newgold Rainy River Project

APPENDIX X-2

DRAFT FISH HABITAT NO NET LOSS PLAN: SECTION 35(2) WATERBODIES

amec

RAINY RIVER RESOURCES LTD.
RAINY RIVER PROJECT

FISH HABITAT NO NET LOSS PLAN SECTION 35(2) WATERBODIES

VERSION B

Submitted by:

AMEC Environment & Infrastructure
a Division of AMEC Americas Limited
160 Traders Blvd. E., Suite 110
Mississauga, Ontario
L4Z 3K7

December 2013
TC111504

Rainy River Project

REVISION HISTORY

Revision Number	Revision Date	Purpose of Revision
Draft Version A	October 31, 2013	Draft for Fisheries Working Group Review and Comment
Draft Version B	December 12, 2013	Draft revised based on preliminary comments from Fisheries Working Group Review.

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS (Cont'd)

PAGE

LIST OF TABLES

LIST OF FIGURES

PAGE

LIST OF APPENDICES

1.0 INTRODUCTION

Rainy River Resources Ltd. (RRR) has been exploring the Rainy River Project (RRP or Project) property since 2005, with the objective of developing a gold mine and milling complex on the site. RRR proposes to construct, operate and eventually reclaim a new open pit and underground gold mine at the RRP property.

Through a collaborative process initiated in mid 2012 with First Nations, Township of Chapple, as well as the Department of Fisheries and Oceans Canada (DFO) and the Ontario Ministry of Natural Resources (MNR) a fish habitat offset framework was developed. The general approach to fish habitat offsets has been endorsed through letters of support to RRR by local First Nations and other stakeholders, and summarized in the RRP Fish Habitat Offset Strategy (AMEC 2013d; Appendix X-1). This No Net Loss Plan (NNLP) provides detail specific to fish habitat affects and offset measures within the context of RRP fish habitat offset framework.

RRR has undertaken a Standard Environmental Assessment pursuant to the *Canadian Environmental Assessment Act, 2012*. In consultation with the local Provincial regulatory agencies, RRR has entered into a Voluntary Agreement with the Ontario Ministry of the Environment to conduct an Environmental Assessment for the RRP in accordance with the requirements of the Ontario *Environmental Assessment Act*.

During the assessment process it has been determined by the Federal Review Team (FRT) that several components of the Project (e.g., pit development, dam construction, watershed and channel diversions) will result in the Harmful Alteration Disruption or Destruction (HADD) of fish habitat and as such require an authorization as per Section 35(2) of the *Fisheries Act*.

As a component of the Section 35(2) Fisheries Act Authorization, an approved habitat offset plan, also referred to as a NNLP is required to demonstrate how the proposed loss of that habitat will be offset to achieve no net loss of fish habitat.

Fisheries resources and the habitat that supports them are protected federally in Canada under the *Fisheries Act* administered by DFO. Bill C-38, passed in June 2012, amended the *Fisheries Act* to focus on the protection of fish that support commercial, recreational or Aboriginal (CRA) fisheries in order to more effectively manage activities that pose the greatest threat to fisheries resources and their habitats. However, at the time of this document development, many of the proposed Bill C-38 amendments are not in force, including changes to Section 35 of the Act that refer to CRA fisheries protection. Future updates to policy, which may affect NNLP approaches and habitat accounting procedures, will be applied as appropriate. As per direction by DFO, the existing guidance and policies continue to apply until such a time as new policies are available.

A separate NNLP will be submitted for Project works that result in the deposition of mine waste in natural waters frequented by fish.

1.1 General Setting

The RRP is located in the Rainy River District, in northwestern Ontario in Chapple Township, approximately 65 km northwest of Fort Frances and 420 km west of Thunder Bay (Figure 1-1). The universal transverse mercator coordinates for the centroid of the proposed open pit are 425660E, 5409700N (NAD 83 Zone 15).

The RRP is located within the Late Achaean Rainy River Greenstone Belt which forms part of the western Wabigoon Subprovince, located in the Superior Province of the Canadian Shield. The terrain in the general vicinity of the Project 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 proximal to the Project 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 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 close 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 Project area mainly reflect low-density rural and some local agricultural and forestry 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 Pinewood River system is characterized for the most part by Lake Agassiz clays which offer limited groundwater recharge potential. Baseflow potential in the system is restricted due to this limited recharge potential coupled with a decreasing trend in precipitation values due to the geographic location near the western border of Ontario. The Pinewood River reaches zero flow in approximately 30% of the years of record (14 out of 47 years) during the late summer and late winter. Tributaries of the Pinewood River are characterized as having low gradients and frequent impoundments by Beaver, and therefore a low energy and depositional properties.

1.2 Spatial Boundaries

The Project site area is positioned within the upper portion of the Pinewood River watershed. The RRP is somewhat unique from an environmental perspective, in that there are no lakes located within, or adjacent to the main RRP site. While limited bait fishing does occur within certain project area creeks, the area does not support a significant commercial or recreational fishery. In addition, the creeks present within the RRP site often encounter zero flow during dry periods.

The Project area for the purposes of this report is focused on drainage systems which represent habitat that will be HADD as a result of mine development including: Clark Creek / Teeple Drain, Loslo Creek / Cowser Drain, Marr Creek, and West Creek (Figure 1-2). Although there will be flow reductions, and increases to the Pinewood River due to site drainage capture and mine return water respectively, we do not anticipate a meaningful reduction to the overall productivity of the system.

Habitat availability, fish community and suitability information specific to other areas proposed for habitat enhancement are included herein so as to provide adequate information for no net loss planning. Specifically information pertaining to the habitat types, species habitat suitability and species abundance for the Pinewood River is included.

The potential impacts to fish habitat are associated with the loss of small baitfish creeks. These creeks support a moderate number of small bodied minnow and forage base fish species and do not necessarily represent a limiting factor to the overall productivity of fish species that are typically more valued by Aboriginal and non-aboriginal harvesters. However, these creeks are valuable with respect to the fish community of the mainstem Pinewood River through the downstream provision of flow, nutrients, organic inputs and primary forage biota (fish and invertebrates; Vannote et al. 1980; Finlay 2001; Tockner et al. 2000; Jardine et al. 2012). Indeed recent studies have indicated the mobility of portions of fish populations otherwise considered 'sedentary' (Radinger and Wolter 2013) through dispersal mechanisms, thereby providing forage base and colonization potential in downstream areas.

Wetland features as generally formed and maintained through Beaver activity within Pinewood River tributaries are considered distinctly within this NNLP due to their importance in water management, water quality and fish habitat.

1.3 Objectives

No net loss is a working principle by which DFO strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that reductions to fisheries resources due to habitat loss or damage may be prevented. The overall objective of this NNLP is to quantitatively assess the distribution, abundance and value of habitat types within the Pinewood River watershed that may be adversely affected by mine development, relative to sections of the watershed that will be unaffected, and to propose options to mitigate or offset the impacts during mine life and beyond.

Guidance documents used to formulate the habitat accounting approach include the *Practitioners Guide to Compensation for DFO Habitat Staff* (DFO 2006), *Review of Approaches for Estimating Changes in Productive Capacity from Whole Lake/Stream Destruction and Related Compensation Projects* (Packman et al. 2006), and *An Introductory Guide to Preparing and Assessing No Net Loss Plans* (Minns 2010b).

The Project team has been exploring options and alternatives to mitigate the potential effects to fish habitat resulting from the RRP with a certain level of success. However, despite best efforts to avoid and minimize impacts, some losses to fish habitat will occur, requiring the provision of measures to offset these losses.

Currently, DFO promotes a hierarchy of fish habitat offset measures as follows:

1. Create or increase the productive capacity of like-for-like habitat in the same ecological unit (local area);

2. Create or increase the productive capacity of unlike habitat in the same ecological unit;

3. Create or increase the productive capacity of habitat in a different ecological unit; and

4. As a last resort, use artificial production techniques to maintain a stock of fish, deferred compensation or restoration of chemically contaminated sites.

The typical method of addressing fish habitat compensation has been the direct replacement of "like for like" habitat, based on area calculations. In other words, for every square metre of habitat that is lost (impacted) a corresponding square metre of habitat is reconstructed elsewhere (compensated). Typically DFO would require an increased quantity of newly developed habitat, compared to the quantity of lost habitat depending on the uncertainties associated with the constructed habitats and the time lag between impact and offset measures. In cases where habitat offsets are deferred well beyond the time the impacts occur, then larger amounts of offset habitat are required to account for the loss in productivity associated with the time lag.

In the case of the RRP NNLP associated with the Section 35(2) Authorizations, the preferred offset measures will be directed at the restoration or enhancement of degraded streams within the Pinewood River watershed to improve habitat and water quality conditions. Although this is expected to improve the overall quality of the habitats, there would be the potential for productivity to decrease in the case of improving water quality and fish habitat in nutrient enriched water bodies. Furthermore, by restoring existing watercourses within the system, there would be little to no "new" habitat developed. As such there will need to be a way to attribute the benefits of the restored or improved habitats into an equation that balances the habitat losses with the offset measures, to meet DFO's no net loss principle.

2.0 OVERVIEW OF APPROACH TO NO NET LOSS PLANNING

The general steps associated with the calculation of habitat losses and gains are:

- Evaluation of baseline habitat characteristics in areas where habitat alterations will occur;
- A determination of which fish species and life history stages will be affected by habitat alteration (species presence);
- Determination of the quantity and quality of fish habitat that will be affected by the Project;
- Determination of the quantity and quality of fish habitat that will be gained / created / enhanced by offset measures; and
- Estimate of the net change in fish habitat quality and quantity.

A detailed account of these general steps is provided in subsequent sections of this report. A Habitat Evaluation Procedure (HEP; USFWS 1980, 1981) approach is proposed to determine the quality and quantity of fish habitat that may be lost (HADD of fish habitat) by the RRP through mine construction, operation and closure.

Recommended steps in the HEP methodology include identification of impacted areas, delineation of cover types, selection of evaluation species, calculation of total area of available habitat, and the calculation of habitat suitability indices for available habitat. HEP uses the concept of Habitat Units (HU), a single dimensionless value that integrates fish habitat quality and quantity metrics. The HU is a product of the quantity of fish habitat estimated as a unit area (typically in square metres) and habitat quality as calculated using a Habitat Suitability Index (HSI).

$$HU = Area \times HSI$$

Minns et al. (2001) used the term Weighted Usable Area (WUA) instead of HU to more accurately reflect the dimensionless value, which is in fact weighted based on habitat preferences of the fish species present and in some cases the socioeconomic value of a particular fish species or guild. To achieve a no net loss, the number of WUA gained by the project must equal or exceed the number of WUA lost.

$$WUA_{lost} – WUA_{offset} = \geq 0$$

In this case the WUAs harmfully altered, disrupted or destructed through the construction, operation, closure and post-closure phases of the RRP will be compared to the WUAs gained from habitat enhanced or created. The ratio of gained habitat to lost habitat will be dependant of on the certainty of the offset measures, and the time lag between the impact and offset measures. Further discussion specific to this is provided in Sections 5.0 and 9.0 of this document.

3.0 FISH HABITAT DATA COLLECTION AND ASSESSMENT

Habitat sampling was completed throughout the Project area with an emphasis on reaches and sections of the watersheds previously listed which may be impacted by mine development. Habitat assessment was conducted on representative stations within the Project study area representing both channel and pond habitat types. Inventories were conducted to provide data specific to hydrogeomorphology and fish habitat availability. Comprehensive fish habitat descriptions were carried out at all sampling locations and included detailed recordings of general gradient and stability observations, channel profile and cross-section morphology, substrate composition, instream aquatic and riparian vegetation communities and cover opportunities.

During field investigations topographic maps, orthophotographs, a handheld global positioning system and rangefinder were used to reference location, orientation and measure distances. Photographic records were collected from each sampling location.

Habitat assessment data collected at representative reaches and ponded areas within the Pinewood River and its tributaries were used to classify habitat types available and delineate their availability throughout the study area. Habitat types were classified using a number of criteria which included the following:

- Watercourse or waterbody: a characterization of whether the water feature is linear and channelized (characterized by fluvial processes) or is a ponded feature created by natural flow regimes or through Beaver activity;

- Permanent (perennial), intermittent or ephemeral: as defined by the MNR *Lakes & Rivers Improvement Act Technical Guidelines* (2004) and the Ministry of Transportation (MTO) *Environmental Guide for Fish and Fish Habitat* (2009):

    - Permanent: a stream which flows continuously for nine or more consecutive months per year under average annual precipitation conditions. A permanent creek or stream must have a channel defined bed and banks of permanent nature.

    - Intermittent: river, creek or stream defined as one which flows for fewer than nine consecutive months per year when it receives a seasonal increase in surface water inputs. At low flow there may be dry segments alternating with flowing segments.

    - Ephemeral: a stream that flows for short periods of time in the spring or in response to runoff events, but not of sufficient duration to create a defined channel (e.g., field swale, gully, inundated hummock).

- Morphology: ranges in the gradient, bankfull widths and depths as well as the occurrence of riffle/run/flat/pool complexes in representative reaches were investigated;

- Land use / dominant riparian features: changes to habitat type were inferred based on the adjacent land use and riparian zone function with forested, graminoid / sedge floodplain and agricultural categories considered to provide different levels of riparian function from the perspective of thermal regulation, bank stability and filtration potential;

- Substrate composition: the percent occurrence within a reach or ponded area of representative particles size (i.e., silt / clay, sand, gravel, cobble, boulder, bedrock); and

- Instream and overhead cover: the availability of cover provided within the water column, as well as from shore, for fish species to carry out life functions including predator avoidance. The type of instream cover was also considered (e.g., vegetation, woody debris, rock).

Representative habitat survey data in combination with detailed satellite imagery were used to delineate the expected occurrence of classified habitat types within watersheds located in the RRP study area.

3.1 Watercourse Classification

Several habitat based criteria were used to classify lengths of watercourses (reaches) and ponded areas of watercourses within the study area into discrete categories or “habitat types”. Table 3-1 provides a summary of both qualitative and quantitative criteria used to delineate habitat types. These habitat types are useful from a broad scale perspective to represent available aquatic habitat. The categorization of reaches and sections of the watersheds in the study area does not negate the importance of small-scale microhabitats on aquatic resources. The location and distribution of habitat types are presented in Figures 3-1 and 3-2 and Appendix A.

Overall, nine habitat types were classified and their presence was delineated throughout the study area. Based on the classification criteria, habitat types were most consistently associated with specific areas of the Pinewood River and/or its tributaries. Habitat types that were most consistently associated with the mainstem Pinewood River are described in this section, despite not necessarily being directly impacted by mine development, to provide context with regard to potential offset scenarios presented in Section 5.0.

Habitat Types 1 and 2 were most consistently associated with the upper Pinewood River. These two types primarily consisted of a relatively deep and wide channel mostly composed of flat morphology with some pools. Generally these habitat types were characterized by relatively narrow flood prone widths and a variable composition of riparian vegetation. Although both habitat Types 1 and 2 showed some similarity with regard to channel dimension, substrate and cover availability, Type 1 was characterized as having a narrower floodplain with moderate entrenchment and forested riparian vegetation extending close to the channel edge. Type 1 aquatic vegetation was dominated by Richardson's Pondweed *(Potamogeton richardsonii)* and Coontail *(Ceratophyllum demersum).*

Habitat Type 2 was characterized by a slightly wider floodplain (maximum 50 m) dominated by sedge, Alder (*Alnus* sp.) and Willow (*Salix* sp.), with mixed forest available within the valley at a greater distance from the channel margins. Aquatic vegetation in Type 2 was dominated by Yellow Pond-lily *(Nuphar luteum),* Broad-leaved Arrowhead *(Sagittaria latifolia),* Tapegrass *(Vallisneria spirallis)* and Coontail. 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, boulder). Mixed forest species associated with both habitat types were Black Spruce *(Picea mariana)*, Tamarack *(Larix laricina),* Balsam Poplar *(Populus balsamifera),* American Elm *(Ulmus Americana)* and White Birch *(Betula papyrifera).*

Habitat Types 3, 4 and 5 generally characterized the smaller tributaries to the Pinewood River including Loslo Creek, Marr Creek, West Creek, and Clark Creek. Type 3 habitat characterized areas of braided diffuse channels with wide and dense grass/sedge dominated floodplains and was often observed in areas directly downstream of Beaver dams. A low width to depth ratio was associated with creek reaches of this type.

Type 4 characterized relatively shallow and narrow single channel reaches and was typically observed in the headwater areas of creeks. Type 4 also included intermittent reaches of tributaries which were transitional to more defined creek channel morphology further downstream. This habitat type had no riffle/run complexes associated with it and was dominated by flat morphology. Woody debris and submerged aquatic vegetation provided a high percentage of in-stream cover for forage-fish species.

Habitat Type 5 specifically classified natural ponded habitats, primarily Beaver ponds, found abundantly scattered throughout the study area and associated with wide floodplains dominated by graminoid species. Beaver activity further decreases the flow rate throughout the study area watercourses and specifically in the tributaries of the Pinewood River. As such, Type 5 Beaver ponds are directly associated with Type 3 habitat which characterizes the shallow and narrow braided/diffuse channels that are linked to the upstream and downstream reaches adjacent to the Type 5 Beaver ponds. This association between Types 3 and 5 reoccurs in many locations across the study area. Substrate throughout Types 3, 4 and 5 remained relatively consistent, comprised of silt/muck, sand, clay and detritus mixed, with a higher degree of organics found in the Type 5 Beaver ponds. Aquatic vegetation within these habitat types consisted primarily of Broad-leaf Arrowhead, Yellow Pond-lily, Coontail, Richardson's Pondweed and Duckweed *(Lemna minor).* All of these habitat types were associated with large floodplains, dominated by grass and sedge, with Alder and Willow interspersed throughout the flood prone width. Upper riparian areas were typically dominated by Black Spruce.

Habitat Types 6 and 7 were characteristic of the lower Pinewood River from downstream of McCallum Creek to its confluence with the Rainy River. As the Pinewood River approaches the Rainy River, the channel widths and depths are significantly increased in comparison to the upper reaches of the river. Types 6 and 7 characterize the majority of the lower Pinewood, consisting of larger bankfull widths and depths and a greater degree of entrenchment. These habitat types also had a considerable difference in available substrate from the upper Pinewood River habitat types, providing more areas having a greater proportion of cobble, gravel and boulder.

The criteria which separated these types were an increase in bankfull width and bankfull depth within habitat Type 7 in comparison to Type 6. Habitat Type 7 included areas of the Pinewood River providing bankfull widths of up to 50 m and maximum bankfull depths of 4.5 m and likely provides the greatest potential for overwintering opportunities. Upper riparian zones of both habitat types were comprised of mixed forest containing Black Spruce, Tamarack, Balsam Poplar, White Birch and American Elm.

Types 8 and 9 were specific to specialized habitat areas found in the lower Pinewood River. Type 8 includes localized natural semi-offline back-bays connected at various locations to the lower Pinewood. These back-bays were shallow (0.15 to 0.85 m) and wide (up to 150 m) flooded depressions that exhibit signs of frequent inundations and varying water level fluctuations. These areas were dominated by grass and sedge riparian vegetation. They were typically connected to the Pinewood River by defined channels with narrow widths and shallow depths. These channels provide the only means of access to and from the mainstem Pinewood River outside of periods of increased water levels and inundation. Habitat Type 8 had an abundance of aquatic vegetation including Horsetail (*Equisetum* spp.), Tapegrass, Water Milfoil (*Myriophyllum* sp.), Broad-leaved Arrowhead, Yellow Pond-lily, Richardson's Pondweed and Duckweed. This habitat type was considered important from the context of spawning and nursery habitat for a number of species, but specifically for Northern Pike (*Esox lucius*).

Habitat Type 9 is specific to sections within the Pinewood River that may be considered high potential spawning habitat for species with a preference for larger particle sizes concentrated in an area of increased flow, such as Walleye. Specifically, habitat Type 9 consisted of sections of the Pinewood River which provided bars and outcroppings dominated by gravel, cobble, boulder and bedrock. These substrates were also associated with expected riffle and run complex morphology during periods of higher flow.

3.2 Distribution and Abundance of Habitat Types (Habitat Quantity)

Based on the habitat delineation criteria, field data collection and alternative assessment methodology, as described previously, the total area (m^2) of each habitat type within each of the watercourses affected by the Project as well as the mainstem Pinewood River is presented in Table 3-2. Habitat types available within the tributaries of the Pinewood River which will be altered by mine development (i.e., Clark Creek, West Creek, Loslo Creek and Marr Creek) are limited to Types 3, 4, and 5, while the Pinewood River provides all types of habitat as delineated and illustrated in Table 3-2 and Figures 3-1 and 3-2.

3.3 Fish Species Presence and Species Weighting

The objectives of previous baseline fish sampling programs were to establish what fish species were present in within aquatic features and catchments. Watercourses were visited by field crews on multiple occasions from 2008 to 2013. The following techniques were used to sample fish: gillnetting, minnow traps, seine netting, boat and backpack electroshocking, dip netting and angling effort. These techniques were deployed to provide a diverse range of passive and active methods to capturing both small-bodied and large bodied fish species in both pond and fluvial habitats. Data recorded included georeferenced location, time, date, gear type, depth, effort (e.g., area, duration, time), numbers and life history stage (Further detail is provided in KCB 2011, AMEC 2012, AMEC 2013a, and AMEC 2013c).

The 34 species listed in Table 3-3 represent those which were captured in the mainstem of the Pinewood River as well as its sampled tributaries. This list reflects sampling results from water features which may be altered by the Project during construction, operation or closure as well as species which are present within other areas of the Pinewood River system. This allows for the most robust and inclusive representation of species which may inhabit water features which may undergo destruction or be applicable to colonization of offset restoration works yet may have not been represented in previous studies. Note that although Lake Sturgeon (3 adult specimens) were captured in the lower Pinewood River during 2013 Spring sampling by AMEC and MNR, they have not been added into the species metrics used in calculating habitat suitability or species groups, as they are not considered to occur within the Local Natural Study Area.

Species habitat weights (SHW) were estimated on a species specific basis using three factors: fish abundance, fishery status and trophic status. The following describes the estimation of each of these factors.

3.3.1 Abundance Weight

Capture data from 1997 to 2012 was pooled to create a database of the relative abundance of each species within each sub-watershed (Table 3-3). Species specific abundances for each sub-watershed were then multiplied to the weighted relative habitat areas for each sub-watershed as provided in Table 3-2. Specifically, estimates of species habitat abundance weight (SHW_{an}) were calculated for each species and sub-watershed by:

$$SHW_{an} = (\% \text{ Species Abundance} / 100) \times (\text{Sub-watershed Habitat Area} / \text{Total Habitat Area})$$

Inclusion of the relative habitat ratio provides a further weighting based on the contribution of sub-watersheds. A single combined abundance weight was then calculated for each species for the whole study area to allow for a single abundance factor for use in calculation WUAs. The combined abundance weight (SHW_A) for each species is the sum of all SHW_a values (1 to n):

$$SHW_A = SHW_{a1} + SHW_{a2} + SHW_{a3}...SHW_{an}$$

The calculation of the abundance weight factor in this fashion provides for inclusion of all fish species within the greater WUA estimate, therefore including species which may not have been captured at other areas of the watershed but may have suitable habitat available as indicated in habitat suitability values. Combined abundance weights for each species are provided in Table 3-4.

3.3.2 Fishery Weight

A methodology was development by Minns (2010a) to group Ontario stream fishes into groups based on criteria of thermal and Balon spawning guilds. These groups were then used to facilitate the categorization of fish species into fishery (e.g., sportfish vs. baitfish vs. other) and trophic (piscivorous vs. non-piscivorous) groups for subsequent ranking. Species within these groups were given the same rank unless known differences in fishery importance or trophic status were applicable.

Each fish species was first given a “fishery rank” which was assigned based on commercial, recreational or sustenance as per the *Draft Fisheries Management Plan* for FMZ 5 (MNR 2012) and the *Draft Pinewood River Fisheries Objectives* (Fort Frances MNR 2013) which state (with respect to species or group specific objectives) 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; and

- Maintain water quality and flows that support successful use of confirmed spawning habitats for large-bodied fish, particularly lake sturgeon, walleye and northern pike.

Therefore fishery ranks were allocated as shown in Table 3-5, with sportfish having a rank of 3, baitfish a rank of 2 and other species a rank of 1. Species were recognized as baitfish based on their popularity for collection and sale through the local and provincial baitfish industry as referenced from the Baitfish Primer (Cudmore and Mandrak 2011) and personal communication with the Fort Frances MNR. Individual species within a rank were not afforded any further weighting and were treated as equal.

A fishery weight factor (SHW_F) was then calculated for each species by dividing the fishery rank for that species by the total sum of fishery ranks for all species. Relative SHW_F for each species are provided in Table 3-5.

Sportfish, although not represented in historical catch records from the tributaries, are afforded a relatively high fishery weight and are assumed to use portions of these tributaries on a seasonal basis with annual variability. This approach allows for a representation of those species which may benefit indirectly from small fish production in affected reaches of the tributaries.

3.3.3 Trophic Weight

Each fish species was also assigned a rank based on trophic level with piscivores given a rank of 2 and non-piscivores given a rank of 1. The trophic weight factor (SHW_T) was calculated by dividing the fishery rank for that species by the total sum of fishery ranks for all species. Relative SHW_T for each species are provided in Table 3-5. The trophic weight factor was incorporated to represent community structure and further represent species which may indirectly benefit from small fish production in downstream sections of the system.

3.3.4 Combined Species Weight Factor

All three of the weight factors discussed previously were then combined to create a single species habitat weight factor for each species (SHW). Abundance, fishery and trophic weights were given criteria weights within the estimation function of the overall SHW. Criteria weights for each factor were assigned the following values (Table 3-5):

Abundance (SHW_A) = 0.25;
Fishery (SHW_F) = 0.50; and
Trophic (SHW_T) = 0.25.

Fishery sensitivities were provided the greatest relative representation to reflect Federal and Provincial legislation and policies with respect to commercial and recreational harvest. Trophic status was included to reflect the importance of biodiversity to fish communities. Abundance was included with a lesser relative weight as it was assumed that the catch information, although spanning multiple years throughout the Pinewood River watershed, may not wholly represent fish species abundance due to timing of sampling and annual variability in water levels, fish movement, recruitment and survival.

The combined SHW (listed in Table 3-5) was calculated as:

$$SWH = (SHW_A \times 0.25) + (SHW_F \times 0.50) + (SHW_T \times 0.25)$$

3.4 Habitat Suitability

Habitat Suitability Index (HSI) models describing spawning, rearing/nursery, feeding, migratory corridor and overwintering/summer refuge habitats for each of the species listed in Table 3-3 were derived using a comparison of the set of habitat variables. The suitability values are rated on a 5-point scale, from 0.0 to 1.0. A rating of 1.0 represents optimal habitat for each life stage of a species. For this NNLP HSI models were derived from:

- Primary literature;
- Technical report models which have previously been accepted by agencies; and/or
- Created using primary and technical literature and professional judgment.

Table 3-6 provides a list of the HSI sources for each species included. These HSI models and the associated values for each habitat type are provided in Appendix B. HSI models which used relationships of suitability to habitat parameters provided SI values of a more continuous nature (e.g., USGS HSI models) than those models which provide a categorical valuation system (e.g., Golder 2008).

HSI models were created by AMEC for Golden Shiner (*Notemigonus crysoleucas*), Iowa Darter (*Etheostoma exile*), Johnny Darter (*Etheostoma nigrum*), Log Perch (*Percina caprodes*), Blackside Darter (*Percina maculata*), Hornyhead Chub (*Nocomis biguttatus*), Mimic Shiner (*Notropis volucellus*), Rock Bass (*Ambloplites rupestris*), Blackchin Shiner (*Notropis heterodon*), Central Mudminnow (*Umbra limi*), and Shorthead Redhorse (*Moxostoma macrolepidotum*) specifically for this project. These models were created using primary literature sources and professional judgement. References used for this exercise included:

- Morphological and ecological characteristics of Canadian freshwater fishes (Coker et al. 2001);

- Fish use of wetlands in Northwestern Ontario: a literature review and bibliography (Hall-Armstrong et al. 1996);

- Adult habitat characteristics of Great Lakes fishes (Lane et al. 1996a);

- Spawning habitat characteristics of Great Lakes fishes (Lane et al. 1996b);

- Nursery habitat characteristics of Great Lakes fishes (Lane et al. 1996c);

- A field guide to freshwater fishes of North America north of Mexico (Page and Burr 1991);

- Riverine habitat characteristics of fishes of the Great Lakes watershed (Portt et al. 1999);

- Freshwater fishes of Canada (Scott and Crossman 1998); and

- Fishbase (www.fishbase.org 2013).

Further consideration was given to the key habitat criteria described in the stream model (Minns 2010a) which emphasized substrate and cover. An ordinal ranking system was then used to rank the quality of each habitat type for each species. This ranking system takes life stage requirements into account, using three primary categories of “optimal”, “sub-optimal”, or “unsuitable”, and intermediary rakings where applicable. These categories and intermediate values correspond with HSI values of 1.0, 0.75, 0.5, 0.25 and 0.0. Field data for a specific habitat type in a given watercourse may have indicated a condition between the matrix categories (e.g., between optimal and sub-optimal) and in these cases a intermediate value was used to represent suitability.

It should be noted that despite there being no capture of Northern Pike, Walleye or Yellow Perch within the tributaries of the Pinewood River during the sampling period it was assumed that where applicable habitat types existed in these tributaries the potential for species habitat use was plausible. As such, HSI values were inserted within the watercourse / habitat type / HSI matrix to represent expected suitability of these species within a given habitat type. Specifically it was assumed that Northern Pike will use the tributaries of the Pinewood River for spawning and nursery habitat, especially during periods of inundation (spring). Therefore Northern Pike was afforded a HSI value greater than 0.1 for each habitat type in each watercourse. Typically for habitat Types 3, 4 and 5 which dominate with respect to availability in the tributaries which will be altered by mine development HSI values of 0.50, 0.10 and 0.80 were allocated, respectively. HSI values for each species by habitat type are presented in Table 3-7.

Although Lake Sturgeon (3 adult specimens) were captured in the lower Pinewood River during 2013 Spring sampling by AMEC and MNR, they are not considered to occur within the Local Natural Study Area and have not been included in the calculation of habitat suitability values.

3.5 Calculation of Weighted Usable Area Scores

Habitat loss and gain was calculated based on the HEP approach (USFWS 1980, 1981) where an area of aquatic habitat can be composed of a variety of habitat types and these types will have varying levels of suitability for a given species which may occur in that area.

In this case as previously discussed and generally following Minns (2001), WUA for each watercourse reach and waterbody (pond) were calculated by multiplying weighted suitability (as represented by the product of HSI and SHW values) by the habitat quantity (area based on bankfull condition) for those species documented or assumed to be present in that watercourse. Geographic information systems (GIS) analysis was then used to sum all of the WUA that will be altered or destroyed by mine development.

The general formula for the calculation of WUA was as follows:

$$WUA = (HA * \sum_{1\text{-}27} (SHW_1 * HV_1) + (SHW_2 * HV_2) + ... + (SHW_{27} * HV_{27}))$$

Where:

WUA = Weighted Usable Area
HA = Available Habitat Area
SHW = Combined Species Habitat Weight
HV = Habitat Value as based on the species specific Habitat Suitability Index

Weighted suitability values by fish species and habitat type are presented in Table 3-8. WUA were calculated for each habitat type for each watercourse. The watercourse and habitat type specific WUA values are provided in Table 3-9.

4.0 FISH HABITATS AFFECTED BY THE PROJECT

Development of the RRP will result in potential impacts to local creeks and rivers due to direct habitat loss (overprinting) and habitat modifications such as channel realignment; and more indirect pathways such as flow reductions, effluent discharge or a combination of the above.

The general arrangement of the site and the features that will overprint water bodies are shown in Figure 4-1. The potential impacts to the aquatic environment and fish habitat are as follows:

- Direct loss or alteration of habitat resulting from the infilling and destruction of portions of creeks in the immediate footprint of the mine or alteration of habitats due to channel realignments from development of the open pit other infrastructure elements associated with mine development (road crossings, pipeline crossings and outlets); and

- Potential indirect effects to habitat due to flow reductions in the Pinewood River resulting from creek runoff collection at site, groundwater interception by the mine workings (open pit and underground) and/or direct water taking from the Pinewood River (construction and potentially closure / post-closure phases).

A brief description of each potential impact and an expectation of whether the work would be considered harmful (HADD) and therefore require an authorization under Section 35(2) of the Fisheries Act is provided below.

4.1 Direct Habitat Loss (infilling) and Channel Diversion (Realignment)

4.1.1 Clark Creek and West Creek

Local creeks expected to be directly overprinted by the mine features (excluding mine waste which is dealt with in a separate NNLP) in whole or in part, include Clark Creek (Teeple Drain) and West Creek. Clark Creek will be diverted and realigned upstream of the mine site, effectively abandoning the lower portions of the former channel, which will ultimately be encompassed by the east mine rock stockpile (Figure 4-1) This will result in the loss of approximately 21,582 m^2 of existing channel downstream of the diversion point (Table 4-1). West Creek and West Creek Tributary 1 (Stockpile Pond tributary) will also be diverted and realigned upstream of the mine and its abandoned lower channel will be incorporated into the footprint of the open pit and plant site, resulting in the loss of approximately 19,551 m^2 of the existing channel.

In both cases, the habitats downstream of the diversion and realignments will be abandoned and considered a HADD of fish habitat requiring formal authorization and offset measures.

4.1.2 Creek Loss Associated with Tailings Dams

Marr Creek and Loslo Creek (Cowser Drain) will be affected by the deposition of mine waste within the proposed Tailings Management Area (TMA), and as such will be approved and compensated for separately in a NNLP associated with Schedule 2 listing under the MMER. However, the dam constructed to contain the tailings, will be subject to a Section 35(2) authorization and as such described and compensated for within this NNLP. The TMA Dam footprint will result in the loss of approximately 196 m^2 of Marr Creek channel. This will require formal authorization and offset measures within this NNLP, but final authorization for the structures will not be granted by DFO until the associated channel sections within the TMA deposition area are listed on Schedule 2 of the MMER. The Loslo Creek dam footprint is considered internal to the overall TMA and is included in the MMER Schedule 2 NNLP.

4.1.3 Roads, Water intakes/Outlets

Works associated with road crossings (east access road, main haul road and Highway 600) are considered to be entirely mitigatable by using best management practices, and standard measures to maintain fish passage. Crossing structures will be sized to accommodate as a minimum the 25 yr return flow unless otherwise required to have a greater capacity (i.e., provincial highway requirements). All culvert crossings would include embedment of the culverts by up to 20% to allow for natural substrates to develop within the culverts and promote fish passage.

Likewise any localized works on water body banks to facilitate pipeline crossings and or water intakes / discharge points are expected to be minor in nature and not result in impacts requiring offset measures. Banks would be restored and stabilized with permanent vegetation and armoured where necessary, and appropriately sized screens would be placed on all intake pipes to prevent fish entrainment as per the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline.

4.2 Flow Reductions

4.2.1 Flow Reduction to Remnant Channels Following Diversion or Loss of Creeks

Following the realignment or loss of channels due to mine infrastructure (Section 4.1), there will be remnant channels either between infrastructure (Marr Creek) or at the terminal segment of the former channel, where the creek channel will still exist, but is unlikely to receive sufficient flow to maintain the function of the habitat. In most cases, these remnant sections are relatively short and have been incorporated into the quantities of lost habitat associated with the mine feature, but in the case of Marr Creek there is a 1 km section of channel between the TMA and the west mine rock / overburden stockpile that is considered to be impaired by the loss of the upstream watershed associated with TMA development. As such, this section of remnant channel, measuring approximately 4,214 m^2 is being considered lost for the purpose of the NNLP and will require offset measures and fisheries authorization.

4.2.2 Pinewood River

The net overall flow reduction or flow increase to the Pinewood River will be a function of the capture of approximately 21 square kilometres (km^2) of watershed associated with the mine site development, periodic takings from the Pinewood River of water required for mine start up and closure, less the effect of returning surplus water (mine return water) back to the Pinewood River through the constructed wetland and the treated effluent discharge downstream of McCallum Creek. During mine life, all water captured and used at the site will be returned to the river with the exception of water loses due to evaporation from the ponds on site, and the water lost due to void spaces within the deposited tailings and dust suppression. A comprehensive description of flow management and water balance as it relates to receiver water volume and quality is provided in the Water Management Plan (AMEC 2013b; Appendix W-1), but for completeness, the potential effect on the Pinewood River habitat is provided in this document below.

The amount of flow reduction, or increased flow, will be dependent on whether it is a wet or dry year (annual precipitation) as well as the stage of mine development and the location along the Pinewood River flow path. As the mine develops, there will be an increased surplus of water to return to the system because of increased runoff coefficients linked to changing landscapes, and as such reduction to net annual flow is greatest during the first years of mine life. As such, we have used year two in the examples below to illustrate effects of the mine on river flows.

Using year two of operation as an example, Table 4-2 shows the net annual effects of the 21 km^2 watershed capture without the mine return water and with the mine return water. There is no scenario where surplus water would not be returned to the Pinewood and accordingly, only examples with mine return water are discussed further.

On an average annual basis, the mine would result in a less than 2% flow reduction to the Pinewood River flows downstream of the Kishkakoesis River, a 3.5% reduction at the McCallum Creek inflow, an 8% reduction between McCallum Creek and Loslo Creek, and a more localized reduction of up to 34% between Marr Creek and Loslo Creek. The approximate net percent reduction in flow along the Pinewood River flow path is shown in Figure 4-2.

The larger flow reduction (27 to 34%) between West Creek and Loslo Creek results from a combination of diverting the sub watersheds of West Creek and Marr Creek further west to the Loslo Creek channel and the lack of opportunity to redirect mine return water into the Pinewood River at this location to mitigate the effect.

To better characterize the potential effects of the flow reductions (or increases) on fish habitat, we have modelled representative cross-sections of the Pinewood River using WinXSPRO, developed by the USDA Forest Service to analyze stream channel cross section data for geometric, hydraulic, and sediment transport parameters. This analysis (Tables 4-3, 4-4, 4-5 and 4-6) provides estimated changes to the wetted width and depth of the channel under average annual flow conditions, by month at cross sections representative of the following locations:

1. Pinewood River downstream of the Kishkakoesis River (Table 4-3);
2. Pinewood River downstream of McCallum Creek (Table 4-4);
3. Pinewood River downstream of Loslo Creek (Table 4-5); and
4. Pinewood River between West Creek and Loslo Creek (Table 4-6).

The flows were modelled based on the top of bank / bankfull channel cross section as measured during our fish habitat surveys. Once the predicted flows exceed these sections changes to the wetted width and depth are considered nominal. The wetted width and depth values have only been modelled for the average annual flow condition at year 2 of operations. However, additional flow reductions in percent by month are available for the same stations along the Pinewood River for both low and high flow years, and at years 7 and 15 of operations (AMEC 2013b; Appendix W-1).

The results of the analysis based on average annual flow, demonstrates that monthly reductions in wetted width and depth downstream of the Kishkakoesis River inflow are minimal (generally less than 2%, Table 4-3) while changes to the Pinewood River channel downstream of McCallum Creek would be in the order of 4%, or less with the exception of February when flow is often negligible within the system due to natural conditions (Table 4-4).

Downstream of Loslo Creek (Table 4-5) the results are somewhat greater with monthly width and depth reductions of 1 to 13%, but typically less than 10%. As expected the greatest changes in width and depth occur between Loslo Creek and Marr Creek (Table 4-6) where there will be a 34% reduction of flow. Width reductions through this reach are expected to range from 5 to 15%, and depth from 8 to 26%. This represents the greatest flow effect resulting from the diversion of flows around the site (Marr and West Creek) which occurs over approximately 1,700 m of channel before partial flows are returned to the river at Loslo Ceek.

Overall, the actual channel condition changes (width and depth) are considered low to moderate and it is the Project teams opinion that they are not expected to result in harmful impacts to the overall river's productive capacity.

5.0 OFFSET MEASURES

As discussed in Section 1.3, the *Fisheries Act* was amended in June 2012 and new fisheries policy is being developed to provide guidance to practitioners on the achievement of no net loss and offset strategy. However, until such a time when the policy and guidance documentation is made available, DFO has directed the continued use of existing guidance documents. As such, habitat offset approaches for the Project have been based on the hierarchy of offset preferences as outlined in the DFO *Policy for Management of Fish Habitat* (DFO 1986) and the *Practitioners Guide to Habitat Compensation for DFO Management Staff* (2006), while taking into account more local fisheries management objectives and stakeholder consultation.

A Fisheries Working group consisting of the RRP team, DFO and MNR has been formed to develop this NNLP and offset strategy to account for the unavoidable effects to fish habitat resulting from the Project (AMEC 2013b; Appendix X-1).

The predicted impacts not associated with mine waste, and as such authorized under Section 35(2) of the *Fisheries Act* represent approximately 45,543 m^2 of habitat loss or 10,148 WUA (Table 4-1). The proposed offsets for these impacts will be achieved through one or more of the following approaches.

5.1 Watershed Based Habitat Enhancements

This approach will be largely focused on reversing long term and wide spread agricultural impacts. The specific locations of where the offset works are best completed would require the ongoing participation of the MNR and a stewardship council composed of the various stakeholders in the Pinewood River watershed, and as such cannot be determined at this time. However, the following general concepts will be used and built upon through continued consultation with DFO and MNR.

Restoration techniques would include measures previously implemented successfully in the watershed such as cattle fencing, offline cattle watering sources, and channel and riparian zone restoration. The proposed strategy would make every effort to compliment and work with existing local programs and initiatives, such as the RRFN Watershed Program, and MNR District Partnership Programs (stewardship council). This means that the compensation program would be set up to support local groups and efforts with a mechanism to track these contributions with respect to ultimate Project commitments.

The challenge with this method is that it is difficult to quantify the overall benefit to both physical habitat and long term water quality to the aquatic community as a whole. As an example, by restoring riparian function and limiting cattle access to creek habitat that is nutrient enriched, the offset measures may actually decrease overall productivity due to nutrient reduction, but improve the conditions of the creek for more sensitive species of fish, and increase species richness.

A conceptual drawing showing the benefits associated with the remediation measures is provided in Appendix D.

We have assumed that watershed restoration works would be performed at a combined ratio with like for like habitat replacement of between 1.5:1 and 2:1 to account for the long term water quality improvement as well as the more immediate physical habitat restoration. Under this assumption then a maximum of approximately 20,000 WUA would need to be created as compensation if all of the works were composed of watershed restoration works at a 2:1 ratio. Assuming a 4 m bankfull width results in approximately 30 km of streambank rehabilitation required to achieve the determined offset area. If only a 1:1 ratio of watershed restoration works is required, then 15 km of stream restoration would be necessary. Note that this calculation requires that the works receive 100 percent credit for the total area restored.

Implementation of watershed restoration works would commence during the first year of the project, but it is not anticipated to be completed until several years into the project.

5.2 Like for Like Habitat Replacement

Like for like habitat replacement is consistent with currently in place DFO hierarchy for the preferred replacement of fish habitat. This is due to the greater certainty of demonstrating a no net loss of fish habitat by providing an equal to or greater area of new habitat to offset the lost habitats. The method is simple and readily monitored for performance.

Within the RRP properties, there are additional opportunities to create like for like habitat replacement associated with the Clark Creek diversion, immediately upstream of Teeple Road. An impoundment is proposed at this location which could provide up to 80,000 m^2 of new fish habitat depending on the height of the flow control structure. This would provide an opportunity to provide a minimum of a 1:1 offset ratio for the Section 35(2) impacts. A conceptual Drawing showing the proposed Teeple Road Pond is provided in Appendix D.

5.3 Blended Approach (Preferred)

As discussed above, stakeholders have expressed an interest in seeing watershed based and water quality focused offset measures implemented within the NNLP. The feasibility and acceptability of this approach as a sole offset measure has significant challenges with respect to quantifying the benefits of the measures and follow up monitoring. As such DFO in consultation with the working group has expressed a preference for a blended approach, consisting of a minimum 1:1 ratio of like for like habitat to provide assurance that minimum habitat replacement targets are met, with watershed based improvement measures employed to account for local stakeholder interests and for consistency with MNR watershed management objectives .

As discussed above in section 5.2 there is appropriate opportunity within the Project property to provide like for like habitat development with the Teeple Road Pond on the Clark Creek realigned system. This combined with the offsite watershed based improvements described in section 5.1 would result in an effective balance between supporting and advancing local fisheries restoration initiatives and achieving offset quantities that are, definable, defendable and reasonably monitored consistent with the current DFO policies.

The ratio of efforts between the two approaches would require further discussion and determination between RRR and DFO but have tentatively been suggested as being between 1.5:1 and 2:1 of gain to loss.

6.0 MEASURES TO MITIGATE IMPACTS TO FISH HABITAT DURING IMPLEMENTATION OF THE PLAN

The risk of impacts on adjacent habitats during implementation of the plan will be primarily related to construction operations and the potential for erosion and sedimentation of downstream areas. The following mitigation measures will be incorporated into the planning, design and construction of the offset features (replacement habitat) to reduce or eliminate the potential impacts during implementation:

- Adherence to construction timing windows guidelines for the protection of fish and fish habitat to minimize disturbance during construction and habitat replacement works.
- Intake and outfall locations will be constructed to avoid entrainment of fish through the use of isolation measures, and appropriately sized screens as per the DFO document "Freshwater Intake End-of-Pipe Fish Screen Guideline".
- Any areas where existing habitats are to be dewatered or overlain by deposits will have fish removed to the extent possible through a fish salvage program.
- Installation of collection ditching around the TMA and MRS to collect and manage runoff and seepage originating these components.
- Use of clean non-acid generating materials to construct dams or berms.
- Access with and use of existing trails and roads to the extent possible to minimize disturbance to adjacent areas.
- To the extent possible, works that infill fish habitat will be staged to occur when fish are less likely to be present in the area, such as during low flow periods. It is noted that this may not be possible depending on the habitat and the mine schedule.
- Vegetation clearing will be kept to the minimum required for access to, and development.
- Effective sediment and erosion control measures will be maintained during all stages of work to prevent sediment from entering adjacent or downstream waterbodies. Such measures may include but not be limited to rock flow checks, silt fence, gravel berms erosion control blankets, and temporary vegetation covers such as nurse crops.
- Use scour protection to prevent erosion at any locations when concentrated flows exit the disturbed construction area.

- Use of fabricated geotextiles, where appropriate, to minimize disturbance and erosion to adjacent areas.

- All materials and equipment used for the purpose of site preparation and project completion will be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, oils, lubricants, silt, etc.) from entering the water.

- Stabilize any excess materials removed from the work site, to prevent them from entering any waterbody.

- Operate machinery in a manner that minimizes disturbance to adjacent habitats.

- Machinery is to arrive on site in a clean condition and will be maintained free of fluid leaks.

- An emergency spill kit will be kept on site in case of fluid leaks or spills from machinery.

- Conduct daily visual inspections of the site to ensure that effective controls are being implemented and maintained as necessary.

7.0 MEASURES TAKEN TO MONITOR THE IMPLEMENTATION OF THE PLAN

To ensure that the plan is implemented as proposed, the construction operation will be monitored daily by RRR onsite monitors to ensure that:

- Mitigation measures as described in Section 6 and specified in the plans and detailed design are employed effectively and supplemented where necessary;
- Fish habitat compensation areas are constructed as per the approved plans and schedule;
- A photographic record of the plan implementation will be taken to document conditions prior to, during and following construction; and
- Any deficiencies in the mitigation measures are identified to the contractor in a timely manner and addressed in a suitable manner.

Following construction of the approved plan, as-built drawings will be developed to confirm that the constructed habitats are consistent with the proposed plan. Any discrepancies will be identified with proposed remediation measure where appropriate. The purpose of the monitoring will be to ensure that the offset measures are constructed in compliance with the approved plans to ensure that the specified habitats are constructed as per the specified schedule (see Section 9).

8.0 MEASURES TO VERIFY THE EXTENT TO WHICH THE PURPOSE OF THE PLAN HAS BEEN ACHIEVED AND CONTINGENCIES

The proposed offset measures for the Section 35(2) impacts will be developed. The effectiveness of the replacement habitat will be assessed as follows:

- The initial construction of the habitat will be documented and reported with an as-built drawing and accompanying photo documentation as per Section 7;
- An annual assessment of the habitat stability and habitat structural function of the compensation pond habitat, will be conducted for three years following construction with a final report in the third year; and
- A non-destructive fish survey will be conducted in year 3 and year 5 following construction to confirm waters are being frequented by fish and constructed habitat is progressing toward an expected level of suitability.

8.1 Contingencies

There is little risk of the offset features not being constructed as designed or that they will not eventually have the capacity and conditions to support appropriate fish habitat.

The only uncertainty is associated with the timely colonization of the diversion channels and constructed ponds by adjacent fish populations. If monitoring shows that colonization has not occurred, the option of enhancing fish species richness and biomass within offset features through adaptive management and fish transfer from adjacent watercourses will be discussed with DFO and the MNR and implemented, if necessary.

9.0 SCHEDULE OF PLAN IMPLEMENTATION

A description of the plan implementation timeline is provided in Table 9-1. Note that plan will be further developed and refined in terms of the offset measures and schedule in cooperation with DFO and MNR.

10.0 ESTIMATED COST OF PLAN IMPLEMENTATION

It is our understanding that the purpose of estimating the cost to implement the offset plan is to provide an estimated cost that would be incurred in the event that a third party were to have to develop the offset works due to a default or abandonment of the site by the proponent. As such a cost for the construction of the NNLP plan, and the proposed monitoring will be provided as per Table 10-1 in the final fisheries authorization application. RRR will arrange the provision of an irrevocable letter of credit. We welcome further discussion regarding this aspect.

11.0 REFERENCES

AMEC. 2012. Rainy River Resources Limited, Rainy River Gold Project, Aquatic Resources 2011 Baseline Investigation.

AMEC. 2013a. Rainy River Resources Limited, Rainy River Gold Project, Aquatic Resources 2012 Baseline Investigation.

AMEC. 2013b. Rainy River Resources Limited, Final Environmental Assessment Report (Environmental Impact Statement).

AMEC. 2013c. Rainy River Resources Limited, Rainy River Project, Aquatic Resources 2013 Baseline Investigation.

Coker, G.A., C.B. Portt and C.K. Minns. 2001. Mophological and Ecological Characteristics of Canadian Freshewater Fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2554.

Cudmore, B. and N.E. Mandrak. The Baitfish Primer – A Guide to Identifying and Protecting Ontario's Baitfishes. Produced by: Department of Fisheries and Oceans and Bait Association of Ontario. Online: http://www.dfo-mpo.gc.ca/regions/central/pub/baitfish-appat-on/index-eng.htm. Last updated: 2011-05-25.

Department of Fisheries and Oceans. 1986. Policy for the Management of Fish Habitat. Ottawa, Canada: Department of Fisheries and Oceans.

Department of Fisheries and Oceans. 2006. Practitioners Guide to Compensation for DFO Habitat Management Staff. Version 1.1. Fisheries and Oceans Canada. Communications Branch. 24 pp.

Edwards, E.A., D.A. Krieger, M. Bacteller and O.E. Maughan. 1982. Habitat Suitability Index Models: Black Crappie. U.S.D.I. Fish and Wildlife Service. FWS/OBS-82/10.6. 25 pp.

Edwards, E.A., G. Gebhart, and O.E. Maughan. 1983. Habitat suitability information: Smallmouth Bass. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.36. 47 pp.

Finlay, J.C. 2001. Stable-Carbon-Isotope Ratios of River Biota: Implications for Energy Flow in Lotic Food Webs. Ecology 82:1052–1064.

Fishbase. 2013. Online: http://www.fishbase.org/. Last updated 02/2013.

Golder Associates Ltd. 2008. Fish Species Habitat Suitability Index Models for the Alberta Oil Sands Region, Version 2.0, October 2008.

Hall-Armstrong, J., A.G. Harris and R.F. Foster. 1996. Fish use of wetlands in northwestern Ontario: A literature review and bibliography. Northwest Sci. & Technol., Ont. Min. Natur. Resour., Thunder Bay, Ont. TR-90. 54 pp + Append.

Inskip, P.D. 1982. Habitat suitability index models: Northern Pike. U.S. Dept. Int. Fish. Wildl. Serv. FWS/OBS-82/10.17. 40 pp.

Jardine, T.D., K.A. Kidd and J.B. Rasmussen. 2012. Aquatic and terrestrial organic matter in the diet of stream consumers: implications for mercury bioaccumulation. Ecological Applications 22:3, 843-855.

Klohn Crippen Berger (KCB). 2011. Rainy River Gold Project Baseline Report 2008-2010.

Krieger, D.A., J.W. Terrell, and P.C. Nelson. 1983. Habitat suitability information: Yellow perch. U.S. Fish Wildl. Service. FWS/OBS-83/10.55. 37 pp.

Lane, J.A., C.B. Portt and C.K. Minns. 1996a. Adult Habitat Characteristics of Great Lakes Fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2358.

Lane, J.A., C.B. Portt and C.K. Minns. 1996b. Spawning Habitat Characteristics of Great Lakes Fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2368.

Lane, J.A., C.B. Portt and C.K. Minns. 1996c. Nursery Habitat Characteristics of Great Lakes Fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2338.

McMahon, T.E. 1982. Habitat suitability index models: Creek chub. U.S.D.I. Fish and Wildlife Service. FWS/OBS-82/10.4 23 pp.

McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984. Habitat suitability information: Walleye. U.S. Fish Wildl. Service. FWS/OBS-82/10.56. 43 pp.

Ministry of Natural Resources. 2004. Lakes & Rivers Improvement Act Technical Guidelines.

Ministry of Natural Resources. 2012. Draft Fisheries Management Plan for FMZ-5. October 2012.

Ministry of Natural Resources. 2013. Fort Frances District Office. E-mail communication.

Ministry of Transportation. 2009. Environmental Guide for Fish and Fish Habitat. June 2009.

Minns, C.K., J.E. Moore, M. Stoneman and B. Cudmore-Vokey. 2001. Defensible Methods of Assessing Fish Habitat: Lacustrine Habitats in the Great Lakes Basin – Conceptual Basis and Approach Using a Habitat Suitability Matrix (HSM) Method. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2559. 80 pp + Appendices.

Minns, C.K. 2010a. Ontario Stream Fishes Habitat Associations and Derivation of a Simple Habitat Assessment Model. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2909. 39 pp + appendices.

Minns, C.K. 2010b. An Introductory Guide to Preparing and Assessing No Net Loss Plans. Canadian Science Advisory Secretariat Research Document [Draft]. Fisheries and Oceans Canada. 2010.

Packman G.A., D.J. Harper, S.C. Samis and D. Lampi. 2006. Review of Approaches for Estimating Changes in Productive Capacity from Whole-lake / Stream Destruction and Related Compensation Projects. Canadian Technical Report of Fisheries and Aquatic Sciences 2664.

Page, L.M. and B.M. Burr. 1991. A Field Guide to Freshwater Fishes of North America North of Mexico. The Peterson Field Guide Series, Houghton-Mifflin Co., Boston, MA.

Portt. C.B., G. Coker, and C.K. Minns. 1999. Riverine Habitat Characteristics of Fishes of the Great Lakes Watershed. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2481: vii + 62 pp.

Radinger, J. and C. Wolter. 2013. Patterns and predictors of fish dispersal in rivers. Fish and Fisheries. doi: 10.1111/faf.12028.

Scott, W.B. and E.J. Crossman. 1998. Freshwater Fishes of Canada. Galt House Publications Ltd. Oakville, Ontario, Canada.

Stuber, R.J. 1982. Habitat suitability index models: Black Bullhead. U.S. Dept. Int. Fish. Wildl. Service. FWS/OBS-82/10.14. 25 pp.

Stuber, R.J., G. Gebhart, and O.E. Maughan. 1982. Habitat suitability index models: Bluegill. U.S.D.I Fish and Wildlife Service. FWS/OBS-82/10.8. 26 pp.

Tockner, K.,F. Malard, and J.V. Ward. 2000. An Extension of the Flood Pulse Concept. Hydrological Processes 14.16-17 (2000): 2861-2883.

Trial, J.G., J.G. Stanley, M. Batcheller, G., Gebhart, O.E., Maughan and P.C. Nelson. 1983a. Habitat suitability information: Blacknose dace. U.S. Fish Wildl. Serv. FWS/OBS-82/10.41. 28 pp.

Trial, J.G., C.S. Wade, J.G. Stanley, and P.C. Nelson. 1983b. Habitat suitability information: Common shiner. U.S. Dept. Int., Fish Wildl. Service. FWS/OBS-82/10.40. 22 pp.

Twomey, K.A., K.L. Williamson, and P.C. Nelson. 1984. Habitat suitability index models and instream flow suitability curves: White sucker. U.S. Fish Wildl. Service. FWS/OBS-82/10.64. 56 pp.

U.S. Fish and Wildlife Service. 1980. Habitat Evaluations Procedures (HEP). ESM 102. U.S.D.I. Fish and Wildlife, Division of Ecological Services.

U.S. Fish and Wildlife Service. 1981. Standards for the development of habitat suitability index models for use in habitat evaluation procedures. U.S.D.I. Fish and Wildlife Service.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell and C.E. Cushing. 1980. The River Continuum Concept. Canadian Journal of Fisheries and Aquatic Sciences 37: 130 – 137.

Table 3-1: Habitat Type Criteria

<table>
<tr><th rowspan="2">Typical Watershed Association</th><th rowspan="2">Habitat Type Classification</th><th rowspan="2">Watercourse vs. Waterbody Dominated</th><th rowspan="2">Permanent / Intermittent / Ephemeral</th><th colspan="5">Characteristic Morphology Features</th><th rowspan="2">% Dominant Landuse / Riparian Features</th><th rowspan="2">Substrate Composition (% Ranges)</th><th rowspan="2">Instream Cover (% by Category)</th></tr>
<tr><th>Habitat Attributes</th><th>Bankfull Width (m)</th><th>Average Depth (m)</th><th>Floodplain Width (m)</th><th>% Riffle, Run, Flat, Pool</th></tr>
<tr><td rowspan="2">Upper Pinewood River</td><td>Type 1</td><td>Watercourse</td><td>Permanent</td><td>• Low gradient (0.05 - 1%)
• Well defined and forested valley
• Moderate entrenchment - banks 1:2 - 1:1 ratio
• Narrower Floodplain
• Moderately sinuous flow path</td><td>5 - 10</td><td>0.25 - 1.75</td><td>10 - 15</td><td>• Flats: >80
• Pools: <20
• Primarily flat morphology
• Occasional pools in thalweg meanders</td><td>• Mixed Forest: 80
• Graminoid/Sedge Floodplain: 10
• Agricultural: 10</td><td>• Silt/Muck: 20 – 40
• Sand: 20 – 40
• Clay: 10 – 20
• Detritus: 5 – 10
• Gravel: 5 – 10
• Boulder: 2 – 5
• Loose organics, silt and detritus over firm silty clay.
• Some sand/gravel beds interspersed throughout</td><td>• Woody Debris: 10 – 20
• Submerged Aquatic Veg: 5 – 10
• Emergent Aquatic Veg: 5 – 10
• Boulder/Cobble: <5
• Overhanging Veg: 5 – 10
• Moderate cover availability consisting of woody debris, bank vegetation and some aquatic vegetation</td></tr>
<tr><td>Type 2</td><td>Watercourse</td><td>Permanent</td><td>• Low gradient (0.05 - 1%)
• Low entrenchment - banks 1:5 - 1:2 ratio
• Moderate past/present beaver activity
• Hummocky</td><td>10 - 20</td><td>0.75 - 2.25</td><td>15 - 50</td><td>• Flats: >90
• Pools: <10
• Pools and flats due to occasional beaver activity</td><td>• Graminoid/Sedge Floodplain: 60
• Agricultural: 30
• Mixed Forest: 10</td><td>• Silt/Muck: 20 – 40
• Sand: 20 – 40
• Clay: 10 – 20
• Detritus: 5 – 15
• Gravel: 5 – 10
• Boulder: 2 – 5
• Loose organics, silt and detritus over firm silty clay</td><td>• Woody Debris: 20 – 30
• Submerged Aquatic Veg: 10 – 15
• Emergent Aquatic Veg: 10 – 20
• Boulder/Cobble: <5
• Overhanging Veg: 20 – 30
• High cover availability consisting of woody debris, bank vegetation and some undercut banks</td></tr>
<tr><td rowspan="3">Upper Reaches of Pinewood River Tributaries</td><td>Type 3</td><td>Watercourse</td><td>Permanent</td><td>• Braided/Diffuse channel
• Low entrenchment - banks 1:10 - 1:5 ratio
• Low gradient (0.05 - 1%)
• Poorly defined flow pattern
• Multiple channels
• Past/present beaver activity</td><td>2 - 5</td><td>0.25 - 1.75</td><td>50 - 150</td><td>• Flats: >90
• Pools: <5
• Runs: <5
• Braided/diffuse channels
• Deep narrow channels
• Low width/depth ratio</td><td>• Graminoid/Sedge Floodplain: 80
• Mixed Forest: 20
• Beaver influenced/Floodplain
• Alder/Willow thickets interspersed</td><td>• Silt/Muck: 15 – 25
• Sand: 20 – 40
• Clay: 15 – 25
• Detritus: 10 – 20
• Loose organics, silt and detritus over firm silty clay</td><td>• Woody Debris: <5
• Submerged Aquatic Veg: 5 – 10
• Emergent Aquatic Veg: 5 – 10
• Overhanging Veg: 30 – 50
• High cover availability consisting of woody debris, bank vegetation, aquatic vegetation</td></tr>
<tr><td>Type 4</td><td>Watercourse</td><td>Intermittent; leading to permanent</td><td>• Intermittent watercourse; leading to more permanent channel
• Defined flow path consisting of one channel
• Low gradient (0.05 - 1%)
• Moderate entrenchment- banks 1:2 - 1:1 ratio</td><td>1 - 8</td><td>0.75 - 2.5</td><td>50 - 100</td><td>• Flats: >60
• Pools: >40
• Primarily flats</td><td>• Graminoid/Sedge Floodplain: 50
• Agricultural: 40
• Mixed Forest: 10</td><td>• Detritus: 20 – 40
• Silt/Muck: 20 – 4
• Sand: 25 – 50
• Clay: 5 – 10
• Loose organics, silt and detritus over firm silty clay</td><td>• Woody Debris: 20 – 30
• Submerged Aquatic Veg: 10 – 15
• Emergent Aquatic Veg: 10 – 20
• Boulder/Cobble: <5
• Overhanging Veg: 40 – 50
• High cover availability consisting of woody debris, bank vegetation</td></tr>
<tr><td>Type 5</td><td>Water Body</td><td>Permanent</td><td>• Beaver Pond
• Wide floodplain
• Extensive beaver activity
• Regulated flow
• Low entrenchment - banks 1:10 - 1:5 ratio
• Low gradient (0.05 - 1%)</td><td>10 - 50</td><td>0.25 - 2.00</td><td>150 ></td><td>• Pools: 100
• Pond habitat</td><td>• Graminoid/Sedge Floodplain: 80
• Mixed Forest: 20
• Beaver influenced/Floodplain
• Alder/Willow thickets interspersed</td><td>• Sand: 20 – 30
• Silt/Muck: 20 – 40
• Clay: 10 -20
• Detritus: 10 – 20
• Loose organics, silt and detritus over firm silty clay</td><td>• Woody Debris: 30 – 50
• Submerged Aquatic Veg: 10 – 15
• Emergent Aquatic Veg: 10 – 20
• Boulder/Cobble: <5
• Overhanging Veg: 10 -20
• Moderate cover availability consisting of woody debris, bank vegetation and some aquatic vegetation</td></tr>
</table>

Typical Watershed Association	Habitat Type Classification	Watercourse vs. Waterbody Dominated	Permanent / Intermittent / Ephemeral	Characteristic Morphology Features					% Dominant Landuse / Riparian Features	Substrate Composition (% Ranges)	Instream Cover (% by Category)
				Habitat Attributes	Bankfull Width (m)	Average Depth (m)	Floodplain Width (m)	% Riffle, Run, Flat, Pool			
Mid to Lower Pinewood River	Type 6	Watercourse	Permanent	• Moderate gradient (1 - 5%) • Steep entrenchment - banks 1:1 - 2:1 ratio • Undercut and bank erosion present	10 -25	0.5 - 2.0	25 - 50	• Flats: >60 • Pools: >30 • Runs: <10 • Primarily flat morphology • Occasional pools in thalweg meander	• Mixed Forest: 80 • Graminoid/Sedge Floodplain: 1 • Agricultural: 10	• Silt/Muck: 30 – 50 • Sand: 15 – 25 • Gravel: 20 -30 • Cobble: 20 – 30 • Boulder: 30 – 40 • Clay: 5 – 10 • Silt bottom, with gravel, cobble and boulders mixed throughout	• Woody Debris: 20 -40 • Submerged Aquatic Veg: 5 – 10 • Emergent Aquatic Veg: 5 – 10 • Boulder/Cobble: 50 – 70 • Overhanging Veg: 10 -20 • High percent cover consisting of woody debris, bank vegetation, some aquatic vegetation, as well as cobble and boulder beds throughout
	Type 7	Watercourse	Permanent	• Moderate gradient (1 - 5%) • Moderate entrenchment - banks 1:2 - 1:1 ratio • Wide Floodplain • Deep holes (>4 m) interspersed • Low Flow	20 - 60	1.0 - 4.5	40 - 100	• Flats: >70 • Pools: <25 • Runs: <5 • Primarily flat morphology • Occasional pools in thalweg meander	• Mixed Forest: 90 • Graminoid/Sedge Floodplain: 10	• Clay: 20 – 30 • Silt/Muck: 20 – 30 • Gravel: 40 -50 • Sand: 20 – 40 • Cobble: 40 – 50 • Boulder: 20 – 30 • Clay/silt bottom, with gravel, cobble and boulders mixed throughout	• Woody Debris: 20 -40 • Submerged Aquatic Veg: 5 – 10 • Emergent Aquatic Veg: 5 – 10 • Boulder/Cobble: 40 – 60 • Overhanging Veg: 5 – 10 • High percent cover consisting of woody debris, bank vegetation, some aquatic vegetation, as well as cobble and boulder beds throughout
	Type 8	Water Body	Permanent	• Intermittent Back Bay area • Large online floodprone depressions • Low Gradient (0.05 - 1%) • Low entrenchment - banks 1:10 - 1:5 ratio • Wide Floodplain • Frequent Inundation and water level fluctuations • Graminoid/sedge dominated floodplain. • Single narrow channel connection to Pinewood River.	30 - 150	0.15 - 0.85	50 - 200	• Pools: 100 • Intermittent pond habitat	• Mixed Forest: 40 • Graminoid/Sedge Floodplain: 30 • Agricultural: 30	• Silt/Muck: 40 -60 • Sand: 20 – 30 • Clay: 10 – 20 • Detritus: 10 - 20 • Silt and detritus over firm silty clay	• Woody Debris: <5 • Submerged Aquatic Veg: 20 – 30 • Emergent Aquatic Veg: 40 – 60 • Boulder/Cobble: <5 • Overhanging Veg: 30 - 50
	Type 9	Watercourse	Permanent	• Potentially critical spawning/staging habitat • Boulder/Cobble/Gravel beds • Exposed bedrock • Riffle/Run Morphology during periods of high flow. • Proximity to back-eddies and slack water areas • Point bars	10 - 25	0.25 - 1.25	25 - 50	• Flats: >40 • Pools: <20 • Runs: <20 • Riffles: <20 • Primarily flat morphology • Riffle/Runs during periods of high flow	• Mixed Forest: 90 • Graminoid/Sedge Floodplain: 10	• Cobble: 40 -60 • Gravel: 40 – 60 • Boulder: 30 – 40 • Sand: 10 – 30 • Silt: 10 -20 • Boulder/Cobble/gravel beds • Exposed bedrock • Underlying clay/silt layer	• Woody Debris: 5 – 15 • Submerged Aquatic: <5 • Emergent Aquatic Veg: <5 • Boulder/Cobble: 70 – 90 • Overhanging Veg: <5 • Large boulders, cobble beds providing ample cover as well as ideal spawning substrate.

Table 3-2: Distribution and Total Areas of Habitat Types

Habitat Type	Habitat Type Area (m^2) per Watercourse / Subwatershed					Total
	Clark Creek (Teeple Drain)	West Creek	Loslo Creek (Cowser Drain)	Marr Creek	Pinewood River	
1	0	0	0	0	236,733	236,733
2	0	0	0	0	192,900	192,900
3	5,135	9,020	16,015	2,203	35,091	67,464
4	7,457	21,907	17,827	4,672	7,134	58,997
5	40,567	63,925	163,810	20,258	20,425	308,985
6	0	0	0	0	188,608	188,608
7	0	0	0	0	158,820	158,820
8	0	0	0	0	1,275	1,275
9	0	0	0	0	19,916	19,916
Total	53,159	94,852	197,652	27,133	860,902	1,233,698

Table 3-3: Percent Abundance of Fish Species from Capture Data

Species	Sub-watershed				
	Clark Creek (Teeple Drain)	West Creek	Loslo Creek (Cowser Drain)	Marr Creek	Pinewood River
Black Crappie	0.00	0.00	0.00	0.00	0.92
Blackchin Shiner	0.00	1.26	0.00	0.61	0.18
Blacknose Dace	1.46	0.00	0.00	0.00	0.18
Blackside Darter	0.22	0.08	0.00	0.00	0.12
Brassy Minnow	19.28	21.92	53.48	33.81	1.76
Brook Stickleback	0.00	0.00	0.00	0.00	6.32
Brown Bullhead	12.22	4.97	0.36	12.79	0.83
Central Mudminnow	1.79	1.89	2.05	2.44	1.11
Common Shiner	5.38	3.94	0.45	2.03	11.28
Creek Chub	2.13	4.50	0.27	0.20	2.83
Emerald Shiner	0.67	0.79	0.36	5.89	41.44
Fathead Minnow	0.00	0.16	0.09	0.00	0.03
Finescale Dace	28.25	41.88	38.59	14.01	2.77
Golden Shiner	0.90	0.00	0.00	0.00	2.68
Hornyhead Chub	0.00	0.00	0.00	0.00	0.25
Iowa Darter	0.00	0.00	0.00	0.81	0.03
Johnny Darter	0.00	0.00	0.00	0.00	1.17
Lake Chub	19.84	0.24	0.98	9.54	0.25
Lake Sturgeon	0.00	0.00	0.00	0.00	*
Log Perch	0.00	0.00	0.00	0.00	0.40
Mimic Shiner	0.00	3.86	0.00	0.00	0.03
Northern Pike	0.00	0.00	0.00	0.00	5.18
Northern Redbelly Dace	1.35	7.65	1.16	15.63	0.65
Pearl Dace	2.13	5.84	1.43	0.00	0.43
Pumpkinseed	0.00	0.00	0.00	0.00	0.74
Rock Bass	0.00	0.00	0.00	0.00	0.74
Sauger	0.00	0.00	0.00	0.00	0.06
Shorthead Redhorse	0.00	0.00	0.00	0.00	0.15
Smallmouth Bass	0.00	0.00	0.00	0.00	0.12
Spottail Shiner	3.48	0.47	0.80	2.13	3.39
Trout-perch	0.00	0.00	0.00	0.00	2.62
Walleye	0.00	0.00	0.00	0.00	1.02
White Sucker	0.90	0.55	0.00	0.10	2.19
Yellow Perch	0.00	0.00	0.00	0.00	8.13
Total	100.00	100.00	100.00	100.00	100.00

Note that although Lake Sturgeon (3 adult specimens) were captured in the lower Pinewood River during 2013 Spring sampling by AMEC and MNR, they have not been added into the species metrics used in calculating habitat suitability or species groups, as they are not considered to occur within the Local Natural Study Area

Table 3-4: Composite Abundance by Watershed

Species	Sub-watershed SHW_a Values					Combined Abundance Weight (SHW_A)
	Clark Creek (Teeple Drain)	West Creek	Loslo Creek (Cowser Drain)	Marr Creek	Pinewood River	
Black Crappie	0.000	0.000	0.000	0.000	0.006	0.006
Blackchin Shiner	0.000	0.001	0.000	0.000	0.001	0.002
Blacknose Dace	0.001	0.000	0.000	0.000	0.001	0.002
Blackside Darter	0.000	0.000	0.000	0.000	0.001	0.001
Brassy Minnow	0.008	0.017	0.086	0.007	0.012	0.131
Brook Stickleback	0.000	0.000	0.000	0.000	0.044	0.044
Brown Bullhead	0.005	0.004	0.001	0.003	0.006	0.018
Central Mudminnow	0.001	0.001	0.003	0.001	0.008	0.014
Common Shiner	0.002	0.003	0.001	0.000	0.079	0.085
Creek Chub	0.001	0.003	0.000	0.000	0.020	0.025
Emerald Shiner	0.000	0.001	0.001	0.001	0.289	0.292
Fathead Minnow	0.000	0.000	0.000	0.000	0.000	0.000
Finescale Dace	0.012	0.032	0.062	0.003	0.019	0.129
Golden Shiner	0.000	0.000	0.000	0.000	0.019	0.019
Hornyhead Chub	0.000	0.000	0.000	0.000	0.002	0.002
Iowa Darter	0.000	0.000	0.000	0.000	0.000	0.000
Johnny Darter	0.000	0.000	0.000	0.000	0.008	0.008
Lake Chub	0.009	0.000	0.002	0.002	0.002	0.014
Log Perch	0.000	0.000	0.000	0.000	0.003	0.003
Mimic Shiner	0.000	0.003	0.000	0.000	0.000	0.003
Northern Pike	0.000	0.000	0.000	0.000	0.036	0.036
Northern Redbelly Dace	0.001	0.006	0.002	0.003	0.005	0.016
Pearl Dace	0.001	0.004	0.002	0.000	0.003	0.011
Pumpkinseed	0.000	0.000	0.000	0.000	0.005	0.005
Rock Bass	0.000	0.000	0.000	0.000	0.005	0.005
Sauger	0.000	0.000	0.000	0.000	0.000	0.000
Shorthead Redhorse	0.000	0.000	0.000	0.000	0.001	0.001
Smallmouth Bass	0.000	0.000	0.000	0.000	0.001	0.001
Spottail Shiner	0.001	0.000	0.001	0.000	0.024	0.027
Trout-perch	0.000	0.000	0.000	0.000	0.018	0.018
Walleye	0.000	0.000	0.000	0.000	0.007	0.007
White Sucker	0.000	0.000	0.000	0.000	0.015	0.016
Yellow Perch	0.000	0.000	0.000	0.000	0.057	0.057
Total	0.043	0.077	0.160	0.022	0.698	1.000

Table 3-5: Fish Species Habitat Weight Factors and Criteria Weights (Abundance, Fishery and Trophic Status)

Group	Species	Abundance Weight (SHWA)	Fishery Rank	Fishery Weight (SHWF)	Trophic Rank	Trophic Weight (SHWT)	Combined Weight Factor (SHW)
Group1: COLD x A1 -- Non-Piscivore / Baitfish	Lake Chub	0.014	2	0.030	1	0.026	0.025
	Pearl Dace	0.011	2	0.030	1	0.026	0.024
	Trout-perch	0.018	1	0.015	1	0.026	0.018
Group 2: COOL x A1 -- Piscivore / Sportfish	Northern Pike	0.036	3	0.045	2	0.051	0.044
	Walleye	0.007	3	0.045	2	0.051	0.037
	Sauger	0.000	3	0.045	2	0.051	0.035
	Yellow Perch	0.057	3	0.045	2	0.051	0.049
Group 3: COOL x A1 -- Non-Piscivore / Baitfish	White Sucker	0.016	2	0.030	1	0.026	0.025
	Blacknose Dace	0.002	2	0.030	1	0.026	0.022
	Brassy Minnow	0.131	2	0.030	1	0.026	0.054
	Finescale Dace	0.129	2	0.030	1	0.026	0.053
	Golden Shiner	0.019	2	0.030	1	0.026	0.026
	Northern Redbelly Dace	0.016	2	0.030	1	0.026	0.025
	Iowa Darter	0.000	1	0.015	1	0.026	0.014
Group 4: COOL x A2 -- Non-Piscivore / Baitfish	Creek Chub	0.025	2	0.030	1	0.026	0.027
	Log Perch	0.003	1	0.015	1	0.026	0.015
	Blackside Darter	0.001	1	0.015	1	0.026	0.014
	Hornyhead Chub	0.002	2	0.030	1	0.026	0.022
Group 5: COOL x B -- Non-Piscivore / Baitfish	Common Shiner	0.085	2	0.030	1	0.026	0.043
	Brook Stickleback	0.044	1	0.015	1	0.026	0.025
	Johnny Darter	0.008	1	0.015	1	0.026	0.016
Group 6: COOL x B -- Piscivore / Sportfish	Rock Bass	0.005	3	0.045	2	0.051	0.036
	Black Crappie	0.006	3	0.045	1	0.026	0.030
Group 7: WARM x A -- Non-Piscivore / Baitfish	Blackchin Shiner	0.002	2	0.030	1	0.026	0.022
	Emerald Shiner	0.292	2	0.030	1	0.026	0.094
	Mimic Shiner	0.003	2	0.030	1	0.026	0.022
	Spottail Shiner	0.027	2	0.030	1	0.026	0.028
	Central Mudminnow	0.014	2	0.030	1	0.026	0.025
	Shorthead Redhorse Sucker	0.001	1	0.015	1	0.026	0.014
Group 8: WARM x B -- Non-Piscivore / Baitfish	Fathead Minnow	0.000	2	0.030	1	0.026	0.021
	Brown Bullhead	0.018	2	0.030	1	0.026	0.026
	Pumpkinseed	0.005	3	0.045	1	0.026	0.030
Group 9: WARM x B -- Piscivore / Sportfish	Smallmouth Bass	0.001	3	0.045	2	0.051	0.035
	Total	1.000	67		39		1.000
	Criteria Weight	0.250		0.500		0.250	

Notes:
F - Fishery rank - sportfish (3), baitfish (2), other (1)
T - Trophic rank - piscivore (2), non-piscivore (1)

Table 3-6: Species List and Grouping of Piscivore / Sportfish and Non-Piscivore / Baitfish with Habitat Suitability Index Source

Group	Species	Source
Group1: COLD x A1 -- Non-Piscivore / Baitfish	Lake Chub	Golder 2008
	Pearl Dace	Golder 2008
	Trout-perch	Golder 2008
Group 2: COOL x A1 -- Piscivore / Sportfish	Northern Pike	Inskip 1982
	Walleye	McMahon et al. 1984 and Golder 2008
	Sauger	Assumed to be similar to Walleye
	Yellow Perch	Krieger et al. 1983
Group 3: COOL x A1 -- Non-Piscivore / Baitfish	White Sucker	Twomey et al. 1984
	Blacknose Dace	Trial et al. 1983a
	Brassy Minnow	Golder 2008
	Finescale Dace	Golder 2008
	Golden Shiner	AMEC 2013*
	Northern Redbelly Dace	Golder 2008
	Iowa Darter	AMEC 2013*
Group 4: COOL x A2 -- Non-Piscivore / Baitfish	Creek Chub	McMahon 1982
	Log Perch	AMEC 2013*
	Blackside Darter	AMEC 2013*
	Hornyhead Chub	AMEC 2013*
Group 5: COOL x B -- Non-Piscivore / Baitfish	Common Shiner	Trial et al. 1983b
	Brook Stickleback	Golder 2008
	Johnny Darter	AMEC 2013*
Group 6: COOL x B -- Piscivore / Sportfish	Rock Bass	AMEC 2013*
	Black Crappie	Edwards et al. 1982
Group 7: WARM x A -- Non-Piscivore / Baitfish	Blackchin Shiner	AMEC 2013*
	Emerald Shiner	Golder 2008
	Mimic Shiner	AMEC 2013*
	Spottail Shiner	Golder 2008
	Central Mudminnow	AMEC 2013*
	Shorthead Redhorse	AMEC 2013*
Group 8: WARM x B -- Non-Piscivore / Baitfish	Fathead Minnow	Golder 2008
	Brown Bullhead	Stuber 1982
	Pumpkinseed	Stuber et al. 1982
Group 9: WARM x B -- Piscivore / Sportfish	Smallmouth Bass	Edwards et al. 1983

Notes / References:

* - Developed by AMEC using a number of species references as listed in subsequent tables in Appendix C

Edwards, E.A., D.A. Krieger, M. Bacteller and O.E. Maughan. 1982. Habitat Suitability Index Models: Black Crappie. U.S.D.I. Fish and Wildlife Service. FWS/OBS-82/10.6. 25 pp.

Edwards, E. A., G. Gebhart, and 0. E. Maughan. 1983. Habitat suitability information: Smallmouth bass. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.36. 47 pp.

Golder Associates Ltd. 2008. Fish Species Habitat Suitability Index Models for the Alberta Oil Sands Region, Version 2.0, October 2008

Inskip, P.D. 1982. Habitat suitability index models: Northern Pike. U.S. Dept. Int. Fish. Wildl. Serv. FWS/OBS-82/10.17. 40 pp.

Krieger, D.A., J.W. Terrell, and P.C. Nelson. 1983. Habitat suitability information: Yellow perch. U.S. Fish Wildl. Service. FWS/OBS-83/10.55. 37 pp.

McMahon, T.E. 1982. Habitat suitability index models: Creek chub. U.S.D.I. Fish and Wildlife Service. FWS/OBS-82/10.4 23 pp.

McMahon, T.E., J.W. Terrell, and P.C. Nelson. 1984. Habitat suitability information: Walleye. U.S. Fish Wildl. Service. FWS/OBS-82/10.56. 43 pp.

Trial, J.G., J.G. Stanley, M. Batcheller, G., Gebhart, O.E., Maughan and P.C. Nelson. 1983a. Habitat suitability information: Blacknose dace. U.S. Fish Wildl. Service. FWS/OBS-82/10.41. 28 pp.

Trial, J.G., C.S. Wade, J.G. Stanley, and P. C. Nelson. 1983b. Habitat suitability information: Common shiner. U.S. Dept. Int., Fish Wildl. Service. FWS/OBS-82/10.40. 22 pp.

Twomey, K.A., K.L. Williamson, and P.C. Nelson. 1984. Habitat suitability index models and instream flow suitability curves: White sucker. U.S. Fish Wildl. Service. FWS/OBS-82/10.64. 56 pp.

Stuber, R.J.,G. Gebhart, and O.E. Maughan. 1982. Habitat suitability index models: Bluegill. U.S.D.I Fish and Wildlife Service. FWS/OBS-82/10.8. 26 pp.

Stuber, R.J. 1982. Habitat suitability index models: Black Bullhead. U.S. Dept. Int. Fish. Wildl. Service. FWS/OBS-82/10.14. 25 pp.

Table 3-7: Habitat Suitability Index Values by Fish Species and Habitat Type

Group	Species	Suitability Index (SI)								
		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9
Group1: COLD x A1 -- Non-Piscivore / Baitfish	Lake Chub	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.50
	Pearl Dace	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Trout-perch	0.25	0.75	0.75	0.75	0.25	0.25	0.25	0.25	0.5
Group 2: COOL x A1 -- Piscivore / Sportfish	Northern Pike	0.80	0.90	0.50	0.10	0.80	0.90	0.80	0.90	0.10
	Walleye	0.10	0.10	0.00	0.00	0.00	0.40	0.50	0.50	0.60
	Sauger	0.10	0.10	0.00	0.00	0.00	0.40	0.50	0.50	0.60
	Yellow Perch	1.00	0.70	0.00	0.00	0.00	1.00	1.00	0.20	0.70
Group 3: COOL x A1 -- Non-Piscivore / Baitfish	White Sucker	0.60	0.50	0.50	0.50	0.00	0.80	0.80	0.00	0.60
	Blacknose Dace	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Brassy Minnow	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25
	Finescale Dace	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25
	Golden Shiner	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Northern Redbelly Dace	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25
	Iowa Darter	0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.25
Group 4: COOL x A2 -- Non-Piscivore / Baitfish	Creek Chub	0.20	0.10	0.10	0.10	0.10	0.70	0.20	0.10	0.20
	Log Perch	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.50
	Blackside Darter	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25
	Hornyhead Chub	0.25	0.25	0.25	0.25	0.00	0.50	0.50	0.00	0.25
Group 5: COOL x B -- Non-Piscivore / Baitfish	Common Shiner	0.10	0.10	0.10	0.10	0.10	0.60	0.60	0.10	0.50
	Brook Stickleback	0.25	0.25	0.25	0.25	0.25	0.25	0.50	0.25	0.25
	Johnny Darter	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.25	0.25
Group 6: COOL x B -- Piscivore / Sportfish	Rock Bass	0.25	0.25	0.00	0.00	0.00	0.50	0.50	0.00	0.25
	Black Crappie	0.20	0.20	0.10	0.20	0.45	0.20	0.20	0.45	0.20
Group 7: WARM x A -- Non-Piscivore / Baitfish	Blackchin Shiner	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Emerald Shiner	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Mimic Shiner	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Spottail Shiner	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.50
	Central Mudminnow	0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.25
	Shorthead Redhorse Sucker	0.25	0.25	0.00	0.00	0.00	0.50	0.50	0.00	0.50
Group 8: WARM x B -- Non-Piscivore / Baitfish	Fathead Minnow	0.75	0.5	0.75	0.5	0.75	0.75	0.75	0.5	0.25
	Brown Bullhead	0.30	0.70	0.50	0.50	0.70	0.70	0.70	0.70	0.20
	Pumpkinseed	0.25	0.10	0.10	0.20	0.25	0.25	0.25	0.25	0.20
Group 9: WARM x B -- Piscivore / Sportfish	Smallmouth Bass	0.20	0.10	0.05	0.20	0.20	0.20	0.20	0.20	0.20
	Criteria Weight	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3-8: Weighted Suitability Values by Fish Species and Habitat Type

Group	Species	Weighted Suitability Value								
		Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9
Group1: COLD x A1 -- Non-Piscivore / Baitfish	Lake Chub	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Pearl Dace	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Trout-perch	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01
Group 2: COOL x A1 -- Piscivore / Sportfish	Northern Pike	0.04	0.04	0.02	0.00	0.04	0.04	0.04	0.04	0.00
	Walleye	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.02
	Sauger	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.02
	Yellow Perch	0.05	0.03	0.00	0.00	0.00	0.05	0.05	0.01	0.03
Group 3: COOL x A1 -- Non-Piscivore / Baitfish	White Sucker	0.02	0.01	0.01	0.01	0.00	0.02	0.02	0.00	0.02
	Blacknose Dace	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Brassy Minnow	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.01	0.01
	Finescale Dace	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.01	0.01
	Golden Shiner	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Northern Redbelly Dace	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Iowa Darter	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00
Group 4: COOL x A2 -- Non-Piscivore / Baitfish	Creek Chub	0.01	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.01
	Log Perch	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
	Blackside Darter	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
	Hornyhead Chub	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01
Group 5: COOL x B -- Non-Piscivore / Baitfish	Common Shiner	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.02
	Brook Stickleback	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Johnny Darter	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
Group 6: COOL x B -- Piscivore / Sportfish	Rock Bass	0.01	0.01	0.00	0.00	0.00	0.02	0.02	0.00	0.01
	Black Crappie	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Group 7: WARM x A -- Non-Piscivore / Baitfish	Blackchin Shiner	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Emerald Shiner	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.02
	Mimic Shiner	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Spottail Shiner	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Central Mudminnow	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Shorthead Redhorse Sucker	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
Group 8: WARM x B -- Non-Piscivore / Baitfish	Fathead Minnow	0.02	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01
	Brown Bullhead	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01
	Pumpkinseed	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Group 9: WARM x B -- Piscivore / Sportfish	Smallmouth Bass	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Weighted Suitability ∑ (SWH x HIS)		**0.31**	**0.30**	**0.22**	**0.21**	**0.23**	**0.52**	**0.51**	**0.35**	**0.32**

Table 3-9: Weighted Usable Area by Habitat Type and Watercourse / Sub-watershed

Habitat Type	Weighted Useable Area per Watercourse / Subwatershed					Total
	Clark Creek (Teeple Drain)	West Creek	Loslo Creek (Cowser Drain)	Marr Creek	Pinewood River	
1	0	0	0	0	72,907	72,907
2	0	0	0	0	57,530	57,529
3	1,131	1,987	3,527	485	7,728	14,858
4	1,554	4,565	3,715	974	1,487	12,295
5	9,416	14,837	38,021	4,702	4,741	71,718
6	0	0	0	0	97,383	97,383
7	0	0	0	0	81,238	81,238
8	0	0	0	0	443	5,443
9	0	0	0	0	6,490	6,490
Total	**12,101**	**21,389**	**45,263**	**6,161**	**329,946**	**414,860**

Table 4-1: Summary of Proposed Habitat Offset Balance for Section 35(2) Authorization Waterbodies

Mine Feature	Total Area Overprinted (m^2)					Weighted Usable Area (WUA) Overprinted					Offset Feature	Total Area of Offset (m^2)	Weighted Usability Value	Weighted Useable Area Offset
	Loslo Creek (Cowser Drain)	Marr Creek	West Creek	Clark Creek (Teeple Drain)	Total	Loslo Creek (Cowser Drain)	Marr Creek	West Creek	Clark Creek (Teeple Drain)	Total				
Clark Creek Diversion, East Mine Rock Stockpile	-	-	-	21,355	21,355	-	-	-	4,828	4,828	Cattle fencing, off-line watering, riparian and channel restoration	TBD	TBD	TBD
Open Pit	-	-	17,412	-	17,412	-	-	3,768	-	3,768				
Dam Structures	-	196	-	227	423	-	41	-	47	88				
Plant Site / Ancillary Facilities	-	-	2,139	-	2,139	-	-	447	-	447	Clark Creek Pond at Teeple road Like for Like Habitat	Min of 45,543 m^2	0.23	Min of 10,148
Remnant Channels	-	4,214	-	-	4,214	-	1,017	-	-	1,017				
Grand Total	**0**	**4,410**	**19,551**	**21,582**	**45,543**	**0**	**1,058**	**4,215**	**4,875**	**10,148**				
										Net Result	**Blended Approach**	**Min 45,543**	**Varies**	**Min 10,148 plus Offsite Measures**

Note: min: minimum

Table 4-2: Summary of Average Annual Flow Reduction with and without Mine Return Water Discharge

Flow Scenario (Year 2 operations)	Downstream of Kishkakoesis River	Downstream of McCallum Creek	McCallum Creek to Loslo Creek	Loslo Creek to Marr Creek	Marr Creek to West Creek	West Creek to Clark Creek
Average Annual Flow without Mine Return Water	-4.5%	-10.1	-19.8	-34.2%	-27.5%	-8.1%
Average Annual Flow with Mine Return Water	-1.5%	-3.5%	-8.0	-34.2%	-27.5%	-8.1%

Table 4-3: Summary of Mine Effects on Monthly Flow Downstream of Kishkakoesis River with Water Discharge through Pipeline.

Month	Existing Average Flow (m^3/s)	Flow with Mine Return Water (m^3/s)	Flow Percent Change	Existing Wetted Width	Existing Depth	New Wetted Width	New Depth	Change in Wetted Width (m)	Change in Wetted Depth (m)	Change in Wetted Width (%)	Change in Wetted Depth (%)
January	0.217	0.226	4.0%	6.06	0.4	6.17	0.41	0.11	0.01	1.8%	2.5%
February	0.144	0.137	-4.6%	5.31	0.33	5.31	0.33	0.00	0.00	0.0%	0.0%
March	0.536	0.512	-4.6%	6.7	0.59	6.67	0.58	-0.03	-0.01	-0.4%	-1.7%
April*	9.574	9.328	-2.6%	*	*	*	*	*	*	*	*
May*	7.119	6.979	-2.0%	*	*	*	*	*	*	*	*
June*	5.400	5.211	-3.5%	*	*	*	*	*	*	*	*
July	3.156	3.128	-0.9%	8.1	1.38	8.09	1.37	-0.01	-0.01	-0.1%	-0.7%
August	1.533	1.578	3.0%	7.62	0.96	7.64	0.98	0.02	0.02	0.3%	2.1%
September	1.783	1.818	1.9%	7.7	1.03	7.71	1.04	0.01	0.01	0.1%	1.0%
October	2.347	2.333	-0.6%	7.87	1.18	7.87	1.18	0.00	0.00	0.0%	0.0%
November	1.909	1.917	0.4%	7.75	1.07	7.75	1.07	0.00	0.00	0.0%	0.0%
December	0.383	0.403	5.2%	6.46	0.51	6.49	0.52	0.03	0.01	0.5%	2.0%
Average				7.06	0.83	7.08	0.83	0.01	0.00	0.2%	0.6%

Notes:

Assumes an average flow year in year two of operations

Zero values reflect changes to the wetted depth of less than 1 cm

Positive numbers represent a flow increase from existing conditions

* Model is only calibrated to the bankfull channel section as measured in the field during aquatic habitat surveys - once the predicted flows exceed these sections changes to the wetted width and depth are considered nominal

Table 4-4: Summary of Mine Effects on Monthly Flow Downstream of McCallum Creek with Water Discharge through Pipeline

Month	Existing Average Flow (m^3/s)	Flow with Mine Return Water (m^3/s)	Flow Percent Change	Existing Wetted Width	Existing Depth	New Wetted Width	New Depth	Change in Wetted Width (m)	Change in Wetted Depth (m)	Change in Wetted Width (%)	Change in Wetted Depth (%)
January	0.098	0.107	9%	4.05	0.4	4.26	0.41	0.21	0.01	5%	2%
February	0.065	0.058	-10%	2.25	0.3	2.17	0.28	-0.08	-0.02	-4%	-7%
March	0.241	0.217	-10%	6.57	0.56	6.34	0.54	-0.23	-0.02	-4%	-4%
April	4.308	4.062	-6%	13.14	1.56	13.03	1.52	-0.11	-0.04	-1%	-3%
May	3.204	3.063	-4%	12.65	1.39	12.59	1.37	-0.06	-0.02	0%	-1%
June	2.430	2.241	-8%	12.25	1.25	12.13	1.21	-0.12	-0.04	-1%	-3%
July	1.420	1.392	-2%	11.1	1.03	11.01	1.02	-0.09	-0.01	-1%	-1%
August	0.690	0.735	7%	8.94	0.8	8.99	0.81	0.05	0.01	1%	1%
September	0.803	0.837	4%	9.11	0.84	9.11	0.84	0.00	0.00	0%	0%
October	1.056	1.042	-1%	10.39	0.93	10.46	0.94	0.07	0.01	1%	1%
November	0.859	0.867	1%	9.19	0.86	9.62	0.88	0.43	0.02	5%	2%
December	0.172	0.192	12%	5.87	0.5	6.11	0.52	0.24	0.02	4%	4%
Average				8.79	0.87	8.82	0.86	0.03	-0.01	0.4%	-0.6%

Notes:

Assumes an average flow year in year two of operations
Zero values reflect changes to the wetted depth of less than 1 cm
Positive numbers represent a flow increase from existing conditions

Table 4-5: Summary of Mine Effects on Monthly Flow in Pinewood River (Downstream of Loslo Creek) with Water Discharge through Constructed Wetland in Year 2 of Operation

Month	Existing Average Flow (m^3/s)	Flow with Mine Water through Wetland (m^3/s)	Flow Percent Change	Existing Wetted Width	Existing Depth	New Wetted Width	New Depth	Change in Wetted Width (m)	Change in Wetted Depth (m)	Change in Wetted Width (%)	Change in Wetted Depth (%)
January	0.050	0.059	17%	2.95	0.2	3	0.21	0.05	0.01	2%	5%
February	0.033	0.027	-20%	2.69	0.15	2.59	0.13	-0.10	-0.02	-4%	-13%
March	0.124	0.099	-20%	3.56	0.32	3.36	0.28	-0.20	-0.04	-6%	-13%
April	2.206	1.885	-15%	7.46	1.35	7.01	1.22	-0.45	-0.13	-6%	-10%
May	1.641	1.431	-13%	6.84	1.17	6.5	1.07	-0.34	-0.10	-5%	-9%
June	1.244	1.056	-15%	6.33	1.02	5.98	0.92	-0.35	-0.10	-6%	-10%
July	0.727	0.699	-4%	5.54	0.79	5.44	0.76	-0.10	-0.03	-2%	-4%
August	0.353	0.399	13%	4.75	0.56	4.82	0.58	0.07	0.02	1%	4%
September	0.411	0.445	8%	4.89	0.6	4.92	0.61	0.03	0.01	1%	2%
October	0.541	0.549	2%	5.2	0.69	5.16	0.68	-0.04	-0.01	-1%	-1%
November	0.440	0.468	7%	4.95	0.62	4.99	0.63	0.04	0.01	1%	2%
December	0.088	0.108	23%	3.31	0.27	3.46	0.3	0.15	0.03	5%	11%
Average				4.87	0.65	4.77	0.62	-0.10	-0.03	-2%	-3%

Notes:
Assumes an average flow year in year two of operations
Positive numbers represent a flow increase from existing conditions

Table 4-6: Summary of Mine Effects on Monthly Flow Pinewood River, between Loslo Creek and Marr Creek (34.2% Watershed Diversion)

Month	Existing Average Flow (m^3/s)	Flow with 32% Watershed Reduction (m^3/s)	Flow Percent Change	Existing Wetted Width	Existing Depth	New Wetted Width	New Depth	Change in Wetted Width (m)	Change in Wetted depth (m)	Change in Wetted Width (%)	Change in Wetted Depth (%)
January	0.050	0.033	-34.2%	2.91	0.27	2.47	0.2	-0.44	-0.07	-15%	-26%
February	0.033	0.022	-34.2%	2.47	0.2	2.3	0.17	-0.17	-0.03	-7%	-15%
March	0.124	0.081	-34.2%	3.41	0.35	3.22	0.32	-0.19	-0.03	-6%	-9%
April	2.206	1.452	-34.2%	*	*	*	*	*	*	*	*
May	1.641	1.079	-34.2%	*	*	*	*	*	*	*	*
June	1.244	0.819	-34.2%	6.05	0.97	5.77	0.89	-0.28	-0.08	-5%	-8%
July	0.727	0.479	-34.2%	5.59	0.84	5.09	0.7	-0.50	-0.14	-9%	-17%
August	0.353	0.232	-34.2%	4.7	0.61	4.27	0.51	-0.43	-0.10	-9%	-16%
September	0.411	0.270	-34.2%	4.88	0.65	4.45	0.55	-0.43	-0.10	-9%	-15%
October	0.541	0.356	-34.2%	5.25	0.74	4.75	0.62	-0.50	-0.12	-10%	-16%
November	0.440	0.289	-34.2%	4.88	0.65	4.49	0.56	-0.39	-0.09	-8%	-14%
December	0.088	0.058	-34.2%	3.29	0.33	2.91	0.27	-0.38	-0.06	-12%	-18%
Average				4.34	0.56	3.97	0.48	-0.37	-0.08	-9%	-15%

Notes:

Assumes an average flow year

The approximate 34.2% watershed diversion (West Cleek, Marr creek and partial Clark Creek) is constant throughout mine life

Positive numbers represent a flow increase from existing conditions

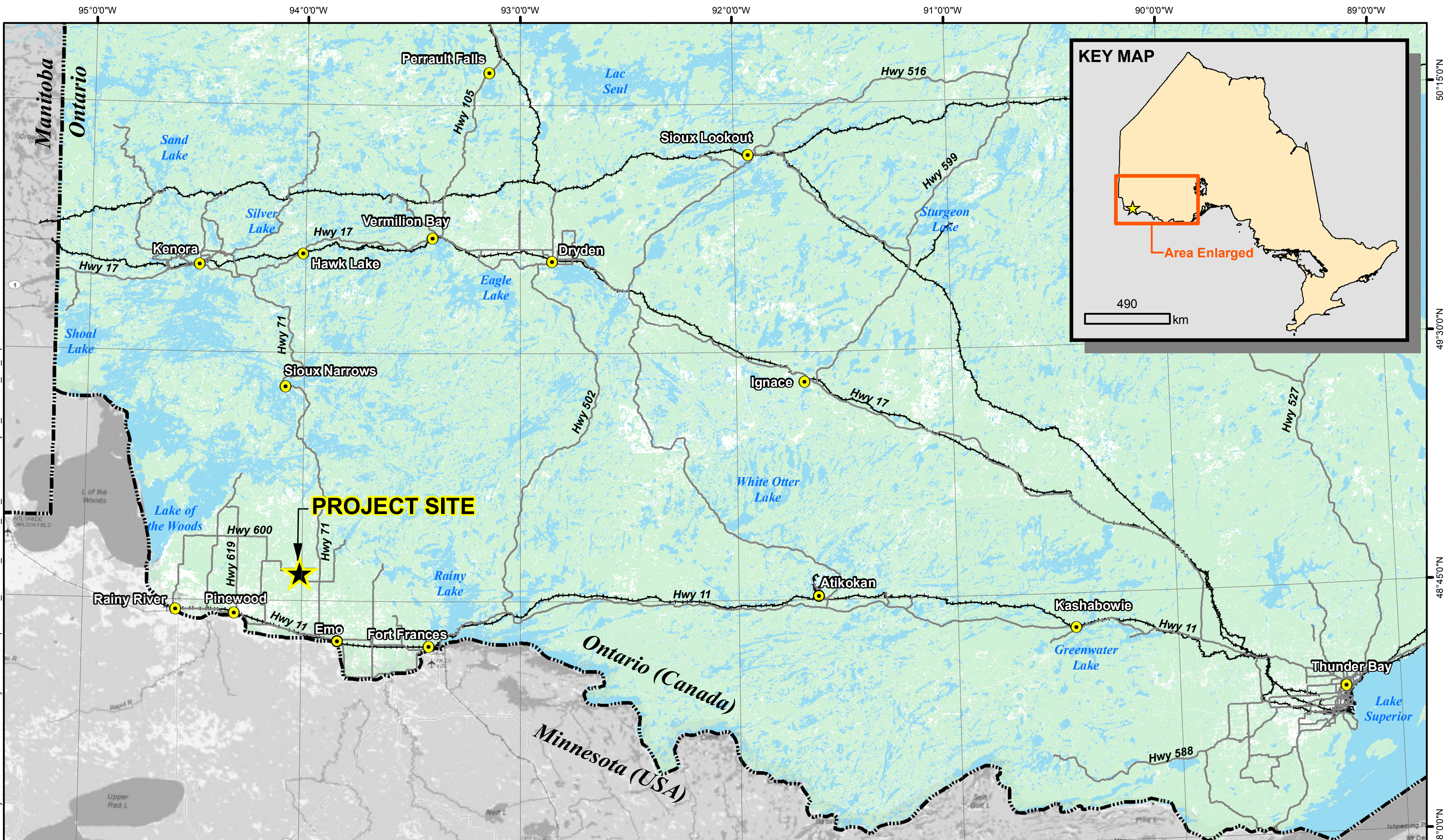
* Model is only calibrated to the bankfull channel section as measured in the field during aquatic habitat surveys - once the predicted flows exceed these sections changes to the wetted width and depth are considered nominal

Table 9-1: Schedule of Plan Implementation

Offset Component / Activity	Estimated Time of Occurrence
Pending further discussion with DFO	Pending
Monitoring Schedule	
Pending further discussion with DFO	Pending

Table 10-1: Estimated Cost of Plan Implementation

Offset Feature	Estimated Cost
To be specified in final application	Pending
Total Cost to Implement Plan	**Pending**



P:\EM\Projects\2011\TC111504 Rainy River\GIS\Aquatics\J_Dietrich_Misc\No_Net_Loss\MXD\Project_Location_S2_Impacts.mxd

LEGEND

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

0 25 50 100 150 200 250 Kilometres

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

Datum: NAD83
Projection: UTM Zone 15N

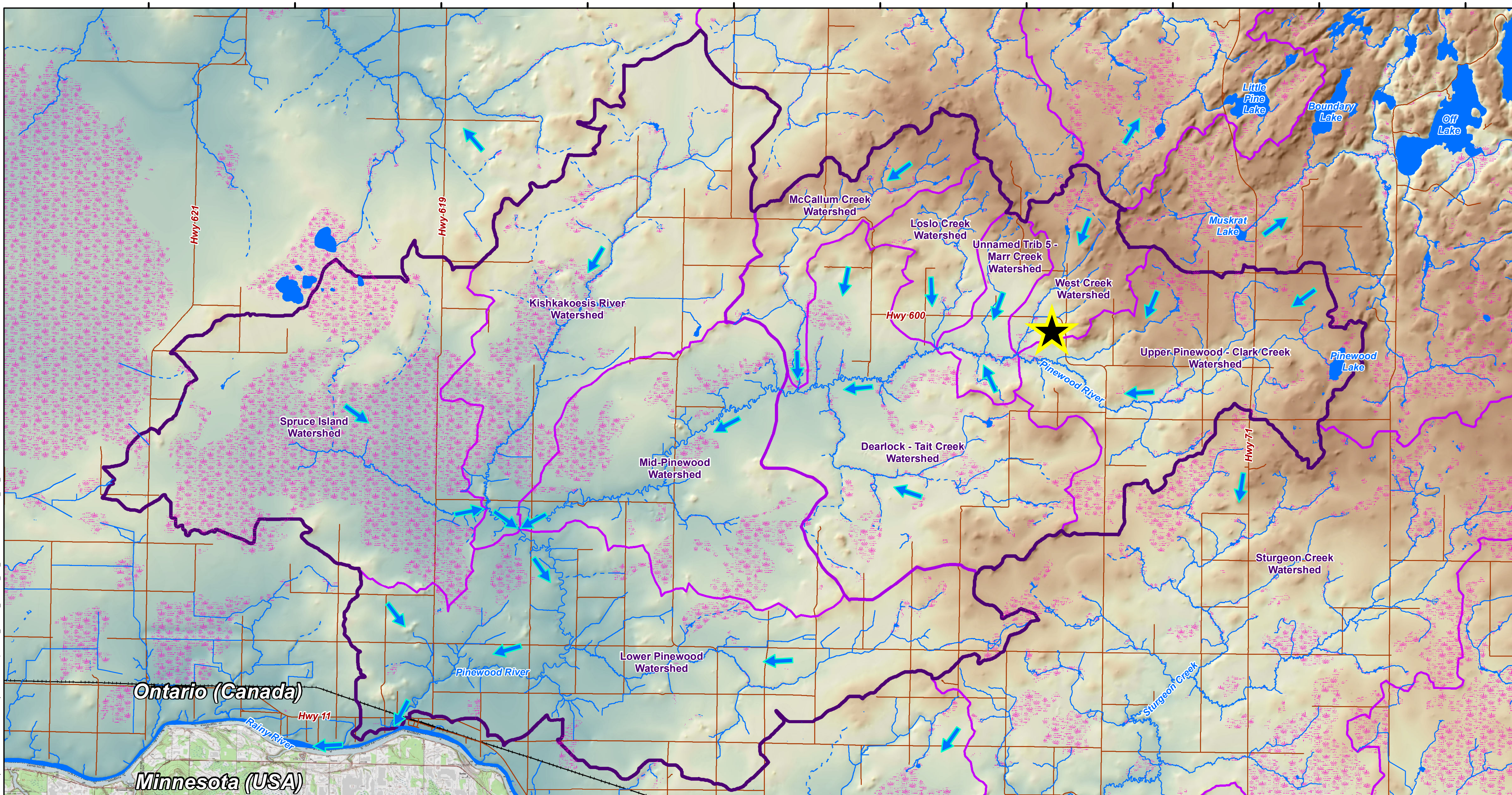
newgold Rainy River Project amec

RAINY RIVER PROJECT

Project Location

PROJECT N°: TC111504 | **FIGURE: 1-1**

SCALE: 1:1,800,000 | DATE: October 2013



LEGEND

- Project Site
- Regional Road / Highway
- Railway
- Waterbody
- Permanent Watercourse
- Intermittent Watercourse
- Low-Lying Area
- General Surface Flow Direction

Elevation Colour Ramp
- High ground
- Low ground

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

-Unnamed 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
-Kishkakoesis R. approx. 9,200 ha
-Spruce Is. approx. 9,580 ha
-Lower Pinewood approx. 11,435 ha
-Sturgeon Cr. approx. 21,477 ha

NOTES:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR
- Ontario base data extracted from Land Information Ontario (MNR) data warehouse.
- 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

N E S W

0 3.5 7 14 21 28 35 Kilometres

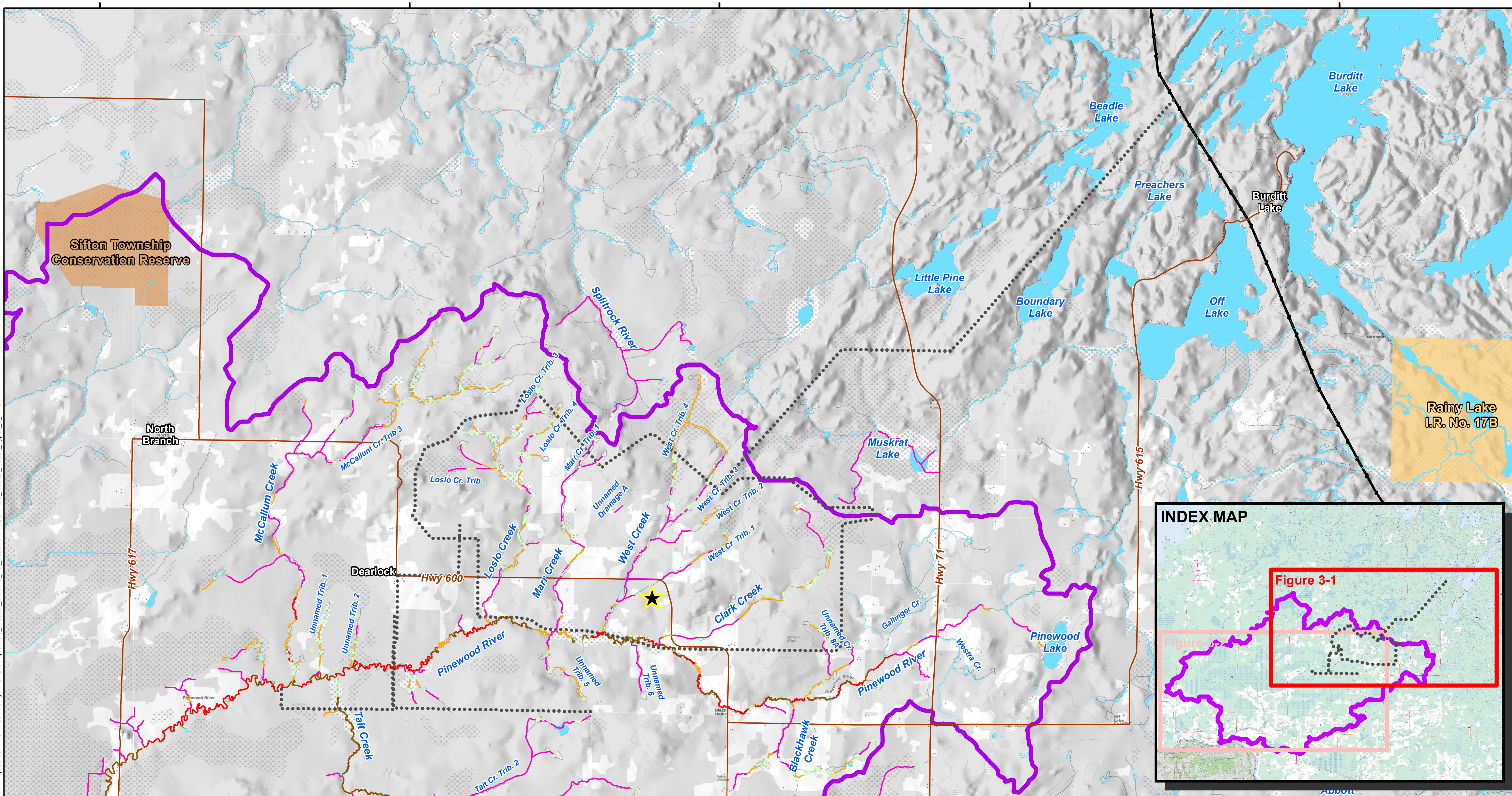
newgold Rainy River Project | amec

RAINY RIVER PROJECT

Regional Topography, Watershed and Subwatershed Boundaries

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

P:\EM\Projects\2011\TC111504 Rainy River\GIS\Aquatics\J_Dietrich_Misc\No_Net_Loss\MXD\Watersheds_and_Subwatersheds2.mxd



LEGEND

- RRP Site
- Approximate RRP Site Boundary
- Regional Road / Highway
- Permanent Watercourse (No Habitat Type Classification)
- Intermittent Watercourse (No Habitat Type Classification)
- Transmission Line
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Aquatic Habitat Classification Types

- Habitat Type 1
- Habitat Type 2
- Habitat Type 3
- Habitat Type 4
- Habitat Type 5
- Habitat Type 6
- Habitat Type 7
- Habitat Type 8
- Habitat Type 9

NOTES:
- All base data on this map was extracted from Land Information Ontario (MNR), Queen's Printer for Ontario, 2011-2012 and NRCan Toporama 1:50,000 NTS DRG map sheets, 2011
- USA land extracted from ESRI base map service, USGS Topo maps

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 25 Kilometres

newgold Rainy River Project amec

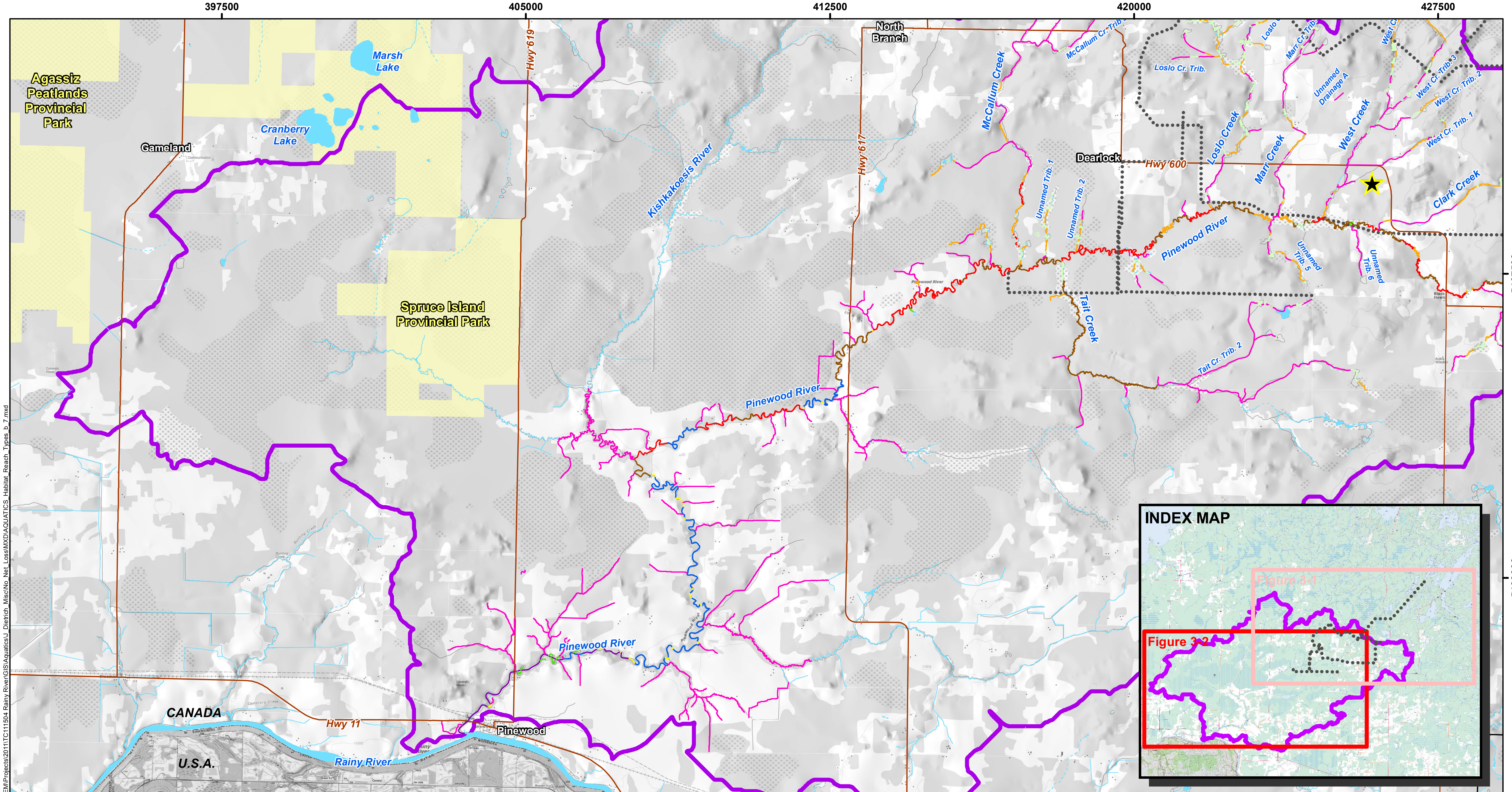
RAINY RIVER PROJECT

Aquatic Habitat Types (Upper Pinewood River Watershed)

PROJECT N°: TC111504 | FIGURE: 3-1

SCALE: 1:90,000 | DATE: October 2013

P:\EM\Projects\2011\TC111504 Rainy River\GIS\Aquatics\J_Dietrich_Misc\No_Net_Loss\MXD\AQUATICS_Habitat_Reach_Types_a_7.mxd



P:\EM\Projects\2011\TC111504 Rainy River\GIS\Aquatics\J_Dietrich_Misc\No_Net_Loss\MXD\AQUATICS_Habitat_Reach_Types_b_7.mxd

LEGEND

- ★ RRP Site
- Approximate RRP Site Boundary
- Regional Road / Highway
- Permanent Watercourse (No Habitat Type Classification)
- Intermittent Watercourse (No Habitat Type Classification)
- Transmission Line
- Pinewood River Watershed
- First Nation Reserve
- Conservation Reserve (Regulated)
- Provincial Park

Aquatic Habitat Classification Types

- Habitat Type 1
- Habitat Type 2
- Habitat Type 3
- Habitat Type 4
- Habitat Type 5
- Habitat Type 6
- Habitat Type 7
- Habitat Type 8
- Habitat Type 9

NOTES:
- All base data on this map was extracted from Land Information Ontario (MNR), Queen's Printer for Ontario, 2011-2012 and NRCan Toporama 1:50,000 NTS DRG map sheets, 2011
- USA land extracted from ESRI base map service, USGS Topo maps

Datum: NAD83
Projection: UTM Zone 15N

0 2.5 5 10 15 20 25 Kilometres

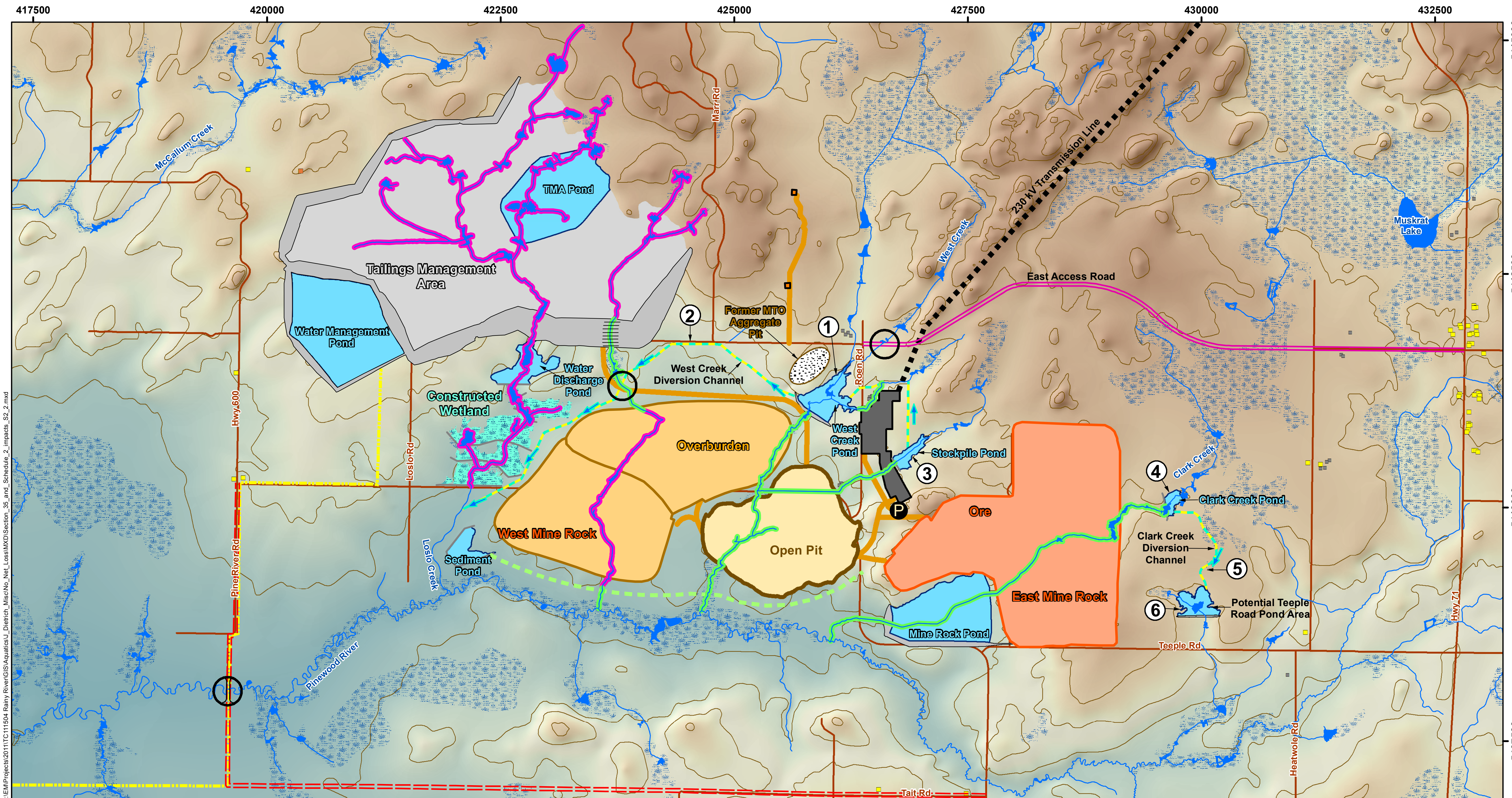
newgold Rainy River Project amec

RAINY RIVER PROJECT

Aquatic Habitat Types (Lower Pinewood River Watershed)

PROJECT N°: TC111504 | **FIGURE: 3-2**

SCALE: 1:90,000 | DATE: October 2013



LEGEND

- Residence-House
- Lodging Cabin-Occasional Use
- Roads
- Contours, 10 m interval (LIO-MNR)
- Water Course
- MMER Schedule 2 Impacts
- Section 35 Impacts
- Section 35 Impacts Impact Dependent On MMER Schedule 2 Listing
- Low Lying Area
- New Road Crossings
- (#) Onsite Like For Like Habitat Offset Areas

Elevation Colour Ramp

- High ground
- Low ground

Proposed Site Features

- Underground Portal
- Explosives Facilities
- Water Management Pipelines
- Plant Site / Ancillary Facilities
- Open Pit
- Major Watercourse Crossing
- Overburden/ West Mine Rock Stockpile
- Ore / East Mine Rock Stockpile
- Former MTO Aggregate Pit
- Site Roads
- Pond
- Tailings Management Area
- Pit Protection Berm
- Highway Re-alignment
- East Access Road
- 230 kV Transmission Line
- Constructed Wetland
- Watercourse Diversion
- Dams

Source / Notes:
- Road data extracted from Land Information Ontario, Ontario Road Network, MNR
- Background topographic and elevation data extracted from MNR Land Information Ontario
- Only major facilities are shown. Connecting infrastructure and supporting facilities are generally not shown.

Datum: NAD83
Projection: UTM Zone 15N

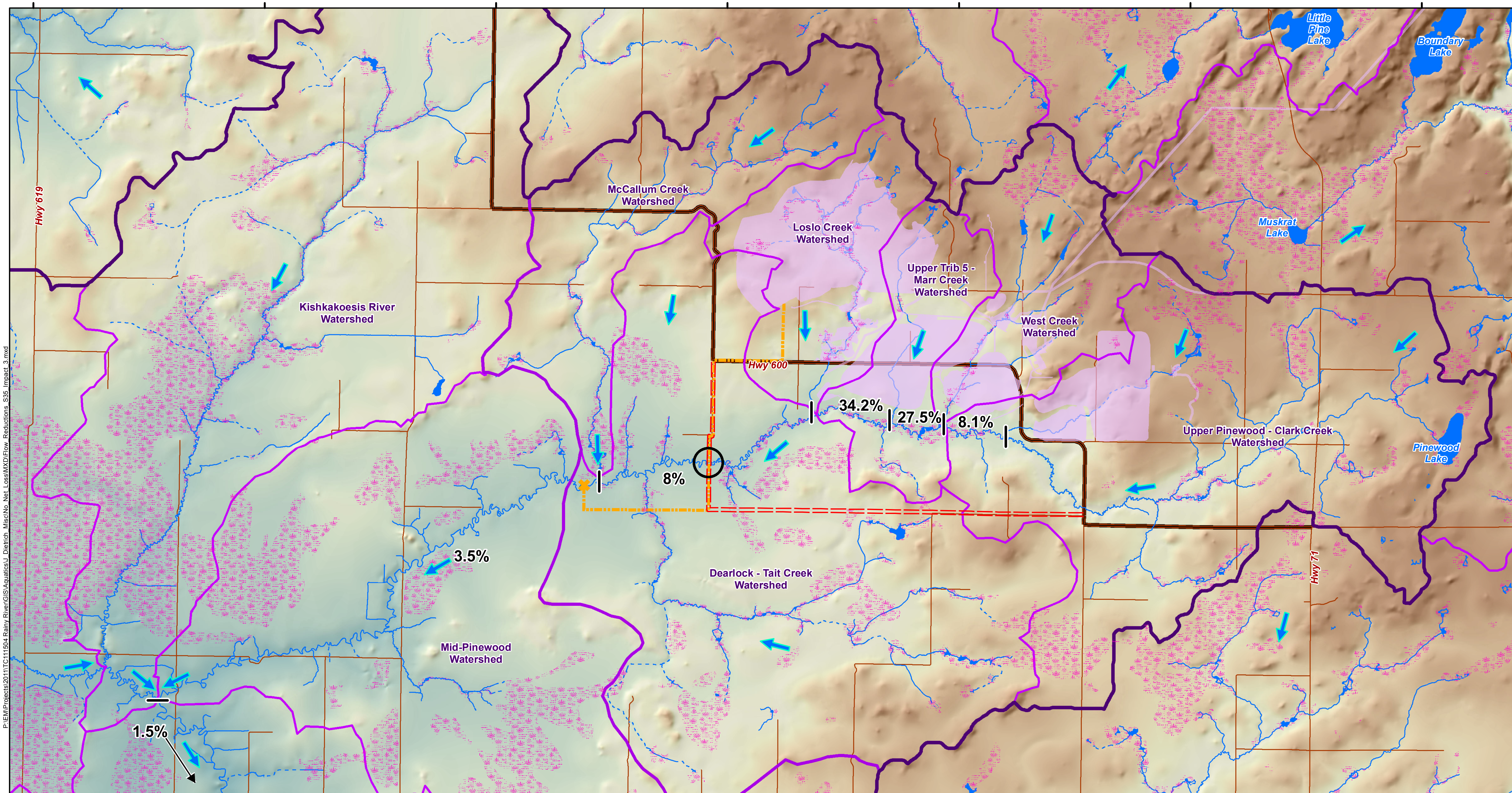
0 1 2 4 6 8 10 Kilometres

newgold Rainy River Project amec

RAINY RIVER PROJECT

Altered/Displaced Waters Frequented by Fish (Section 35, Schedule 2 Impacts)

PROJECT N°: TC111504	FIGURE: 4-1
SCALE: 1:39,000	DATE: October 2013



LEGEND

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

Elevation Colour Ramp
High ground
Low ground

- 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
-Kishkakoesis R. approx. 9,200 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

0 2.5 5 10 15 20 Kilometres

N E S W

newgold Rainy River Project amec

RAINY RIVER PROJECT

Flow Reduction along Pinewood River Flow Path

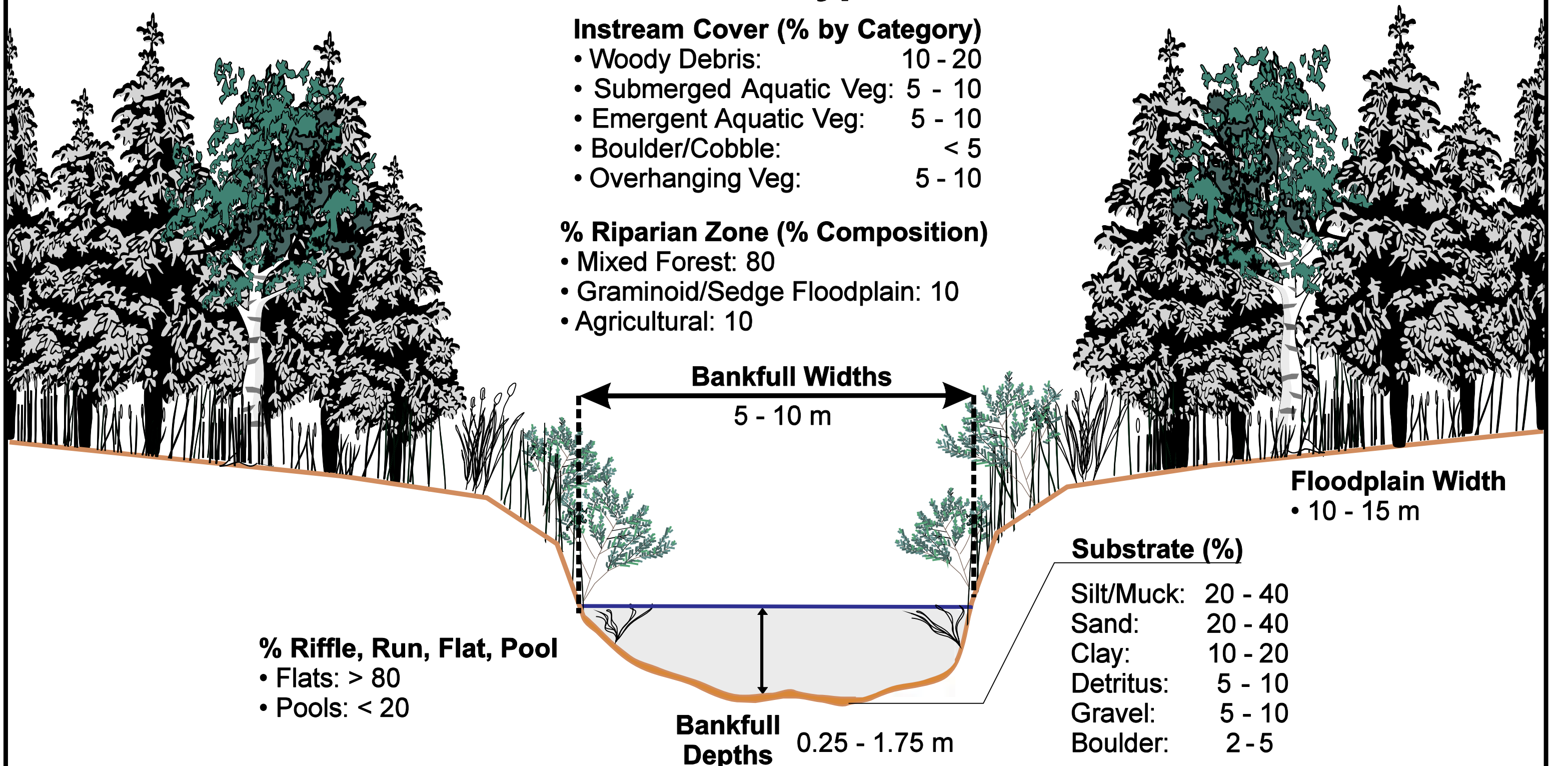
PROJECT N°: TC111504	FIGURE: 4-2
SCALE: 1:80,000	DATE: October 2013

P:\EM\Projects\2011\TC111504 Rainy River\GIS\Aquatics\J_Dietrich_Misc\No_Net_Loss\MXD\Flow_Reductions_S35_Impact_3.mxd

APPENDIX A

HABITAT TYPE ILLUSTRATIONS

Habitat Type 1



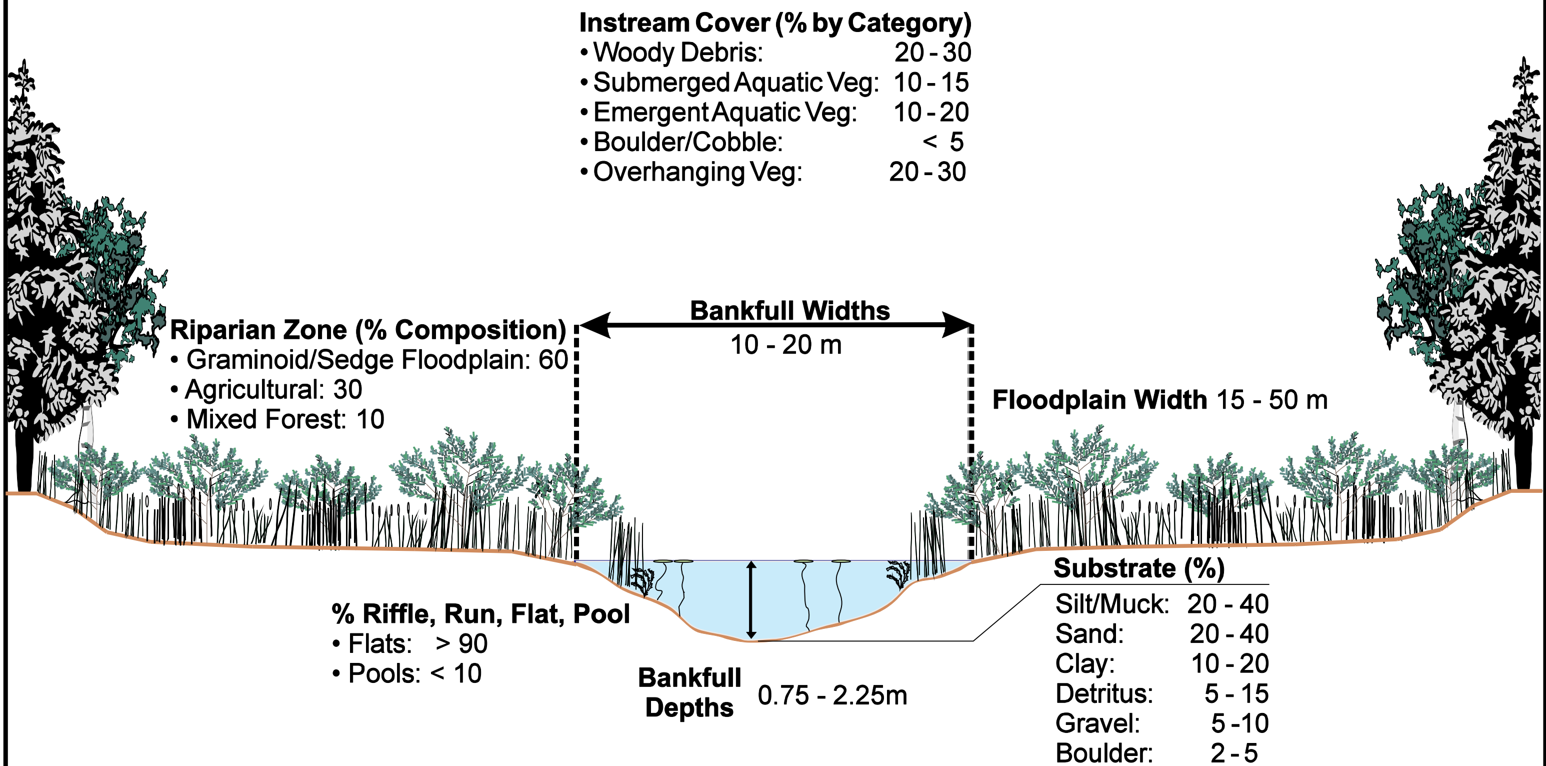
Pinewood River: PIN-10A - Facing Downstream

Pinewood River: PIN-10A - Facing Upstream

Pinewood River: PIN-9 - Facing Downstream

Pinewood River: PIN-9 - Facing Downstream

Habitat Type 2



Pinewood River: PIN-2A - Facing Upstream

Pinewood River: PIN-2A - Facing Downstream

Pinewood River: PIN-8 - Facing Downstream

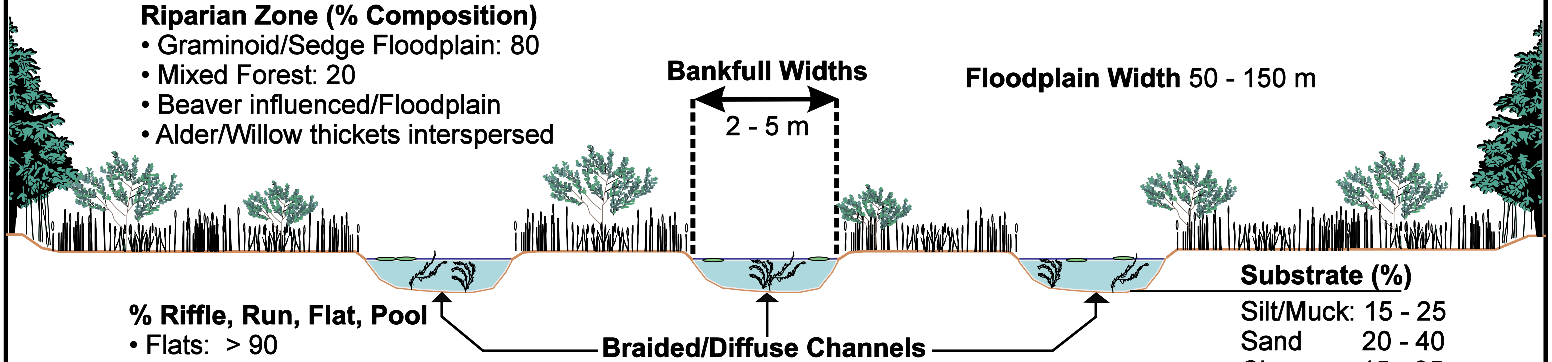
Pinewood River: PIN-8 - Facing Upstream

Habitat Type 3

Instream Cover (% by Category)
- Woody Debris: < 5
- Submerged Aquatic Veg: 5 - 10
- Emergent Aquatic Veg: 5 - 10
- Overhanging Veg: 30 - 50

Riparian Zone (% Composition)
- Graminoid/Sedge Floodplain: 80
- Mixed Forest: 20
- Beaver influenced/Floodplain
- Alder/Willow thickets interspersed

Floodplain Width 50 - 150 m



% Riffle, Run, Flat, Pool
- Flats: > 90
- Pools: < 5
- Runs: < 5

Bankfull Depths 0.25 - 1.75 m

Substrate (%)
Silt/Muck: 15 - 25
Sand 20 - 40
Clay: 15 - 25
Detritus: 10 - 20

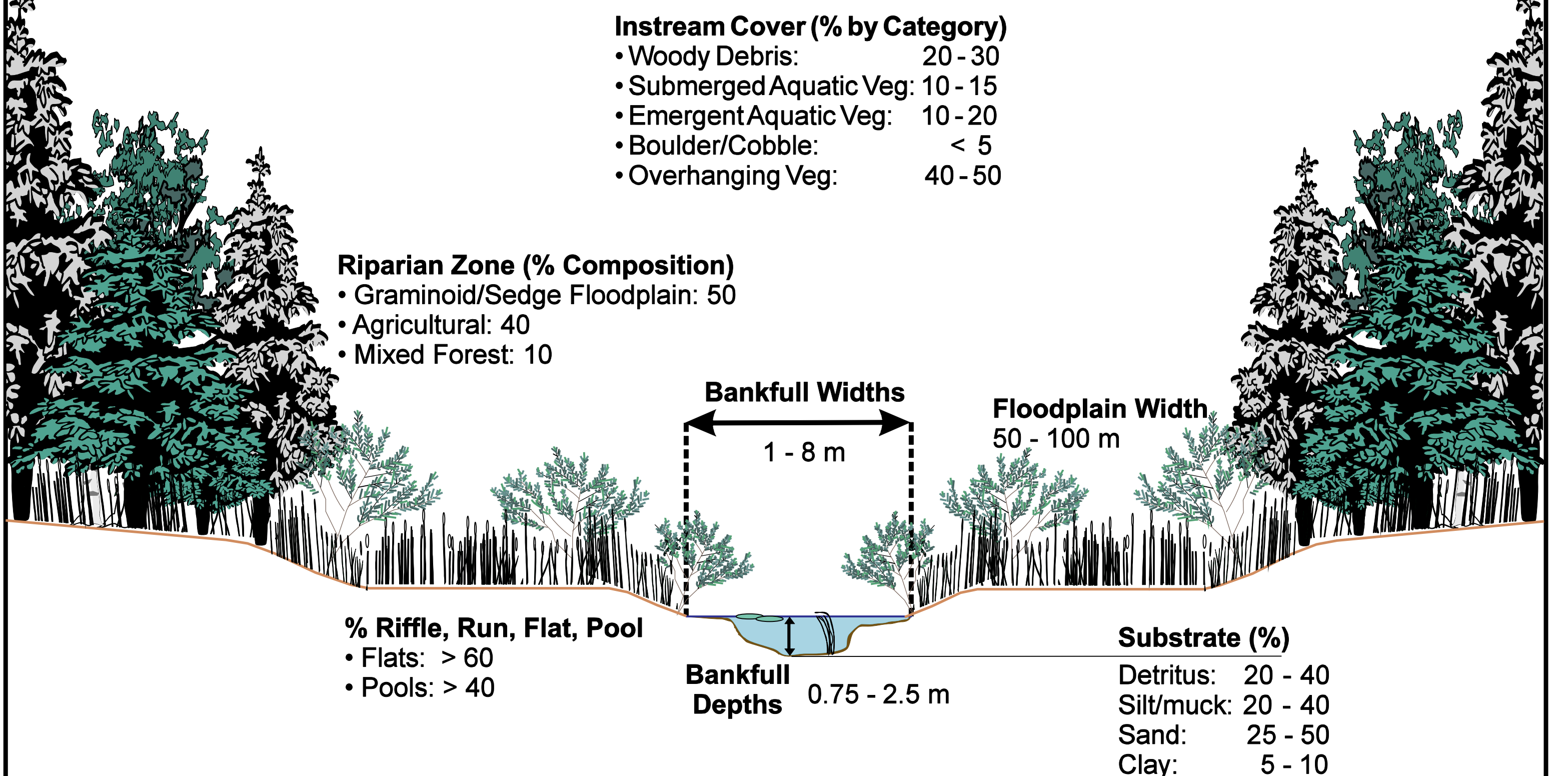
Clark Creek: CLA-5A - Vegetated Floodplain

Clark Creek: CLA-5 - Facing Upstream

Loslo Creek: LOS-8 - Beaver Pond Outlet Channel

Loslo Creek: LOS-8 - Vegetated Floodplain

Habitat Type 4



Jones Creek: JON-1 - Facing Upstream

Loslo Creek: LOS-1 - Dry Intermittent Channel

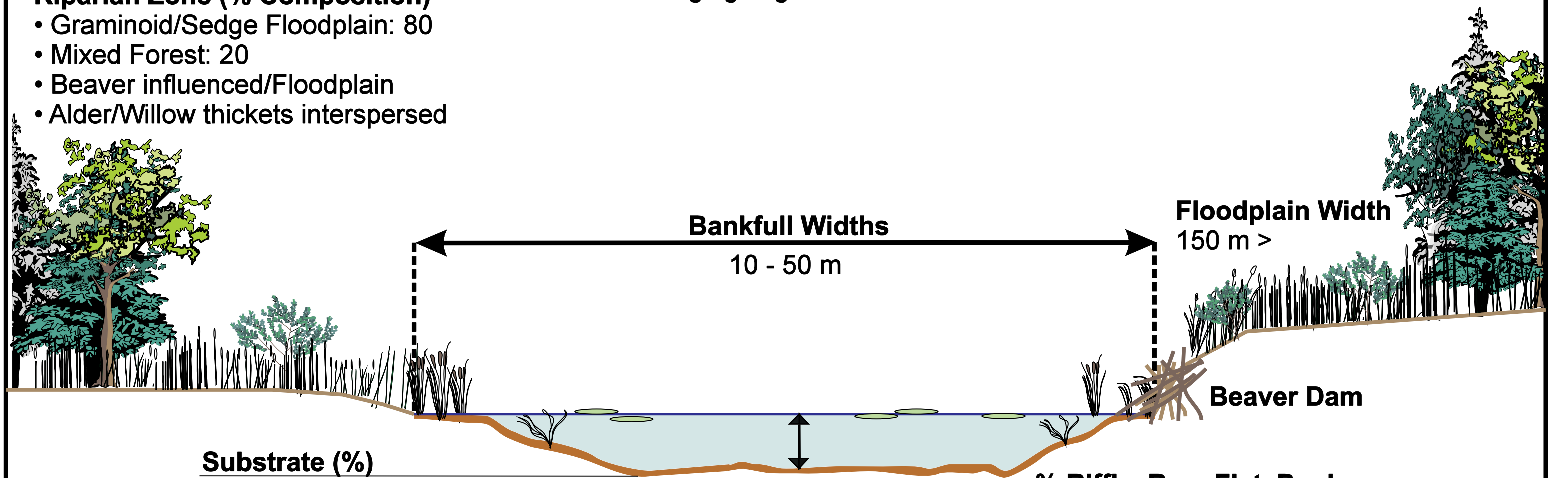
Loslo Creek: LOS-10 - Saturated Intermittent Channel

Loslo Creek: LOS-11- Beaver Pond Outlet Channel

Habitat Type 5

Instream Cover (% by Category)
- Woody Debris: 30 - 50
- Submerged Aquatic Veg: 10 - 15
- Emergent Aquatic Veg: 10 - 20
- Boulder/Cobble: < 5
- Overhanging Veg: 10 -20

Riparian Zone (% Composition)
- Graminoid/Sedge Floodplain: 80
- Mixed Forest: 20
- Beaver influenced/Floodplain
- Alder/Willow thickets interspersed



Substrate (%)

Silt/Muck:	20 - 40
Sand:	20 - 30
Clay:	10 - 20
Detritus:	10 - 20

% Riffle, Run, Flat, Pool
- Pools: 100
- Pond habitat

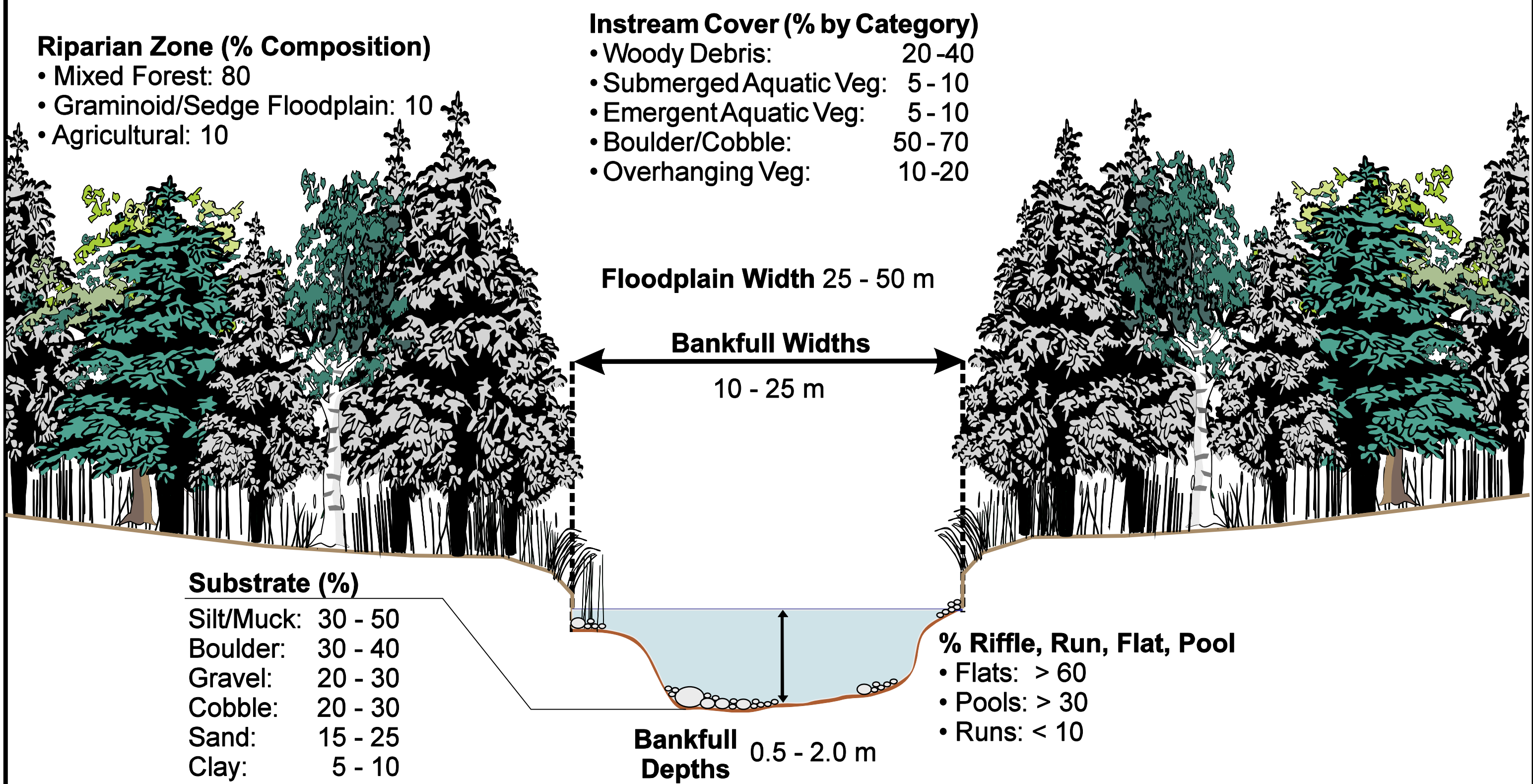

Clark Creek: CLA-5A - Beaver Pond


Clark Creek: CLA-5A - Beaver Pond


Clark Creek: CLA-5A - Beaver Pond


Clark Creek: CLA-5A - Beaver Pond

Habitat Type 6



Pinewood River: PIN-15 - Facing Upstream

Pinewood River: PIN-15 - Facing Downstream

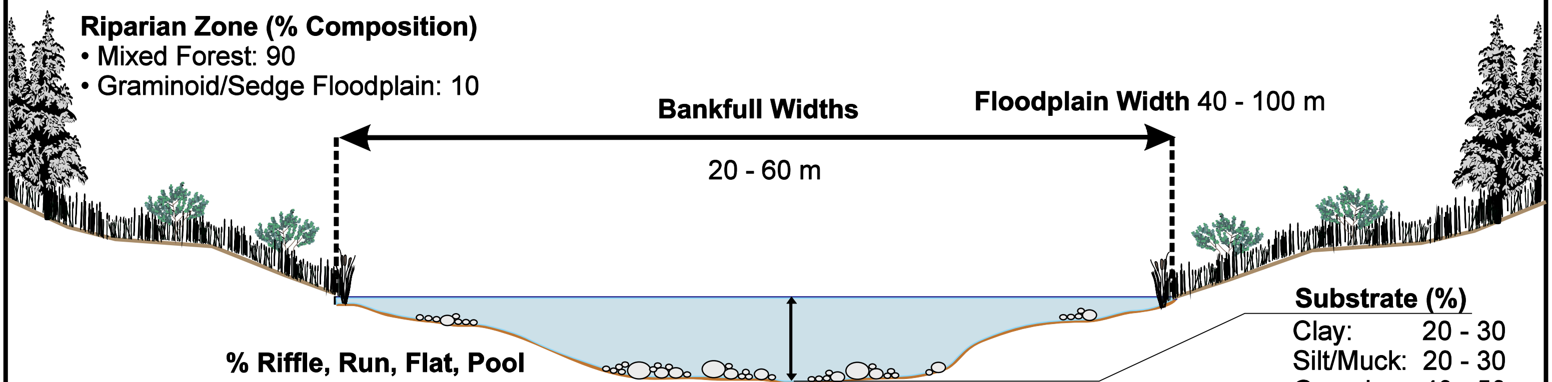
Pinewood River: Upstream of PIN-15

Pinewood River: PIN-12 - Facing Downstream

Habitat Type 7

Instream Cover (% by Category)
- Woody Debris: 20 -40
- Submerged Aquatic Veg: 5 - 10
- Emergent Aquatic Veg: 5 - 10
- Boulder/Cobble: 40 - 60
- Overhanging Veg: 5 - 10

Riparian Zone (% Composition)
- Mixed Forest: 90
- Graminoid/Sedge Floodplain: 10



% Riffle, Run, Flat, Pool
Flats: >70
Pools: <25
Runs: < 5

Substrate (%)

Clay:	20 - 30
Silt/Muck:	20 - 30
Gravel:	40 - 50
Cobble:	40 - 50
Sand:	20 - 40
Boulder:	20 - 30


Lower Pinewood River: PIN-18 Facing Upstream


Lower Pinewood River: Upstream of PIN-18


Lower Pinewood River: PIN-17 Facing Upstream

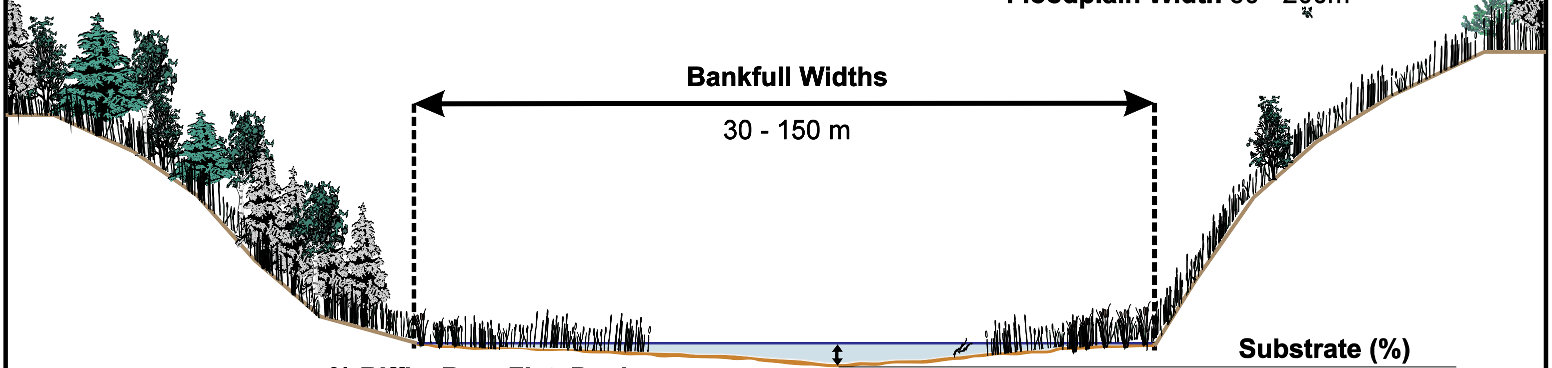

Lower Pinewood River: PIN-17 Facing Upstream

Habitat Type 8

Instream Cover (% by Category)
- Woody Debris: < 5
- Submerged Aquatic Veg: 20 - 30
- Emergent Aquatic Veg: 40 - 60
- Boulder/Cobble: < 5
- Overhanging Veg: 30 - 50

Riparian Zone (% Composition)
- Mixed Forest: 40
- Graminoid/Sedge Floodplain: 30
- Agricultural: 30

Floodplain Width 50 - 200m



% Riffle, Run, Flat, Pool
- Pools: 100
- Intermittent pond habitat

Bankfull Depths 0.15 - 0.85 m

Substrate (%)

Silt/Muck:	40 - 60
Sand:	20 - 30
Clay:	10 - 20
Detritus:	10 - 20

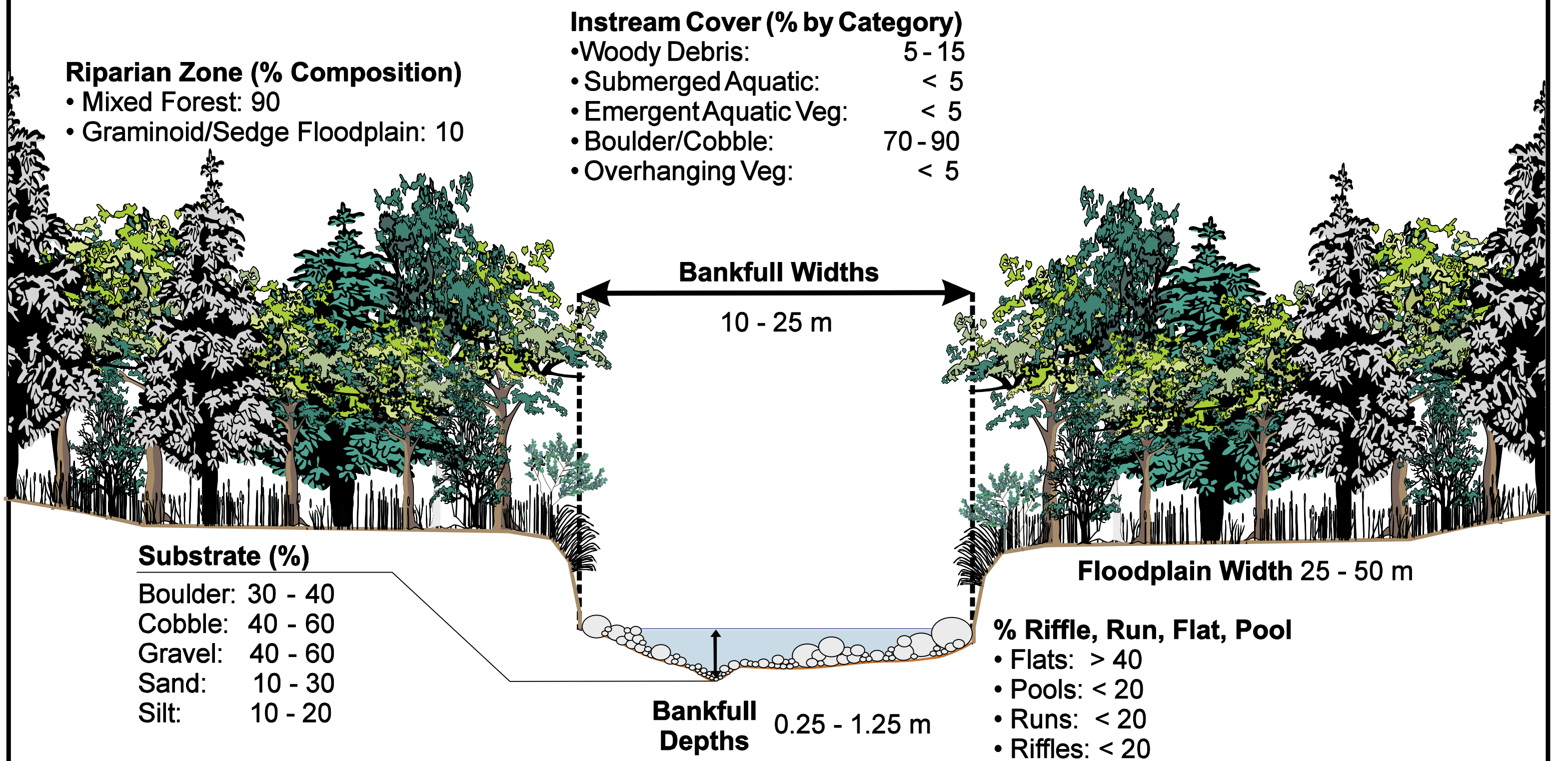
Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 2

Habitat Type 9



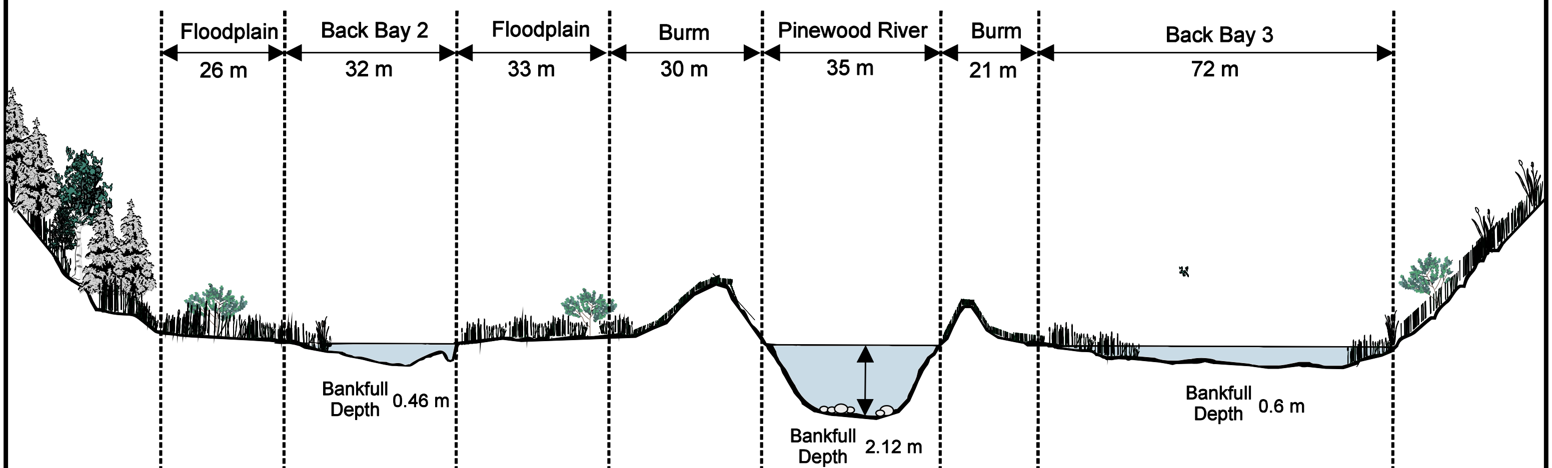
Lower Pinewood River: PW-24 - Facing downstream

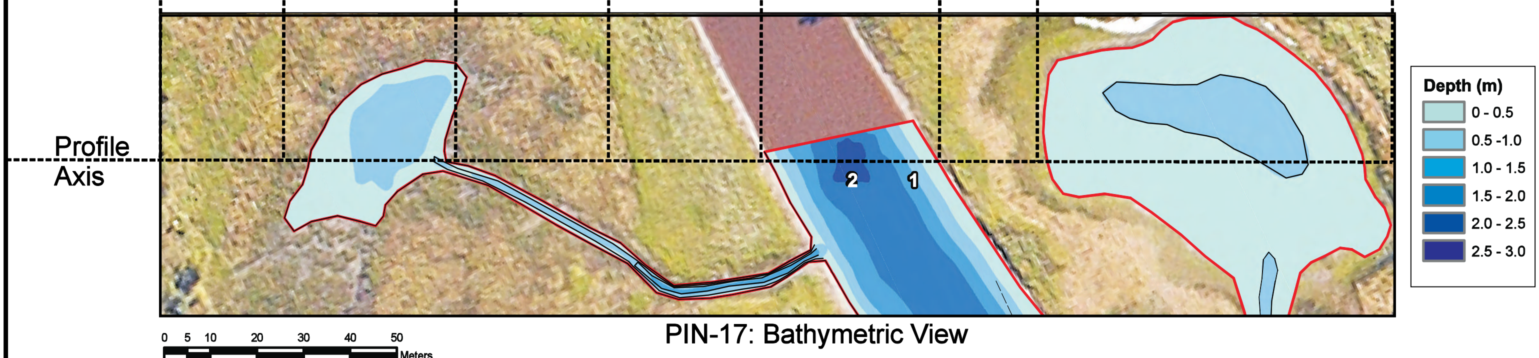
Lower Pinewood River: PW-24 - Cobble Shoal

Lower Pinewood River: Downstream of PIN-14

Lower Pinewood River: PW-23 - Bedrock Outcrop

Lower Pinewood River and Back Bay Combined Profile (PIN-17)





PIN-17: Bathymetric View

Back Bay 2: Facing Northwest

Back Bay 3: Facing Southwest

Back Bay 2: Facing Northeast

Back Bay 3: Facing Southeast

APPENDIX B

FISH HABITAT SUITABILITY INDEX VALUES

TABLE B-1: HABITAT SUITABILITY FOR LAKE CHUB FOR EACH REACH TYPE WITHIN THE PINEWOOD RIVER WATERSHED

Model Variable	Variable Description	Category	Suitability Index (SI)									Notes
			Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	
V_1	Dominant substrate type	Percent area (%) having rubble, gravel, cobble, boulder						1.00	1.00		0.75	Percent areas based on habitat assessments for representative habitat types. Golder 2008 HSI model used with 0.75 representing a habitat with approximately 75% of suitable habitat but 25% of low suitability habitat.
		Percent area (%) having sand, clay/silt, bedrock	0.50	0.50	0.50	0.50	0.50			0.50		
V_2	Instream cover	Rubble, cobble, boulder, vegetation, woody debris, submergent and emergent plants	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Percent areas based on habitat assessments for representative habitat types and specific to substrates and available classes of cover.
V_3	Dominant channel morphology	Percent area (%) having runs, flats and pools										Percent areas based on habitat assessments for representative habitat types. Limited occurrence of riffle and run habitats within these watercourses.
		Percent area (%) having riffles										
		Percent area (%) having rapids										
V_4	Percent instream cover	> 20 to 50%	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Percent areas based on habitat assessments for representative habitat types percent cover observations
		> 10 to 20% or > 50 to 65%										
		> 5 to 10% or > 65 to 75%										
		0 to 5% or > 75 to 100%										
V_5	Late winter dissolved oxygen (mg/L)	≥ 1 mg/L						0.50	0.50	0.50	0.50	Rainy River Resources has established a number of water quality monitoring stations within the project area. Of these stations SW1A, SW3, and SW10 are located on the upper Pinewood (Type 1 and 2), and SW15 is located on the lower pinewood (Type 6-9). SW1A and SW10 have DO values below 0.1 and have been assigned a SI of 0.25. SW15 has a low of 3.11, which gives a SI of 0.5. Assumed that Types 3 to 5 levels less than 1 mg/L based on mid summer levels in 2011 and 2012 (2 to 12 mg/L), therefore SI of 0.25
		< 1 mg/L	0.25	0.25	0.25	0.25	0.25					
V_6	pH	> 6.0 to 9.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	In-situ water sampling was performed at a number of locations. pH ranged from 6.6 to 8.15. If the pH is between 6 and 9 then the SI is 1.0. All sites were within this range thus all types have an SI of 1.0.
		5.5 to < 6										
		< 5.5 to > 9										
HSI Value			0.25	0.25	0.25	0.25	0.25	0.50	0.50	0.50	0.50	

newgold Rainy River Project

APPENDIX C

FISH HABITAT SUITABILITY INDEX CRITERIA

amec

TABLE C-1: CENTRAL MUDMINNOW HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Clay/silt and organics			Gravel and sand	
V_2	Instream cover	Submergent and emergent vegetation			Rubble, cobble	
V_3	Channel unit	Percent area (%) having flats, pools and backwater areas		Percent area having runs	Percent area riffles	Percent area having rapids, chutes, falls
V_4	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Scott and Crossman 1998, Fishbase 2013, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-2: IOWA DARTER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Dominant substrate type	Gravel, Sand	Silt, Clay, Detritus		Cobble, Rubble	Bedrock, Boulder
V_2	Cover type	Vegetation, Algae, Undercut Banks			Other	
V_3	Dominant channel morphology	Pool	Flat, Backwater		Run	Riffle, Rapids
V_4	Late winter dissolved oxygen (mg/L)	> 4		≥ 2 to 4	< 2	
V_5	pH	> 6.5 to 8.5		> 6.0 to 6.5, > 8.5 to 9.5		≤ 6 or > 9.5

Notes:

1. Based on the following in order of importance: Portt 1999, Scott and Crossman 1998, Lane 1996a, Lane 1996b.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-3: JOHNNY DARTER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Dominant substrate type	Gravel, Sand		Silt, Clay, Boulder, Cobble, Rubble	Bedrock, Detritus	
V_2	Cover type	Vegetation, Wood, Substrate			Other	
V_3	Dominant channel morphology	Pool, Run, Flat			Backwater, Riffles	Rapids
V_4	Late winter dissolved oxygen (mg/L)	> 4		≥ 2 to 4	< 2	
V_5	pH	> 6.5 to 8.5		> 6.0 to 6.5, > 8.5 to 9.5		≤ 6 or > 9.5

Notes:

1. Based on the following in order of importance: Portt 1999, Scott and Crossman 1998, Lane 1996a, Lane 1996b.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-4: BLACKSIDE DARTER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Dominant substrate type	Gravel, Sand, Boulder		Cobble, Rubble, Silt, Clay	Bedrock, Detritus	Other
V_2	Cover type	Vegetation, Wood, Undercut Banks			Other	
V_3	Dominant channel morphology	Pool	Flats	Runs	Backwater, Riffles	Rapids
V_4	Late winter dissolved oxygen (mg/L)	> 4		≥ 2 to 4	< 2	
V_5	pH	> 6.5 to 8.5		> 6.0 to 6.5, > 8.5 to 9.5		≤ 6 or > 9.5

Notes:

1. Based on the following in order of importance: Portt 1999, Scott and Crossman 1998, Lane 1996a, Lane 1996b.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-5: LOGPERCH HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	**Above Average (SI = 0.75)**	**Average (SI = 0.5)**	**Below Average (SI = 0.25)**	**None (SI = 0.0)**
V_1	Dominant substrate type	Gravel, Sand		Boulder, Cobble, Silt, Clay	Hard-pan, Bedrock, Detritus	Other
V_2	Cover type	Vegetation, Wood, Substrate			Other	
V_3	Dominant channel morphology	Pool, Riffle	Flats, Runs		Backwater	Rapids
V_4	Late winter dissolved oxygen (mg/L)	> 4		≥ 2 to 4	< 2	
V_5	pH	> 6.5 to 8.5		> 6.0 to 6.5, > 8.5 to 9.5		≤ 6 or > 9.5

Notes:

1. Based on the following in order of importance: Portt 1999, Scott and Crossman 1998, Lane 1996a, Lane 1996b.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-6: GOLDEN SHINER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Dominated by gravel and sand		Dominated by clay / silt	Dominated by bedrock, boulder, cobble or rubble	
V_2	Instream cover	Submergent and emergent vegetation, filamentous algae			Rubble, cobble	
V_3	Dominant channel morphology	Flats, pools and backwater areas		Runs	Riffles	Rapids, chutes and falls
V_4	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-7: BLACKCHIN SHINER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Dominated by gravel, sand and silt		Dominated by silt / clay	Dominated by bedrock, boulder, cobble, or rubble	
V_2	Instream cover	Submergent and emergent vegetation			Rubble, cobble	
V_3	Dominant channel morphology	Flats, pools and backwater areas		Runs	Riffles	Rapids, chutes and falls
V_4	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-8: MIMIC SHINER HABITAT SUITABILITY MODEL

Variable		Habitat Suitability: Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Dominated by gravel, sand, clay/silt			Dominated by bedrock, boulder, cobble, or rubble	
V_2	Instream cover		Submergent and emergent vegetation		Boulder, cobble	
V_3	Dominant channel morphology	Riffle and pool		Flats and runs		Rapids, chutes and falls
V_4	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-9: ROCK BASS HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate (adult)	Dominated by cobble, rubble and gravel		Dominated by bedrock, boulder and sand		Dominated by silt and clay
V_2	Substrate (nursery)	Dominated by gravel with silt		Dominated by rubble, sand and silt		Dominated by bedrock and/or clay
V_3	Substrate (spawning)	Dominated by cobble, rubble and gravel		Dominated by sand, silt and clay		Dominated by bedrock
V_4	Instream cover	Boulder, logs, submergent vegetation		Submergent and emergent vegetation		
V_5	Dominant channel morphology	Dominated by pools		Flats and runs		Rapids, chutes and falls
V_6	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_7	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_8	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-10: SHORTHEAD REDHORSE HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Dominated by rubble, gravel and sand		Dominated by cobble, sand and silt		Dominated by bedrock and/or clay
V_2	Instream cover	Dominated by cobble and rubble	Dominated by cobble and rubble with submerged vegetation		Dominated by emergent and submergent vegetation	
V_3	Dominant channel morphology	Dominated by pool and run morphology		Dominated by flats		Dominated by riffle and rapids
V_4	% instream cover	> 20 to 30%		> 30 to 50%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

TABLE C-11: HORNYHEAD CHUB HABITAT SUITABILITY MODEL

Variable		Habitat Suitability				
		Excellent (SI = 1.0)	Above Average (SI = 0.75)	Average (SI = 0.5)	Below Average (SI = 0.25)	None (SI = 0.0)
V_1	Substrate	Dominated by boulder, cobble, gravel and sand		Dominated by rubble, sand and silt		Dominated by bedrock and/or silt/clay
V_2	Instream cover	Dominated by boulder, cobble with vegetation/algae		Dominated by submerged and emergent vegetation		
V_3	Dominant channel morphology	Dominated by pool morphology		Dominated by runs and flats		Dominated by riffle and rapids
V_4	% instream cover	> 50%	> 30 to 50%	> 20 to 30%	> 0 to 20%	0%
V_5	Late winter dissolved oxygen (mg/L)	≥ 2 mg/L			< 2 mg/L	
V_6	pH	≥ 6.0 to 7.5		5.0 to < 6		< 5.0 or > 9

Notes:

1. Based on Coker 2001, Lane 1996a, Lane 1996b, Portt 1999, Scott and Crossman 1998, Fishbase 2012, and Page and Burr 1991.
2. Boulder (> 256 mm), cobble (> 64 to 256 mm, rounded), rubble (> 64 to 256 mm, angular), gravel (> 2 to 64 mm), sand (>0.06 to 2.0 mm) and clay/silt (≤ 0.06 mm) and includes detritus (Bradbury et al. 1999). The distinction between cobble and rubble is that cobble material has a smooth rounded shape while rubble is material in the same size range, but with sharp angular corners.
3. Late winter dissolved oxygen (DO) criteria are based on the assumptions that if measured late winter DO is greater than the indicated concentration, DO is not limiting at any time of year, and if measured late winter DO is less than the indicated concentration, DO may be limiting in winter but not during the open-water period. In addition, since DO is not measured in all areas within a watercourse or waterbody, there may exist some local areas where late winter DO is greater than the measured concentrations.

APPENDIX D

HABITAT OFFSET CONCEPTUAL DRAWINGS

D-1 Conceptual Watershed Restoration Methods
D-2 Teeple Pond Road

newgold Rainy River Project

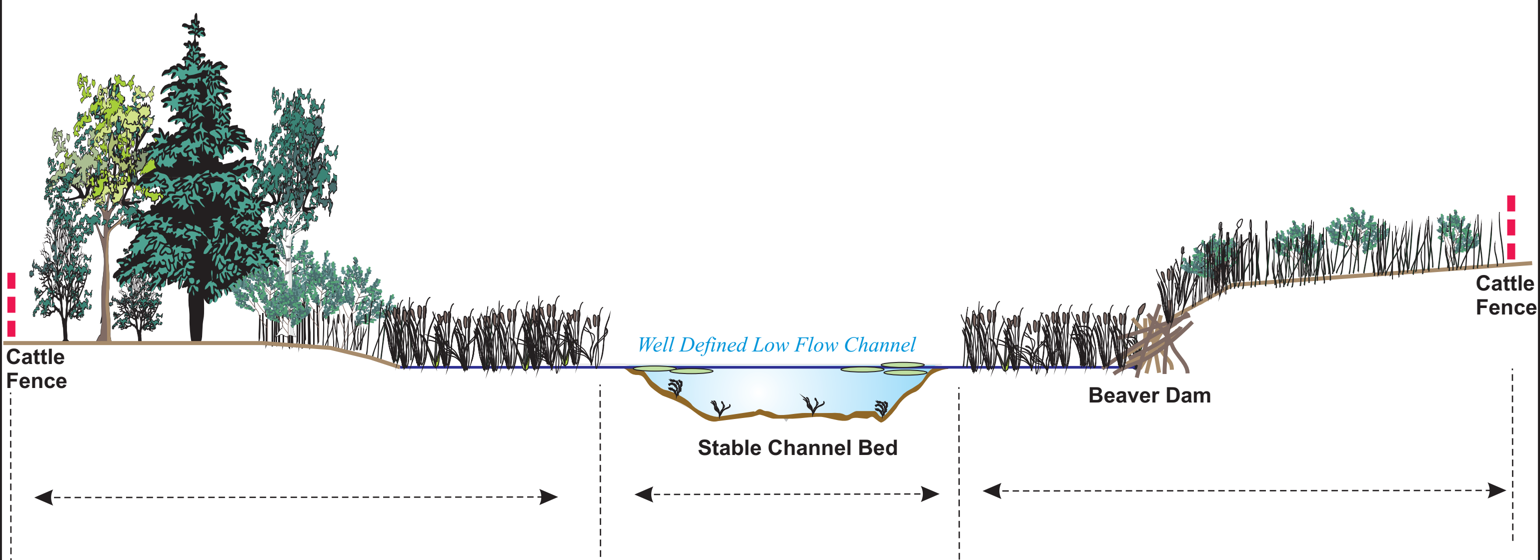
APPENDIX D-1

CONCEPTUAL WATERSHED RESTORATION METHODS

amec

Overview Stream with Cattle Impacts

Overview Treatment Options



Riparian Restoration Benefits:

- Increases reduction of nutrient loading and TSS
- Accelerates establishment of native vegetation
- Accelerates improvements to aquatic habitat (shading, organic matter input, etc.)
- Productive capacity increase of 34.0%

Stream Restoration Benefits:

- Immediate re-establishment of in-stream habitat (aquatic vegetation, substrate, cover objects, etc.)
- Immediate re-establishment of geomorphically appropriate channel cross section
- Productive capacity increase of 69.4%

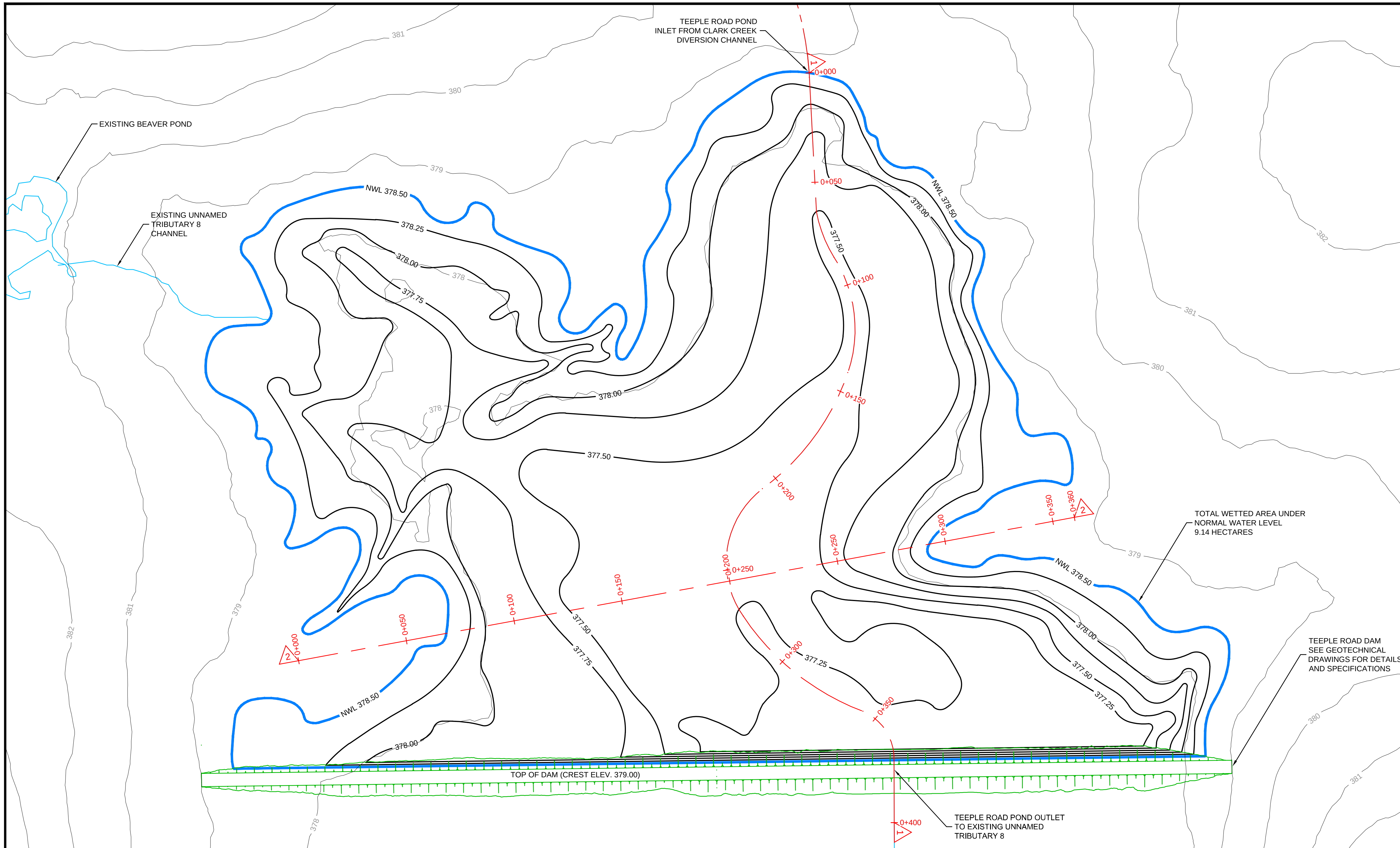
Cattle Fence with Off-Stream Watering Benefits:

- Reduces nutrient loading and TSS
- Allows natural regeneration of vegetation
- Eliminates impacts to stream morphology and in-stream habitat
- Allows stream to re-establish its dynamic equilibrium
- Productive capacity increase of 18.4%

newgold Rainy River Project

APPENDIX D-2

TEEPLE ROAD POND



TEEPLE ROAD POND PLAN VIEW
SCALE : 1:1000

Elevations Table				
Minimum Elevation	Maximum Elevation	Area (m^2)	% Area	Water Depth
376.50	377.25	11,008	12.1%	1.25 - 1.50
377.25	377.75	14,589	16.0%	1.00 - 1.25
377.75	378.25	17,354	19.0%	0.75 - 1.00
378.25	378.50	19,275	21.1%	0.50 - 0.75
378.50	378.65	13,816	15.1%	0.25 - 0.50
378.65	378.75	15,310	16.8%	0.00 - 0.25
TOTAL		91,532		

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR

Client: newgold Rainy River Project

AMEC Environment & Infrastructure
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

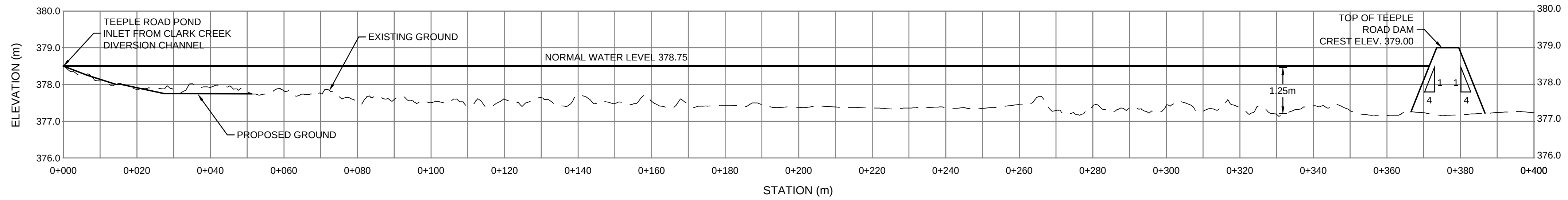
DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
TEEPLE ROAD POND
PLAN VIEW

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-400-001

www.amec.com/earthandenvironmental

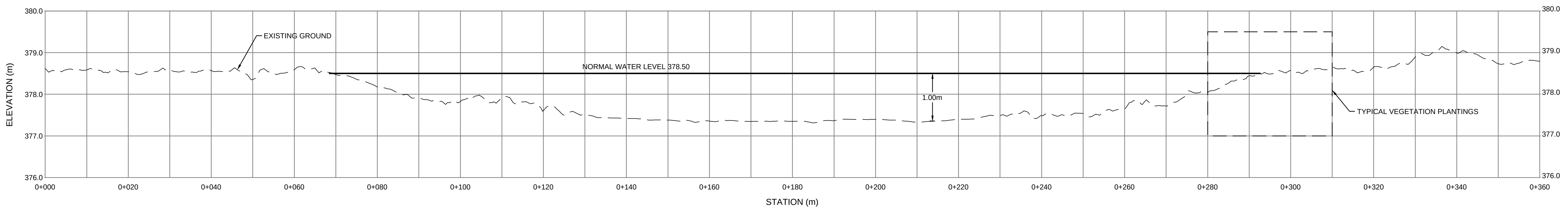


SECTION 1-1: TEEPLE ROAD POND

SCALE : H=1:750 V=1:75

HORIZONTAL SCALE: 1 : 750

VERTICAL SCALE: 1 : 75



SECTION 2-2: TEEPLE ROAD POND

SCALE : H=1:500 V=1:50

HORIZONTAL SCALE: 1 : 500

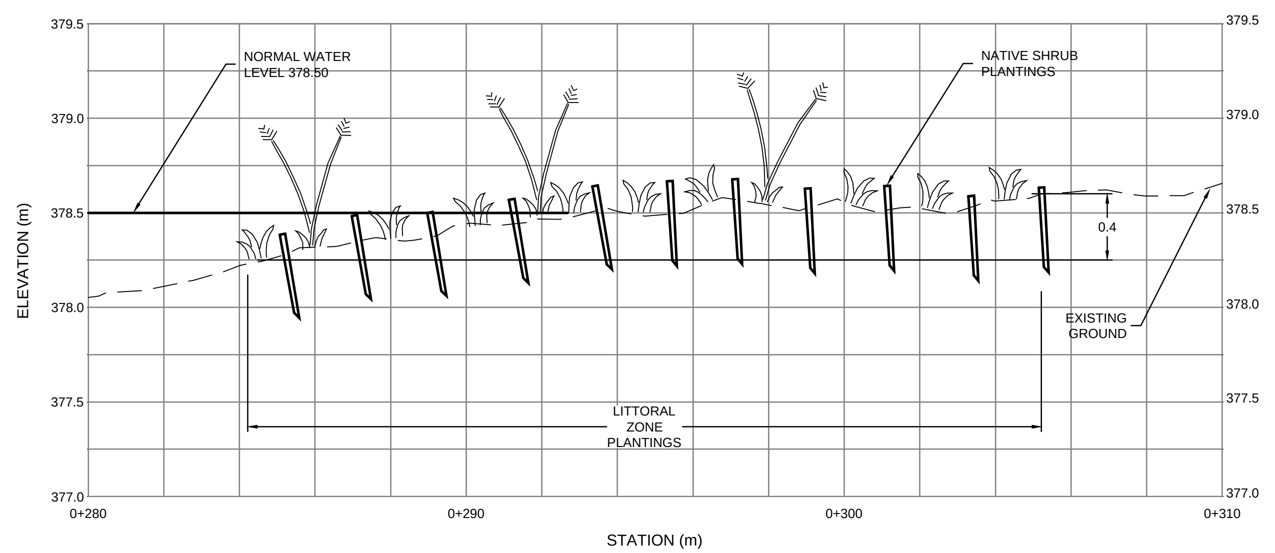
VERTICAL SCALE: 1 : 50

VEGETATION RESTORATION NOTES:

1. ANY COMPACTED SOIL DUE TO MACHINERY ACCESS SHALL BE LOOSENED PRIOR TO TOPSOIL AND SEED APPLICATION.
2. ALL EXCAVATED AREAS SHALL BE TREATED WITH A MINIMUM OF 100mm OF TOPSOIL / ORGANIC SOIL SALVAGED FROM SITE.
3. SALVAGED SOIL SHALL BE FREE OF INVASIVE SPECIES.
4. ALL DISTURBED SOILS ABOVE THE NORMAL WATER LEVEL SHALL BE STABILIZED WITH A NURSE CROP AS OUTLINED IN TABLE 1.
5. LITTORAL PLANTING ZONE SHALL BE SEEDED WITH NATIVE WETLAND SEED MIX IN ADDITION TO NURSE CROP SEED.
6. A TOTAL OF 15%-25% OF THE LITTORAL PLANTING ZONE SHALL BE PLANTED WITH NATIVE SHRUB CUTTINGS AT A 0.75m SPACING.
7. NATIVE SHRUB CUTTINGS SHALL BE TAKEN FROM WILLOW AND DOGWOOD SPECIES PRESENT ON SITE AND IN SURROUNDING AREA.
8. NATIVE SHRUB CUTTINGS SHALL BE HARVESTED DURING THE PLANT'S DORMANT PERIOD AND SHALL BE TREATED WITH ROOTING HORMONE PRIOR TO PLANTING.

TABLE 1. NURSE CROP SEEDING

TIMING OF SEEDING	SELECTED SEED TYPE		
	LATIN NAME	COMMON NAME	SEEDING RATE
POST-SPRING FRESHET TO AUG. 14	*Avena sativa*	Oats	30 kg/ha
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	30 kg/ha



TYPICAL VEGETATION PLANTINGS

SCALE : H=1:100 V=1:20

HORIZONTAL SCALE: 1 : 100

VERTICAL SCALE: 1 : 20

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR
B						

Client: newgold Rainy River Project

AMEC Environment & Infrastructure
160 Traders Boulevard East
Mississauga, Ontario, Canada L4Z 3K7

amec

www.amec.com/earthandenvironmental

DRAWN BY: NSH
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
TEEPLE ROAD POND
CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO. A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-400-002

P:\EA\Projects\2011\TC111504 Rainy River\CAD\Fish Habitat Compensation\Teeple Pond\TP - Pond.dwg - Sections - Oct. 30, 2013 3:22pm - nathan.hellings