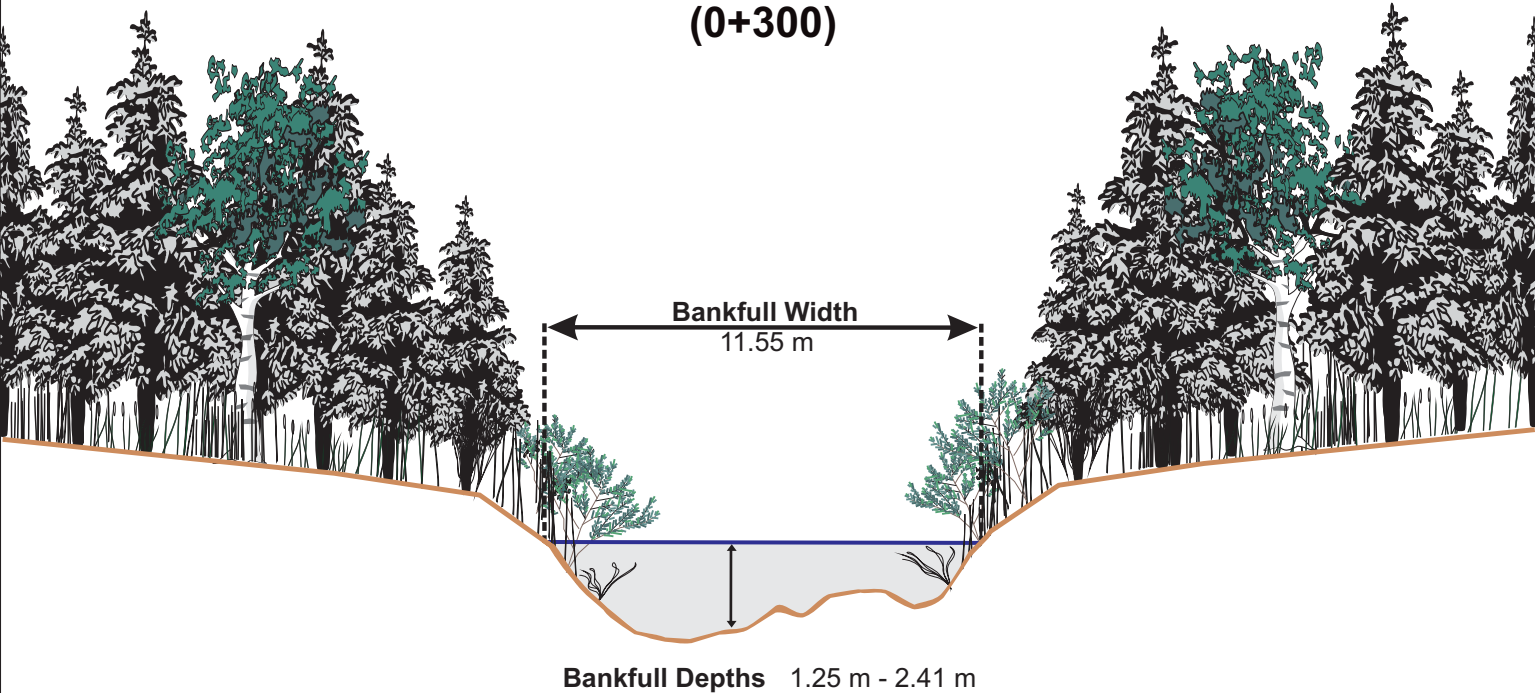


Pinewood River: (0+000) - Upstream Left Bank



Pinewood River: (0+000) - Upstream Right Bank

Pinewood River (0+300)



Pinewood River: (0+300) - Downstream Right Bank



Pinewood River: (0+300) - Downstream Left Bank

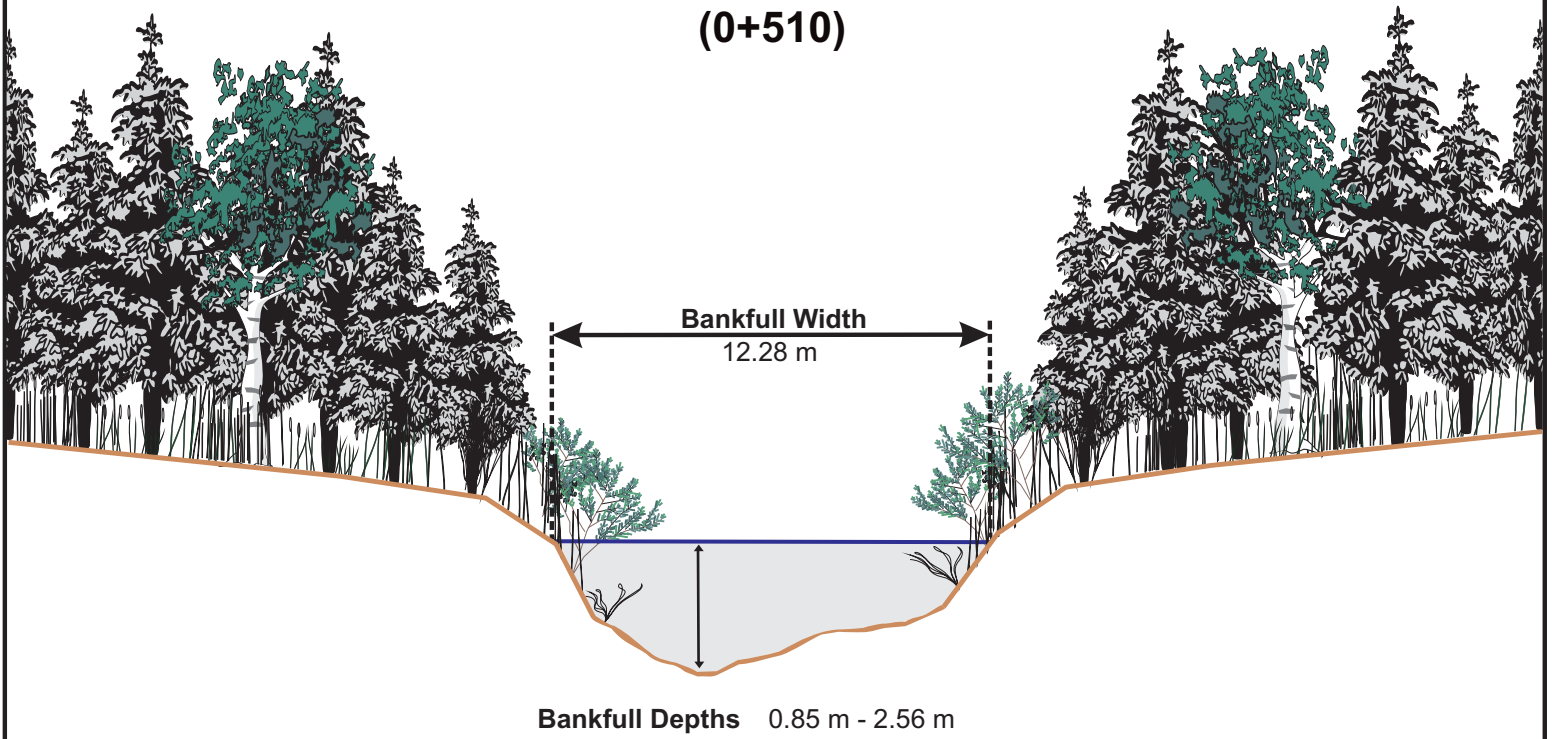


Pinewood River: (0+300) - Upstream Right Bank



Pinewood River: (0+300) - Upstream Right Bank

Pinewood River (0+510)



Pinewood River: (0+510) - Right Bank



Pinewood River: (0+510) - Left Bank

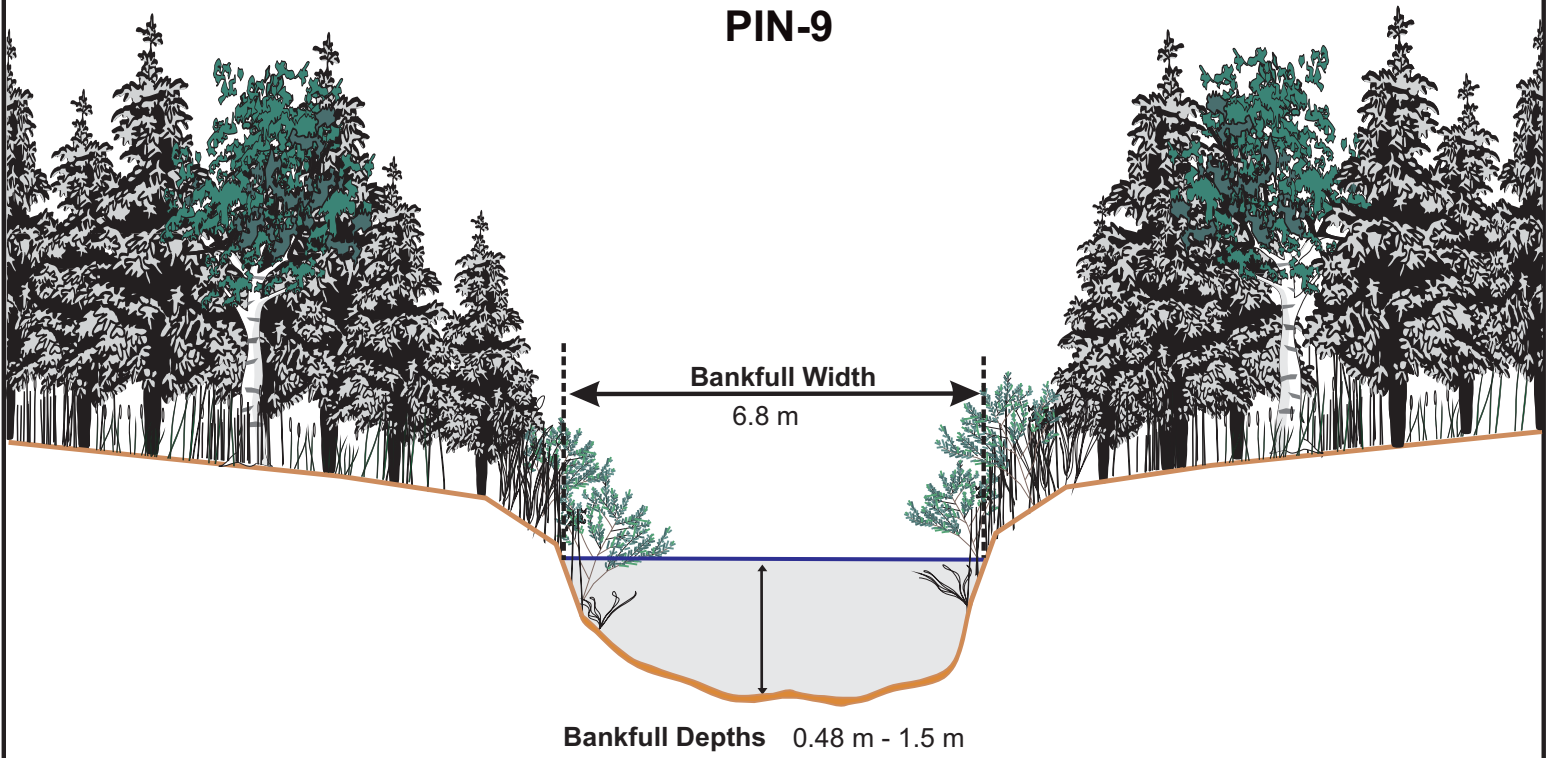


Pinewood River: (0+510) - Facing Downstream



Pinewood River: (0+510) - Facing Upstream

Pinewood River PIN-9



Pinewood River: PIN-9 - Launch Facing South



Pinewood River: PIN-9 - Launch Facing South

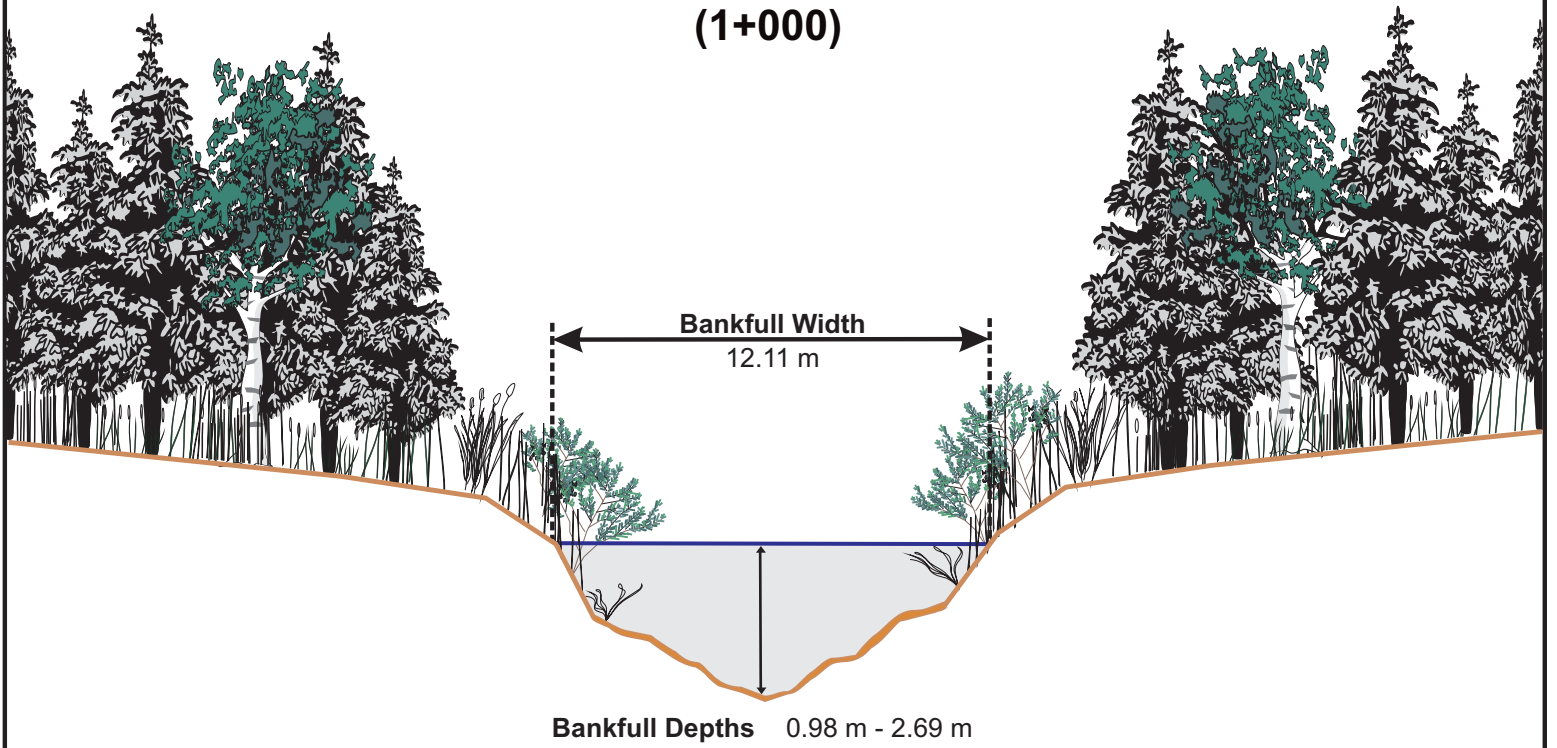


Pinewood River: PIN-9 - Left Bank Downstream



Pinewood River: PIN-9 - Left Bank Upstream

Pinewood River (1+000)



Pinewood River: (1+000) - Downstream Right Bank



Pinewood River: (1+000) - Left Bank



Pinewood River: (1+000) - Facing Downstream



Pinewood River: (1+000) - Facing Upstream



APPENDIX B

**PHOTO RECORD
PINEWOOD RIVER – SUMMER 2012**



Photo 1: Intermittent back-channel at downstream of PIN-9 sampling location.



Photo 2: PIN-9 riparian vegetation (looking upstream) dominated by grasses.



Photo 3: Pinewood River at PIN-9 exhibited high amounts of in-stream cover ($\approx 60\%$), undercut banks ($\approx 10\%$), debris ($\approx 25\%$ woody and $\approx 5\%$ organic) and vascular macrophytes ($\approx 20\%$).



Photo 4: Gill net set across pool at PIN-9 during field reconnaissance (summer 2012).



Photo 5: Aquatic vegetation 200 m downstream PIN-9 was dominated by coontail ($\approx 20\%$), floating pond lily ($\approx 10\%$) and arrowhead ($\approx 20\%$).



Photo 6: Pinewood River, facing upstream 200 m downstream PIN-9. Low water conditions, steep entrenchment and dense aquatic vegetation



Photo 7: Flat water, with minimal bank undercutting ($\approx 5\%$), and instream ($\approx 10\%$) and overhanging ($\approx 15\%$) woody debris 200 m downstream PIN-9.



Photo 8: Standing pool with organic debris ($\approx 20\%$) and instream ($\approx 20\%$) and overhanging ($\approx 20\%$) vascular macrophytes.



APPENDIX C
SPRING FIELD RECORDS

GENERAL INFORMATION					
PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:	
TE111504	RAINY RIVER	22	MAY	2012	

Is STREAM REALIGNMENT required for this section:
 Yes No Unknown

COLLECTORS: A. NAGROBSKI L. SNOOK	WEATHER CONDITIONS: SUNNY, 18°C	TIME STARTED: 12:00	TIME FINISHED: 12:40
--------------------------------------	------------------------------------	------------------------	-------------------------

AIR TEMP: 18°C	WATER TEMP: 8.3°C	CONDUCTIVITY (µS/cm): 112
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PHOTO NUMBERS AND DESCRIPTIONS: IN 'PHOTO' FILE, IN 'RAINY RIVER 2013', IN PROJECT FILE
 6 PHOTOS = P1012584 (SHORE 2 SHORE); P1012585 (WMS); P1012586 (UP/S); P1012587 (middle 2 shore), P1012588 (Middle to Shore), P1012589 (DWN/S)

LOCATION			
NAME OF WATERBODY: PINWOOD RIVER	DRAINAGE SYSTEM: RAINY RIVER	CROSSING #: 10+510	STATION #: 0+510

LOCATION OF CROSSING:
100m DWN/S FROM PIN 9. (ISU 0419651 5408041)

GPS COORDINATES: ISU 41965 5408072	MTO CHAINAGE: N/10m DWN/S (0+510)
---------------------------------------	--------------------------------------

TOWNSHIP: RAINY RIVER	MNR DISTRICT: THUNDER BAY
--------------------------	------------------------------

LAND USE AND POLLUTION	SOURCES OF POLLUTION:
SURROUNDING LAND USE: AGRICULTURAL	PESTICIDES, RUN-OFF, SEDIMENTATION, EUTROPHICATION.

EXISTING STRUCTURE TYPE				
Bridge <input type="checkbox"/>	Box Culvert <input type="checkbox"/>	Open Foot Culvert <input type="checkbox"/>	CSP <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Other Describe: _____ Size (w x h) m² N/A.

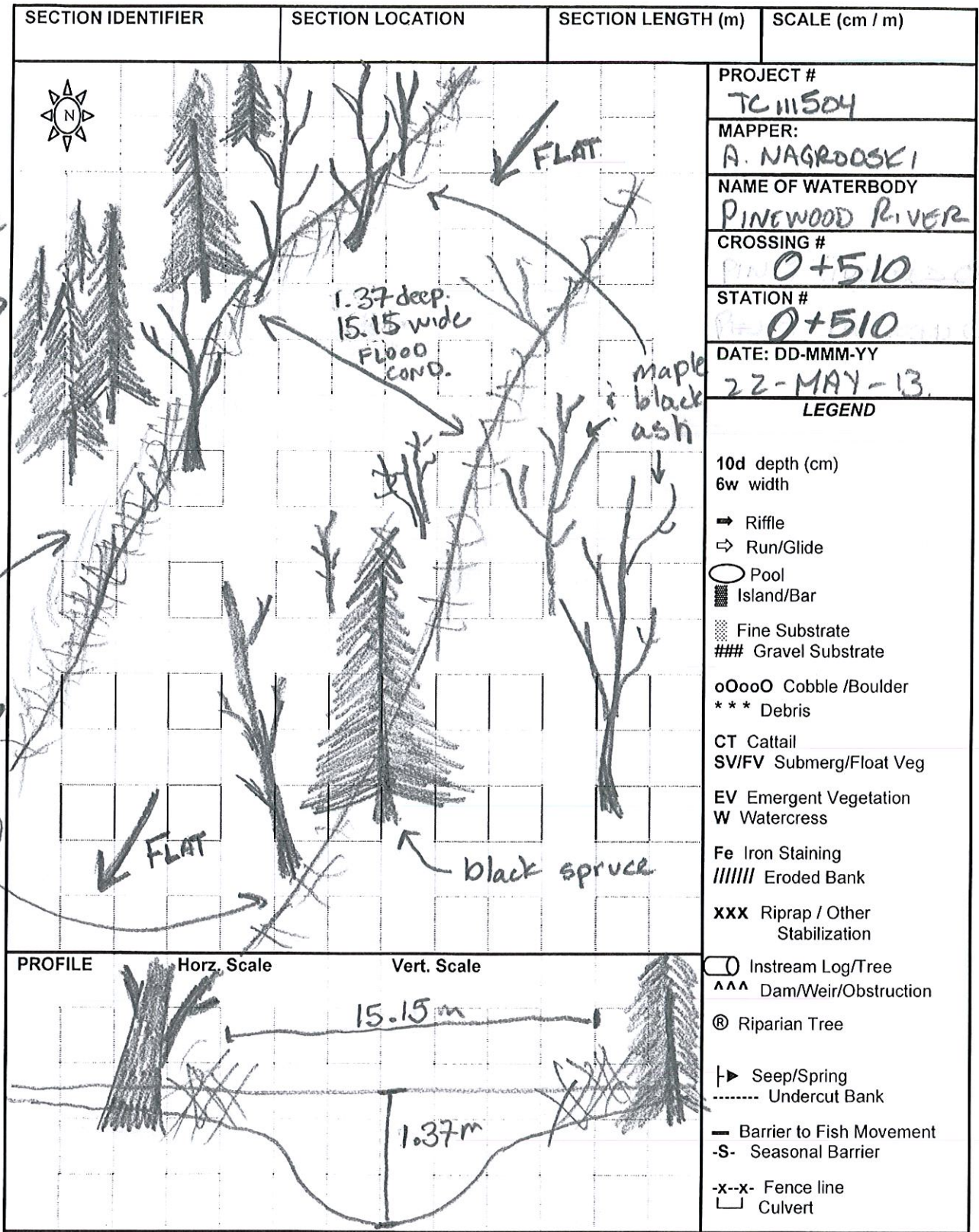
SECTION TYPE AND MORPHOLOGY	
SECTION IDENTIFIER: 0+510	SECTION LOCATION: (Include on habitat map)

TYPE:	Stream / river <input checked="" type="checkbox"/>	Channelized <input type="checkbox"/>	Permanent <input type="checkbox"/>	Intermittent <input type="checkbox"/>	Ephemeral <input type="checkbox"/>	ASSOCIATED WETLAND:
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TOTAL SECTION LENGTH (m) 100 m (DWN/S)	CURRENT VELOCITY (m/s) 1.88
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SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other		
Percentage of area				100%				
mean depth wetted (m)				1.37				
mean width wetted (m)				15.15				
Mean bankfull width (m)				10.18				
Mean bankfull depth (m)				1.83				
Substrate				10% CO; Macrophy 40% Woody D 30% Overhanging 20%				
Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

BANK STABILITY							
	Stable	Slightly Unstable	Moderately Unstable	Unstable			
Left Upstream Bank	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
Right Upstream Bank	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
HABITAT							
IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
			10	Instream 5 Overhanging 20	5	Instream 40 Overhanging 20	
	100-50%	50-20%	10-5%	10-5%	10-5%	10-5%	10-5%
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
VEGETATION TYPE (%):	Submergent		Floating		Emergent		None
Predominant Species							
	None		None		None		None
POTENTIAL CRITICAL HABITAT LIMITING:	Spawning		Evidence of Groundwater		Other		
POTENTIAL ENHANCEMENT OPPORTUNITIES:							
COMMENTS:							
- FLOOD CONDITIONS REACHING INTO FOREST. - Black spruce, alder, willow, red maple, black ash present							
Additional Notes Appended? <input type="radio"/> No <input checked="" type="radio"/> Yes number of pages <u>1</u>							



GENERAL INFORMATION				
PROJECT #:	PROJECT DESCRIPTION:	DAY:	MONTH:	YEAR:
T0111504	RAINY RIVER	22	MAY	2013

Is STREAM REALIGNMENT required for this section:

Yes No Unknown

COLLECTORS: A. NAGROBCKI L. SNOOK	WEATHER CONDITIONS: SUNNY, 17°C	TIME STARTED: 11:00	TIME FINISHED: 11:25
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AIR TEMP: 17°C	WATER TEMP: 8.3°C	CONDUCTIVITY (µS/cm): 112
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PHOTO NUMBERS AND DESCRIPTIONS: IN 'PHOTO' FILE, IN 'RAINY RIVER 2013' IN PROJECT FILE
4 PHOTOS = P1012572 (UP/S); P1012573 (UP/S); P101274 (DOWN/S); P1012575 (DOWN/S)

LOCATION			
NAME OF WATERBODY: PINWOOD RIVER	DRAINAGE SYSTEM: RAINY RIVER	CROSSING #: (0+000)	STATION #: (0+000)

LOCATION OF CROSSING:
410m upstream Pin. 9 (150 0419651 5408041)

GPS COORDINATES: 150 0419854 5408095	MTO CHAINAGE: 0+000
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TOWNSHIP: RAINY RIVER	MNR DISTRICT: THUNDER BAY
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LAND USE AND POLLUTION	
SURROUNDING LAND USE: AGRICULTURAL DWN/S	SOURCES OF POLLUTION: PESTICIDES, RUN-OFF, SEDIMENTATION, EUTROPHICATION

EXISTING STRUCTURE TYPE				
Bridge <input type="checkbox"/>	Box Culvert <input type="checkbox"/>	Open Foot Culvert <input type="checkbox"/>	CSP <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Other Describe: _____ Size (w x h) m² N/A

SECTION TYPE AND MORPHOLOGY	
SECTION IDENTIFIER: (0+000)	SECTION LOCATION: (Include on habitat map)

TYPE:	Stream / river <input checked="" type="checkbox"/>	Channelized <input type="checkbox"/>	Permanent <input type="checkbox"/>	Intermittent <input type="checkbox"/>	Ephemeral <input type="checkbox"/>	ASSOCIATED WETLAND:
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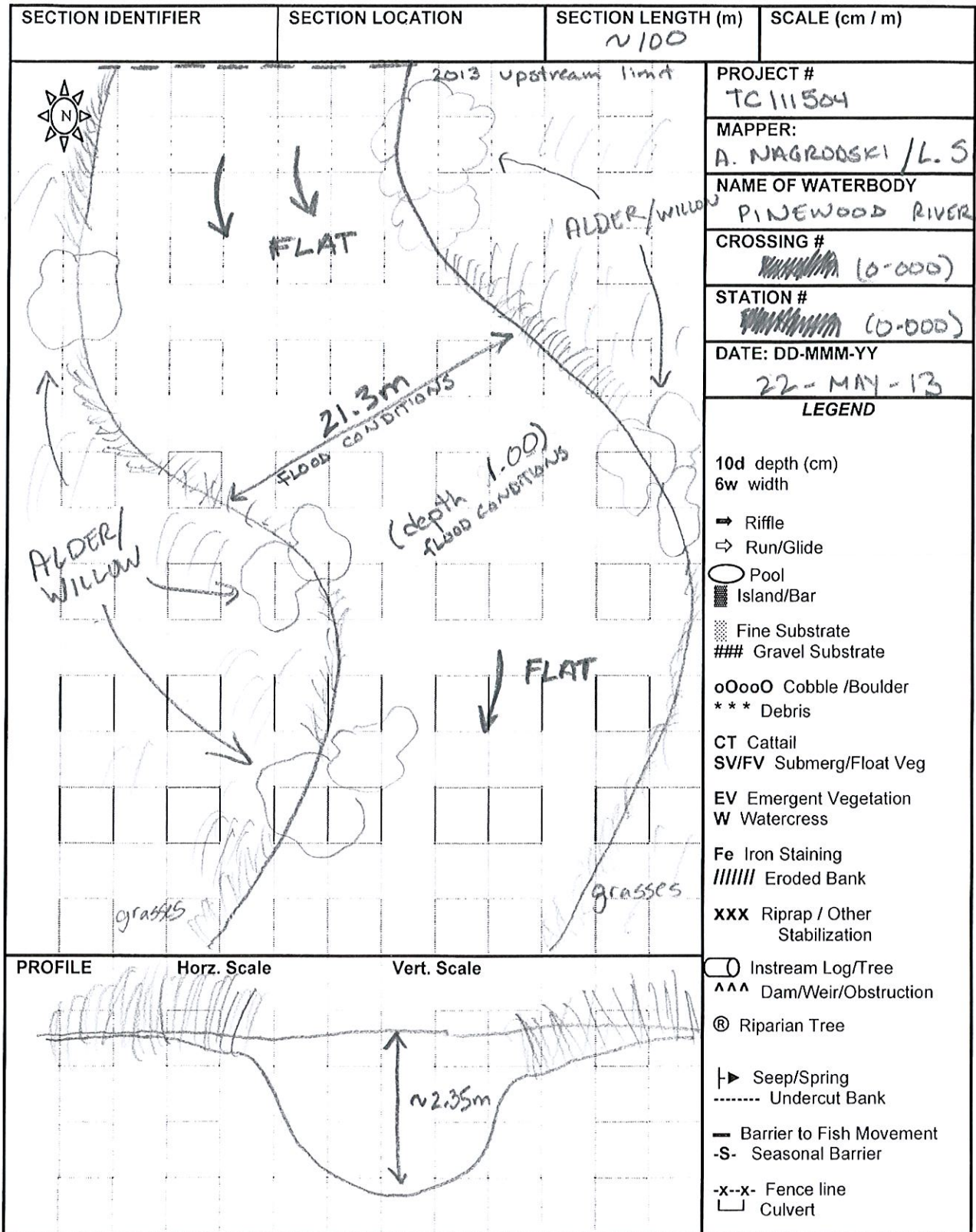
TOTAL SECTION LENGTH (m) 100m (DOWN/S); width @ flood conditions ~22m	CURRENT VELOCITY (m/s) 2.36
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SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other		
Percentage of area				100%				
mean depth wetted (m)				1.0				
Mean width wetted (m)				21.3				
Mean bankfull width (m)				12.34				
Mean bankfull depth (m)				1.5				
Substrate				10% Gr/Co, 30% Woody D, 40% silt/clay				
Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

veg.
veg.

BANK STABILITY				
	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	0	0	0	0
Right Upstream Bank	0	0	0	0

HABITAT							
IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
			5%	Instream 30% Overhanging 30%	5%	Instream Overhanging	
VEGETATION TYPE (%):	Submergent		Floating		Emergent		None
Predominant Species							X
POTENTIAL CRITICAL HABITAT LIMITING:	Spawning		Evidence of Groundwater		Other		
POTENTIAL ENHANCEMENT OPPORTUNITIES:							
COMMENTS:							
Riparian Zone: dominated by grass - alder/willow thickets - black spruce, red alder dogwood. Area is very homogenous throughout							
Additional Notes Appended? <input type="radio"/> No <input checked="" type="radio"/> Yes number of pages <u>1</u>							



Ministry of Transportation
 Environmental Guide for Fish and Fish Habitat

Section 4: Field Investigations
 Appendix 4.A: Watercourse Field Record Form

GENERAL INFORMATION				
PROJECT #: TC111504	PROJECT DESCRIPTION: RAINY RIVER	DAY: 22	MONTH: MAY	YEAR: 2013

Is STREAM REALIGNMENT required for this section:
 Yes No Unknown

COLLECTORS: A. NAGRODSKI L. SNOOK	WEATHER CONDITIONS: SUNNY 17°C	TIME STARTED: 11:30	TIME FINISHED: 11:40
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AIR TEMP: 17°C	WATER TEMP: 8.3°C	CONDUCTIVITY (µS/cm): 112
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PHOTO NUMBERS AND DESCRIPTIONS: IN 'PHOTO' FILE, IN 'RAINY RIVER 2013' IN PROJECT FILE.
 5 photos = P101277 (UP/S); P1012578 (DWN/S); P1012579 (DWN/S); P1012580 (DWN/S), P1012581 (UP/S)

LOCATION			
NAME OF WATERBODY: PINWOOD RIVER	DRAINAGE SYSTEM: RAINY RIVER	CROSSING #: (0+300)	STATION #: (0+300)

LOCATION OF CROSSING: 110 UPSTREAM PIN 9 (15U 0419651 5408041)

GPS COORDINATES: 15U 0419703 5408057	MTO CHAINAGE: (0+300)
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TOWNSHIP: RAINY RIVER	MNR DISTRICT: THUNDER BAY
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LAND USE AND POLLUTION	SOURCES OF POLLUTION:
SURROUNDING LAND USE: AGRICULTURAL DWN/S	PESTICIDES, RUN-OFF, SEDIMENTATION, EUTROPHICATION.

EXISTING STRUCTURE TYPE				
Bridge <input type="checkbox"/>	Box Culvert <input type="checkbox"/>	Open Foot Culvert <input type="checkbox"/>	CSP <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Other <input type="checkbox"/> Describe:			Size (w x h) m ² N/A.	

SECTION TYPE AND MORPHOLOGY	
SECTION IDENTIFIER: (0+300)	SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river <input checked="" type="checkbox"/>	Channelized <input type="checkbox"/>	Permanent <input type="checkbox"/>	Intermittent <input type="checkbox"/>	Ephemeral <input type="checkbox"/>	ASSOCIATED WETLAND:
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TOTAL SECTION LENGTH (m) 100m (DWN/S)	width @ flood conditions ~ 16m	CURRENT VELOCITY (m/s) 2.36
---------------------------------------	--------------------------------	-----------------------------

SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other		
Percentage of area				100%				
mean depth wetted (m)				1.68				
mean width wetted (m)				14.50				
mean bankfull width (m)				12.46				
Mean bankfull depth(m)				1.86				
Substrate				GR/CO				
Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D

BANK STABILITY				
	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	0	0	0	0
Right Upstream Bank	0	0	0	0

HABITAT							
IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
			5%	Instream 30% Overhanging 30%	5%	Instream Overhanging	

--	--	--	--	--	--	--	--

VEGETATION TYPE (%):	Submergent	Floating	Emergent	None
Predominant Species				

--	--	--	--

POTENTIAL CRITICAL HABITAT LIMITING:	Spawning	Evidence of Groundwater	Other

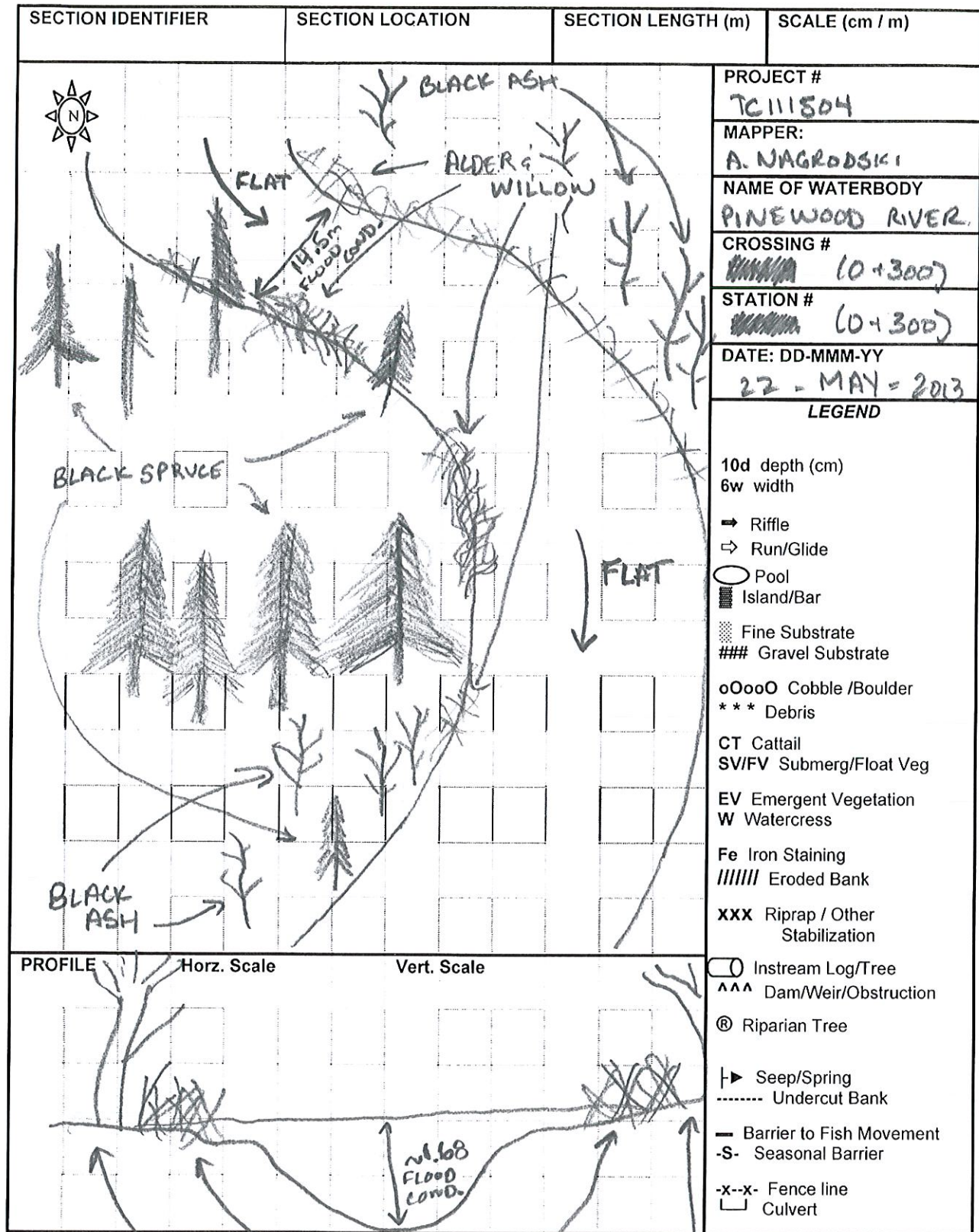
POTENTIAL ENHANCEMENT OPPORTUNITIES:

more gravel by bank stability

COMMENTS:

- cover provided by trees (black spruce, black ash), alder / willow thickets.
- minimum dogwood in this area

Additional Notes Appended? No Yes number of pages 1



GENERAL INFORMATION									
PROJECT #:	TC111504	PROJECT DESCRIPTION:	RAINY RIVER	DAY:	22	MONTH:	MAY	YEAR:	2013

Is STREAM REALIGNMENT required for this section:
 Yes No Unknown

COLLECTORS:	A. NAGROOSKI L. SNOOK	WEATHER CONDITIONS:	SUNNY 18°C	TIME STARTED:	1:10	TIME FINISHED:	1:30
AIR TEMP:	18°C	WATER TEMP:	8°C	CONDUCTIVITY (µS/cm):	112		

PHOTO NUMBERS AND DESCRIPTIONS: IN 'PHOTO' FILE, IN 'RAINY RIVER 2013' IN PROJECT FILE
 5 PHOTO = P1012592 (DWN/S); P1012593 (cross); P1012594 (DWN/S); P1012595 (DWN/S);

LOCATION			
NAME OF WATERBODY:	DRAINAGE SYSTEM:	CROSSING #:	STATION #:
PINGWOOD RIVER	RAINY RIVER	PIN 9 (DSLINT)	1+000 (1)
LOCATION OF CROSSING: 450 m DWN/S FROM PIN 9 (15U 0419651 5408041)			

P1012596 (cross);
 P1012597 (cross);
 US/S!

GPS COORDINATES:	15U 419395 5408083	MTO CHAINAGE:	(1+000)
TOWNSHIP:	RAINY RIVER	MNR DISTRICT:	THUNDER BAY

LAND USE AND POLLUTION	
SURROUNDING LAND USE: AGRICULTURAL	SOURCES OF POLLUTION: PESTICIDES, RUNOFF, SEDIMENTATION, EUTROPHICATION.

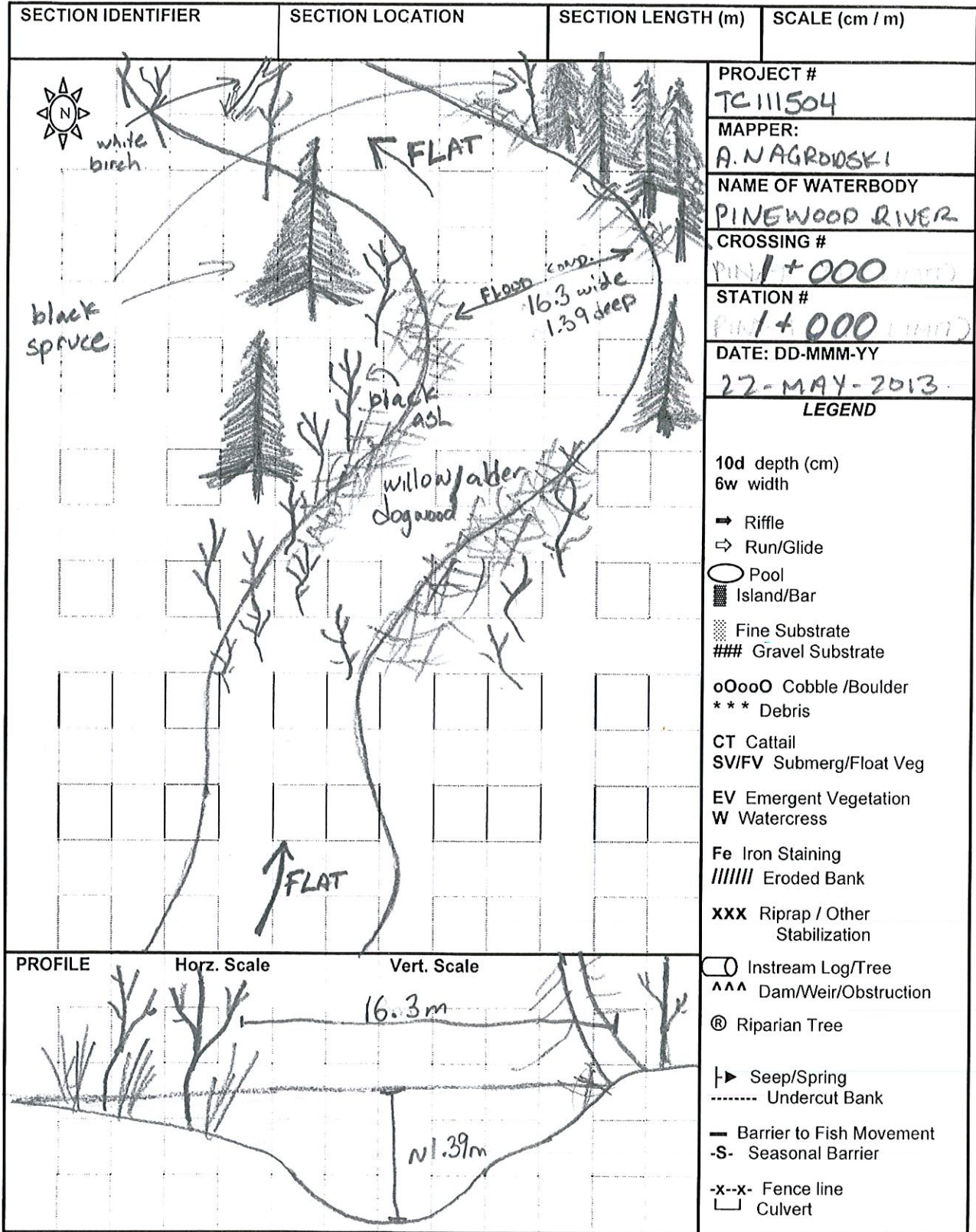
EXISTING STRUCTURE TYPE				
Bridge <input type="checkbox"/>	Box Culvert <input type="checkbox"/>	Open Foot Culvert <input type="checkbox"/>	CSP <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Other <input type="checkbox"/> Describe:			Size (w x h) m ² N/A	

SECTION TYPE AND MORPHOLOGY	
SECTION IDENTIFIER: 1+000	SECTION LOCATION: (include on habitat map)

TYPE:	Stream / river	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:
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TOTAL SECTION LENGTH (m)	100m	CURRENT VELOCITY (m/s)	1.61
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SUB-SECTION(S)	Run	Pool	Riffle	Flats	Inside culvert	Other		
Percentage of area				100.				
mean depth wetted (m)				1.39				
mean width wetted (m)				16.30				
mean bankfull width (m)				12.11				
Mean bankfull depth (m)				1.84				
Substrate								
Bedrock Br	Boulder Bo	Cobble Co	Gravel Gr	Sand Sa	Silt Si	Clay Cl	Muck Mu	Detritus D





APPENDIX D
SUMMER FIELD RECORDS

GENERAL INFORMATION									
PROJECT #: TC11504		PROJECT DESCRIPTION: Rainy River			DAY: 11	MONTH: 07	YEAR: 2012		
COLLECTORS: SA/LS		WEATHER CONDITIONS:			TIME STARTED: 1545		TIME FINISHED: 1605		
AIR TEMP: 36°C		WATER TEMP: see book			CONDUCTIVITY (µS/cm):				
PHOTO NUMBERS AND DESCRIPTIONS: Steve's Camera									
LOCATION									
NAME OF WATERBODY: Pinewood R.		DRAINAGE SYSTEM: Pinewood			CROSSING #: PIN-9		STATION #: PIN-9 (0+200)		
LOCATION OF CROSSING: _____									
GPS COORDINATES:					MTO CHAINAGE: _____				
TOWNSHIP: 150 0419651 ↑ 5408041					MNR DISTRICT: Fort Francois				
LAND USE AND POLLUTION									
SURROUNDING LAND USE: Agriculture					SOURCES OF POLLUTION:				
EXISTING STRUCTURE TYPE									
Bridge <input type="checkbox"/>		Box Culvert <input type="checkbox"/>		Open Foot Culvert <input type="checkbox"/>		CSP <input type="checkbox"/>		N/A <input checked="" type="checkbox"/>	
Other <input type="checkbox"/> Describe:							Size (w x h) m ²		
SECTION TYPE AND MORPHOLOGY									
SECTION IDENTIFIER:					SECTION LOCATION: (Include on habitat map)				
TYPE	Stream / river	Channelized	Perennial	Intermittent	Ephemeral	ASSOCIATED WETLAND:			
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
TOTAL SECTION LENGTH (m): 100					CURRENT VELOCITY (m/s):				
Sub-sections	Run	Pool	Riffle	Flow	Inside culvert	Other			
Percentage of area		50		50					
Mean depth (m)		0.2		0.42					
Mean width (m)		1.5		5.2					
Mean bankfull width (m)		4.1		2.2					
Mean bankfull depth (m)		+1.1		+2					
Substrate		80=C 20=S		75=C 25=S					
Bedrock <input type="checkbox"/>	Boulder <input type="checkbox"/>	Cobble <input type="checkbox"/>	Gravel <input type="checkbox"/>	Sand <input type="checkbox"/>	Silt <input type="checkbox"/>	Clay <input type="checkbox"/>	Muck <input type="checkbox"/>	Debris <input type="checkbox"/>	
Br	Bo	Co	Gr	Sa	Si	Cl	Mu	D	

5=0

BANK STABILITY				
	Stable	Slightly Unstable	Moderately Unstable	Unstable
Left Upstream Bank	0	0	0	X
Right Upstream Bank	0	0	X	0

HABITAT							
IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris	Organic debris	Vascular Macrophytes	None
60	10	0	0	Instream 10 Overhanging 15	5	Instream 10 Overhanging 10	40

SHORE COVER (% stream shaded):	100-90%	80-90%	60-80%	30-60%	10-30%	None
	0	0	0	0	0	0

VEGETATION TYPE (%):	Submergent	Floating	Emergent	None
Predominant Species			25 Arrowhead	75

OBSTRUCTORY OBSTRUCTIONS:	None	Seasonal	Permanent

POTENTIAL CRITICAL HABITAT LIMITING:	Spawning	Evidence of Groundwater	Other

POTENTIAL ENHANCEMENT OPPORTUNITIES:

COMMENTS:

- Bear tracks
- Area is intermittent areas (pools/flats)
- No flow
- Good cover
- Likely fish habitat

SECTION IDENTIFIER:		SECTION LOCATION:		SECTION LENGTH (m):	SCALE (cm / m):
					PROJECT #:
					MAPPER:
					NAME OF WATERBODY:
					CROSSING #:
					STATION #:
					DATE: DD-MMM-YY
					LEGEND
10d depth (cm) 6w width → Riffle ⇨ Run/Glide ○ Pool ■ Island/Bar ● Fine Substrate ### Gravel Substrate oOooO Cobble /Boulder *** Debris CT Cattail SVFV Submerg/Float Veg EV Emergent Vegetation W Watercress Fe Iron Staining // // // // // Eroded Bank xxx Riprap / Other Stabilization ○ Instream Log/Tree ^^^ Dam/Weir/Obstruction ⊗ Riparian Tree ▶ Seep/Spring ----- Undercut Bank — Barrier to Fish Movement -S- Seasonal Barrier -x-x- Fence line L Culvert					
PROFILE:	Horz. Scale	Vert. Scale			

GENERAL INFORMATION									
PROJECT #: TC111504		PROJECT DESCRIPTION: Rainy River			DAY: 11	MONTH: July	YEAR: 2012		
COLLECTORS: L. SNOOK		WEATHER CONDITIONS: Sunny		TIME STARTED: 3:30pm		TIME FINISHED:			
AIR TEMP: 32°C		WATER TEMP: 29.1°C			CONDUCTIVITY (µS/cm): 548				
PHOTO NUMBERS AND DESCRIPTIONS:									
LOCATION									
NAME OF WATERBODY: Pinewood River		DRAINAGE SYSTEM: Pinewood		CROSSING #: Pin-9		STATION #: Pin-9-DS200			
LOCATION OF CROSSING: Levi's Camera									
GPS COORDINATES: Pin-9					MTO CHAINAGE:				
TOWNSHIP:					MNR DISTRICT: Rainy River				
LAND USE AND POLLUTION									
SURROUNDING LAND USE: Agriculture					SOURCES OF POLLUTION: Agriculture				
EXISTING STRUCTURE TYPE									
Bridge <input type="radio"/>		Box Culvert <input type="radio"/>		Open Foot Culvert <input type="radio"/>		CSP <input type="radio"/>		N/A <input type="radio"/>	
Other <input type="radio"/> Describe:						Size (w x h) m ²			
SECTION TYPE AND MORPHOLOGY									
SECTION IDENTIFIER:				SECTION LOCATION: (Include on habitat map)					
TYPE	Stream/inter	Channelized	Permanent	Intermittent	Ephemeral	ASSOCIATED WETLAND:			
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>				
TOTAL SECTION LENGTH (m): 200 m				CURRENT VELOCITY (m/s): 0.0 m/s					
SUB-SECTIONS	Run	Pool	Riffle	Flow	Inside culvert	Other			
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>				
Percentage of area				100					
Mean depth water (m)				0.35					
Mean width water (m)				8.5					
Mean bankfull width (m)				12.5					
Mean bankfull depth (m)				1.56					
Substrate				80% silt/muck 20% clay					
Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay	Muck	Detritus	
Gr	Bo	Co	Gr	Sa	Sl	Cl	Mu	D	

BANK STABILITY								
	Stable	Slightly Unstable	Moderately Unstable	Unstable				
Left Upstream Bank	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>				
Right Upstream Bank	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>				
HABITAT								
IN-STREAM COVER (% surface area):	Undercut banks	Boulders	Cobble	Woody Debris		Organic debris	Vascular Macrophytes	None
	5	/	/	Instream 10	Overhanging 15	20	Instream 20	Overhanging 20
SHORE COVER (% stream shaded):	100-50%	50-30%	20-10%	5-1%	None			
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			
VEGETATION TYPE (%):	Submergent		Floating		Emergent		None	
	20		10		20			
Predominant Species	coontail		floating pond lily		Arrowhead			
MIGRATORY OBSTRUCTIONS:	None		Seasonal		Permanent			
POTENTIAL CRITICAL HABITAT LIMITING:	Spawning		Evidence of Groundwater		Other			
	/		/		/			
POTENTIAL ENHANCEMENT OPPORTUNITIES:								
/								
COMMENTS:								
<ul style="list-style-type: none"> - Extremely low flow - Cannot canoe through - standing water - brackish pools - some eroded banks - water levels low 								
Additional Notes Appended? <input type="radio"/> No <input type="radio"/> Yes number of pages _____								

SECTION IDENTIFIER:	SECTION LOCATION:	SECTION LENGTH (m):	SCALE (cm / m):
			PROJECT #:
			MAPPER:
			NAME OF WATERBODY:
			CROSSING #:
			STATION #:
			DATE: DD-MMM-YY
			LEGEND 10d depth (cm) 6w width → Riffle ⇨ Run/Glide ○ Pool ■ Island/Bar ▨ Fine Substrate ### Gravel Substrate ○○○○ Cobble /Boulder *** Debris CT Cattail SV/FV Submerg/Float Veg EV Emergent Vegetation W Watercress Fe Iron Staining // // // Eroded Bank XXX Riprap / Other Stabilization ○ Instream Log/Tree ^^^ Dam/Weir/Obstruction ⊗ Riparian Tree ▶ Seep/Spring - - - Undercut Bank - Barrier to Fish Movement -S- Seasonal Barrier -x-x- Fence line □ Culvert
PROFILE:	Horz. Scale	Vert. Scale	



APPENDIX E
AQUATIC HABITAT MEASUREMENT DATA

APPENDIX E: PINEWOOD RIVER CROSS-SECTION / PROFILE MEASUREMENTS

Sample Location ID	Date	Distance* (m)	Depth (m)
PIN-9	28-Aug-12	0.00	0.00
	28-Aug-12	1.00	0.43
	28-Aug-12	1.50	0.63
	28-Aug-12	2.00	0.94
	28-Aug-12	3.00	1.25
	28-Aug-12	4.00	1.46
	28-Aug-12	5.00	1.50
	28-Aug-12	6.00	1.37
	28-Aug-12	7.00	1.13
	28-Aug-12	8.00	0.76
	28-Aug-12	8.30	0.48
(0+000)	28-Aug-12	8.60	0.00
	22-May-13	0.00	0.86
	22-May-13	2.00	2.30
	22-May-13	4.00	2.35
	22-May-13	6.00	1.81
	22-May-13	8.00	0.83
	22-May-13	10.00	0.80
	22-May-13	12.00	0.89
	22-May-13	14.00	0.52
	22-May-13	16.00	0.51
	22-May-13	18.00	0.42
(0+300)	22-May-13	20.00	0.38
	22-May-13	21.30	0.31
	22-May-13	0.00	0.53
	22-May-13	1.00	1.25
	22-May-13	2.00	1.79
	22-May-13	3.00	2.25
	22-May-13	4.00	2.38
	22-May-13	5.00	2.41
	22-May-13	6.00	2.25
	22-May-13	7.00	2.15
	22-May-13	8.00	1.75
(0+500)	22-May-13	9.00	1.89
	22-May-13	10.00	1.48
	22-May-13	11.00	1.40
	22-May-13	12.00	1.41
	22-May-13	13.00	1.72
	22-May-13	14.00	1.51
	22-May-13	14.50	0.69
	22-May-13	0.00	0.63
	22-May-13	1.00	0.98
	22-May-13	2.00	1.59
	22-May-13	3.00	1.78
(0+510)	22-May-13	4.00	2.08
	22-May-13	5.00	2.15
	22-May-13	6.00	2.35
	22-May-13	7.00	2.26
	22-May-13	8.00	2.11
	22-May-13	9.00	1.99
	22-May-13	10.00	1.55
	22-May-13	11.00	1.25
	22-May-13	12.00	0.72
	22-May-13	13.00	0.63
	22-May-13	14.00	0.52
(0+510)	22-May-13	15.00	0.43
	22-May-13	15.10	0.36
	22-May-13	0.00	0.45
	22-May-13	1.00	0.78
	22-May-13	2.00	1.36
	22-May-13	3.00	1.98
	22-May-13	4.00	2.22
	22-May-13	5.00	2.56
	22-May-13	6.00	2.55
	22-May-13	7.00	2.10
	22-May-13	8.00	1.98
22-May-13	9.00	1.77	
22-May-13	10.00	1.35	
22-May-13	11.00	1.03	
22-May-13	12.00	0.89	
22-May-13	13.00	0.85	
22-May-13	14.00	0.66	
22-May-13	15.00	0.61	
22-May-13	16.00	0.35	
22-May-13	16.30	0.31	

APPENDIX E: PINEWOOD RIVER CROSS-SECTION / PROFILE MEASUREMENTS

Sample Location ID	Date	Distance* (m)	Depth (m)
(0+600)	22-May-13	0.00	0.41
	22-May-13	1.00	0.36
	22-May-13	2.00	0.78
	22-May-13	3.00	1.32
	22-May-13	4.00	1.86
	22-May-13	5.00	2.21
	22-May-13	6.00	2.56
	22-May-13	7.00	2.63
	22-May-13	8.00	2.66
	22-May-13	9.00	2.41
	22-May-13	10.00	2.02
	22-May-13	11.00	1.89
	22-May-13	12.00	1.32
	22-May-13	13.00	1.15
	22-May-13	14.00	0.89
	22-May-13	15.00	0.56
	22-May-13	16.00	0.32
22-May-13	17.00	0.16	
22-May-13	17.80	0.30	
(0+800)	22-May-13	0.00	NR
	22-May-13	1.00	0.45
	22-May-13	2.00	0.41
	22-May-13	3.00	0.36
	22-May-13	4.00	0.95
	22-May-13	5.00	1.48
	22-May-13	6.00	1.56
	22-May-13	7.00	1.91
	22-May-13	8.00	2.13
	22-May-13	9.00	2.28
	22-May-13	10.00	2.24
	22-May-13	11.00	1.95
	22-May-13	12.00	1.69
	22-May-13	13.00	0.98
	22-May-13	14.00	0.90
	22-May-13	15.00	0.51
	22-May-13	15.80	0.54
(1+000)	22-May-13	0.00	0.54
	22-May-13	1.00	0.63
	22-May-13	2.00	0.98
	22-May-13	3.00	1.10
	22-May-13	4.00	1.53
	22-May-13	5.00	1.88
	22-May-13	6.00	2.36
	22-May-13	7.00	2.45
	22-May-13	8.00	2.69
	22-May-13	9.00	2.58
	22-May-13	10.00	2.11
	22-May-13	11.00	1.77
	22-May-13	12.00	1.65
	22-May-13	13.00	0.98
	22-May-13	14.00	0.53
	22-May-13	15.00	0.51
	22-May-13	16.00	0.36
22-May-13	16.30	0.31	

Notes

* Distance refers to number of meters measured from the true left bank (i.e. facing in the upstream direction)
 NR - Not recorded



APPENDIX F

KEY HABITAT CHARACTERISTICS

APPENDIX F
TABLE F-2: KEY CHARACTERISTICS



Pinewood River											
Station	0+000					Station	0+510				
Coordinates	15U 0419854 5408095					Coordinates	15U 0419615 5408072				
Watercourse Type	Permanent					Watercourse Type	Permanent				
Velocity (m/s)	2.36					Velocity (m/s)	1.88				
Section Length (m)	100					Section Length (m)	100				
Surrounding Land Use	Agricultural					Surrounding Land Use	Agricultural				
Morphology						Morphology					
	Flat	Pool	Riffle	Run	Other		Flat	Pool	Riffle	Run	Other
Percentage of Area (%)	100					Percentage of Area (%)	100				
Mean Depth Wetted (m)	2.4					Mean Depth Wetted (m)	2.56				
Mean Width Wetted (m)	22					Mean Width Wetted (m)	16.61				
Mean Width Bankfull (m)	14.5					Mean Width Bankfull (m)	16.61				
Mean Depth Bankfull (m)	2					Mean Depth Bankfull (m)	2.56				
Substrate (%)	Gravel/Cobble: 10 Woody Debris: 30 Overhanging Veg: 30 Instream Veg: 30					Substrate (%)	Cobble: 10 Macrophytes: 40 Woody Debris: 30 Overhanging Veg: 20				
Left Bank Stability	Slightly Stable					Left Bank Stability	Stable				
Right Bank Stability	Slightly Stable					Right Bank Stability	Stable				
Stable						Habitat					
Undercut Banks (%)	Woody Debris (%)		Organic Debris (%)	Vascular Macrophytes (%)		Undercut Banks (%)	Woody Debris (%)		Organic Debris (%)	Vascular Macrophytes (%)	
	Instream	Overhanging		Instream	Overhanging		Instream	Overhanging		Instream	Overhanging
0	30	30	5	0	0	0	5	20	5	40	20
Dominant Vegetation Type						Dominant Vegetation Type					
	Submergent	Floating		Emergent			Submergent	Floating		Emergent	
Percentage (%)						Percentage (%)					
Dominant Species						Dominant Species					
Notes	<ul style="list-style-type: none"> At flood conditions Sources of possible pollution: pesticides, run-off, sedimentation, eutrophication Riparian zone dominated by grass, alder/willow thickets, black spruce and red oiser dogwood Area is very homogenous throughout 					Notes	<ul style="list-style-type: none"> At flood conditions, reaching into forest Littoral zone dominated by: bluck spruce, alder willow, red maple, black ash Sources of possible pollution: pesticides, run-off, sedimentation, eutrophication 				

Pinewood River											
Station	0+300					Station	1+000				
Coordinates	15U 0419703 5408057					Coordinates	15U 0419395 5408083				
Watercourse Type	Permanent					Watercourse Type	Permanent				
Velocity (m/s)	2.36					Velocity (m/s)	1.61				
Section Length (m)	100					Section Length (m)	100				
Surrounding Land Use	Agricultural					Surrounding Land Use	Agricultural				
Morphology						Morphology					
	Flat	Pool	Riffle	Run	Other		Flat	Pool	Riffle	Run	Other
Percentage of Area (%)	100					Percentage of Area (%)	100				
Mean Depth Wetted (m)	1.6					Mean Depth Wetted (m)	1.4				
Mean Width Wetted (m)	16					Mean Width Wetted (m)	18				
Mean Width Bankfull (m)	-					Mean Width Bankfull (m)	-				
Mean Depth Bankfull (m)	-					Mean Depth Bankfull (m)	-				
Substrate (%)	Gravel/Cobble					Substrate (%)					
Left Bank Stability	Slightly Unstable					Left Bank Stability	Stable				
Right Bank Stability	Slightly Unstable					Right Bank Stability	Stable				
Habitat						Habitat					
Undercut Banks (%)	Woody Debris (%)		Organic Debris (%)	Vascular Macrophytes (%)		Undercut Banks (%)	Woody Debris (%)		Organic Debris (%)	Vascular Macrophytes (%)	
	Instream	Overhanging		Instream	Overhanging		Instream	Overhanging		Instream	Overhanging
0	30	30	5	0	0						
Dominant Vegetation Type						Dominant Vegetation Type					
	Submergent	Floating		Emergent			Submergent	Floating		Emergent	
Percentage (%)						Percentage (%)					
Dominant Species						Dominant Species					
Notes	<ul style="list-style-type: none"> At flooded conditions Cover provided by trees (black spruce & black ash), alder/willow thickets Minimum dogwood in this area Sources of possible pollution: pesticides, run-off, sedimentation, eutrophication 					Notes	<ul style="list-style-type: none"> At flooded conditions, water reaching into trees Dominated by black spruce, Black ash, alder/willow also present Sources of possible pollution: pesticides, run-off, sedimentation, eutrophication 				