newgold Rainy River Project

APPENDIX X-3

**DRAFT FISH HABITAT NO NET LOSS PLAN:
MMER SCHEDULE 2 AMENDMENT WATERBODIES**

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RAINY RIVER RESOURCES LIMITED
RAINY RIVER PROJECT

FISH HABITAT NO NET LOSS PLAN
MMER SCHEDULE 2 AMENDMENT WATERBODIES

VERSION B

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newgold™ Rainy River Project

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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 2013e; 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 is completing 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 (i.e., tailings management and mine rock storage) will result in the placement of deleterious substances in natural waterbodies frequented by fish and as such, an amendment is required to Schedule 2 of the *Metal Mine Effluent Regulation* (MMER) pursuant to subsections 34(2), 36(5) and 38(9) of the *Fisheries Act*.

As a component of the Schedule 2 amendment process, an approved compensation plan, also referred to as an NNLP is required to demonstrate how the proposed deposition of material will affect fish habitat (fish-bearing waters) and how the loss of that habitat will be offset.

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 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 commercial, recreational or Aboriginal fisheries protection. Future updates to policy, which may affect NNLP approaches and habitat accounting procedures, will be applied as appropriate. As per direction on the DFO official internet site (DFO 2013), 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 affecting fish habitat as per Section 35(2) of the *Fisheries Act*.

1.1 General Setting

The RRP is located in the Rainy River District, in northwestern Ontario in Chapple Township, approximately 65 kilometres (km) northwest of Fort Frances and 420 km west of Thunder Bay (Figure 1-1). The UTM 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 (*Castor canadensis*) 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 have 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 harmfully altered, disrupted, or destroyed (HADD) as a result of mine development including: Clark Creek / Teeple Drain, Loslo Creek / Cowser Drain, Marr Creek, and West Creek (Figure 1-2). However, 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 majority of 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). 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 further 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. 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 (to compensate). 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 MMER Schedule 2 fish habitat compensation (offset) measures, it is expected that all offsets will be in place prior to the deposition of mine waste into waters frequented by fish, and as such the amount of habitat replaced to habitat lost will be close to a 1:1 ratio.

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;
- 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
- An estimation of the net change in fish habitat quality and quantity.

A detailed account of these general steps is provided in subsequent section of this report. A Habitat Evaluation Procedure (HEP) (USFWS 1980) approach is proposed to determine the quality and quantity of fish habitat that may be affected by the RRP through mine construction, operation and closure including those components requiring an amendment to Schedule 2 of the MMER.

Recommended steps in the HEP methodology include identification of impacted areas, delineation of cover types, selection of evaluation species, the 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.

$$WUA_{lost} - WUA_{offset} = 0$$

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. In the case of the MMER Schedule 2 related habitat losses the offset plan must be in place prior to initiating the deposition of mine waste in natural waters frequented by fish. As such, it is expected that all offset measures will be completed in advance of the deposits. 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 a 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: a 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 (i.e., vegetation, woody debris, rock etc.).

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 metres; m) dominated by sedge, Alder (*Alnus* sp.) and Willow (*Salix* sp.) species, 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 species, with Alder and Willow species 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 were considerably different in available substrate from the upper Pinewood River habitat types, consisting of more areas with a greater proportion of cobble, gravel and boulder.

The criteria which separated these types were an increase in bankfull width and an increase in 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 riparian areas were dominated by grass and sedge species. 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 fish 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 (*Sander vitreus*). 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 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 by KCB (2011) and AMEC (2012, 2013a and 2013b).

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 (*Acipenser fulvescens*; three 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} = (% Species Abundance / 100) x (Sub-watershed Habitat Area / 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 versus baitfish versus other) and trophic (piscivorous versus 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.

- 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
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:

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

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 (three 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 Natural Local 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) 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 et al. (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 DEPOSIT OF MINE WASTE

Project components have been determined to fall under the MMER description of tailings impoundment area (tailings management area; TMA) containing natural waters frequented by fish and therefore requiring an amendment to Schedule 2 of the MMER. These components include waste rock stockpiles, overburden stockpiles, tailings management areas and mine water ponds. Summaries of RRP area waterbodies identified as requiring amendment to Schedule 2 due to Project components are provided below. As demonstrated in Table 3-2, all of the affected habitats associated with the waste deposition and Schedule 2 requirements, as quantified in Table 4-1 are characteristic of Habitat Types 3, 4 and 5. A plan view of the proposed site the project components that will overlay watercourses is provided in Figure 4-1.

4.1 Tailings Management Area

The proposed TMA (Figure 4-1) will cover an area of approximately 765 hectares (ha) excluding associated external ponds and infrastructure, and provides storage capacity for the approximately 85 million cubic metres (115 million tonnes) of tailings anticipated to be produced over the projected mine life. TMA capacity is based on an average deposited tailings dry density of 1.4 tonnes per cubic metres. The TMA has the potential for expansion should additional mineral resources be delineated during ongoing exploration and mine development. The facility will be bounded by natural topography (high ground) in the northeast and by impoundment dams along the remaining perimeter.

The proposed TMA will overlay the upper portions of the Loslo Creek and Marr Creek sub-watersheds. Portions of these creeks located upstream of the expected overlaid areas are also considered to be lost as a result of the deposit.

The total area of fish bearing waters overlaid by the proposed TMA is 143,344 m^2 for Loslo Creek and 14,949 m^2 for Marr Creek for a total of 158,293 m^2. The WUA overlaid by the TMA is 32,895 units for Loslo Creek and 3,434 units for Marr Creek for a total of 36,329 units (Table 4-1).

Loslo Creek

Originating in a large wetland complex extensively influenced by Beaver activity, Loslo Creek flows south toward the Pinewood River. The creek is characterized by a low gradient with a multitude of Beaver ponds throughout its length creating a low flow system with a wide flood prone area dominated by grass and sedge species.

The wetlands of the upper end of Loslo Creek are well established and highly productive for emergent and submergent vegetation including Common Cattail, Broadleaf Arrowhead, Floating-leaf Pondweed, Hornwort Coontail, sedge species and Marsh Spike-rush (*Eleocharis* *palustris*). Flowing south from the convergence of the upper Loslo Creek tributaries, the creek becomes channelized and well defined.

Habitat Type 5 (ponds) was present throughout the majority of upper Loslo Creek (Figure 3-1) with bankfull widths ranging between 10 to 50 m and bankfull depths between 0.25 to 2 m. Inlet and outlet areas of multiple braided and diffuse water features classified as Habitat Type 3 were associated with Habitat Type 5. Habitat Type 3 extended through the transition areas between Beaver ponds.

Habitat Type 4 was also abundant in many of the smaller upper tributaries of the Loslo Creek system. Specifically, sections of the west branches of Loslo Creek were observed to be intermittent with less well-defined channel morphology. Some reaches of these intermittent channels existed in dense Speckled Alder (*Alnus incana*) and willow species thickets with localized areas of terrestrial vegetation growing within the channel. Substrates were variable and particle sizes increased in a downstream direction from a more silt dominated matrix to one of mixed sand and silt. Silt with a higher degree of organics was more typical of Habitat Type 5 pond habitat.

Fishing effort in the Loslo Creek system consisted of seine netting, minnow trapping, dip netting and gill netting. A total of 10 species were captured through baseline assessments between 2008 and 2012 within the Loslo Creek sub-watershed including: White Sucker (*Catostoums commersonii*), Blackchin Shiner, Brassy Minnow (*Hybognathus hankinsoni*), Creek Chub (*Semotilus atromaculatus*), Emerald Shiner (*Notropis atherinoides*), Finescale Dace (*Phoxinus neogaeus*), Lake Chub (*Couesius plumbeus*), Northern Redbelly Dace (*Chrosomus eos*), Spottail Shiner (*Notropis hudsonius*), Brook Stickleback (*Culaea inconstans*) and Central Mudminnow. Further information pertaining to methodology and results are provided by KCB (2011), AMEC (2012, 2013a).

Marr Creek

Marr Creek originates at a large wetland complex to the east of the Loslo Creek system and flows south to the Pinewood River. The headwater wetland of this sub-watershed is well-established, highly productive and diverse in aquatic vegetation. Littoral vegetation is dense and dominated by grass and sedge species, Broadleaf Arrowhead and Marsh Spike-rush. Floating Pond-lily is present in open water areas. A partial fish barrier exists at the eastern edge of the wetland / Beaver pond complex in the form of a 1.5 m high Beaver dam / waterfall. Such obstructions to movement are temporary and cyclic sometimes resulting in fish population fragmentation.

Exiting the wetland complex, the creek becomes channelized (Habitat Type 4) through pasture lands with limited riparian vegetation. There was generally limited overhead cover with the exception of overhanging riparian grasses and woody debris in localized areas. Similar to many of the other tributary creeks of the Pinewood River, Marr Creek had several areas of Beaver pond habitat (Habitat Type 5) which were often followed by braided diffuse channels with wide densely vegetated (with grass and sedge species) floodplains. Stream banks in this area were highly entrenched with an abundance of undercut banks providing cover for fish. Due to the low gradient in Marr Creek, the Beaver activity could restrict flow along its length, creating a step / pool morphology and potentially isolating fish within pond habitats with reduced connectivity. Emergent aquatic vegetation, primarily sedge species and Broadleaf Arrowhead, occupied the riparian zone within sections adjacent to pasture lands while submergent aquatic macrophytes dominate the open water pooled areas.

A total of 12 fish species were captured in the Marr Creek system including Brassy Minnow, Brook Stickleback, Central Mudminnow, Common Shiner (*Luxilus cornutus*), Creek Chub, Emerald Shiner, Fathead Minnow (*Pimephales promelas*), Finescale Dace, Lake Chub, Northern Pearl Dace (*Margariscus margarita*), Northern Redbelly Dace and Spottail Shiner. Mid-stream sections of Marr Creek which have been cleared of riparian vegetation for agricultural purposes exhibited relatively high surface water temperatures and intermittent flow, thereby reducing fish habitat quality.

4.2 Constructed Wetland and Water Discharge Pond

A constructed wetland is proposed to be established downstream of the water discharge pond within the Loslo Creek (Cowser Drain) valley, upstream of the Pinewood River (Figure 4-1), which will receive mine water from the water management pond. Constructed wetlands are manmade wetlands designed to improve water quality through the enhancement of natural water treatment processes. As constructed wetlands rely in part on biological processes, they are most effective in warm climates where the growing season is longer. A literature review completed by AMEC (2013c) supports that constructed wetlands remain a viable treatment option in northern climates for low volume effluent streams, when the seasonality of biological treatment processes are accounted for in the design and operation. Several studies were found that support the hypothesis that constructed wetlands in cold climates can be utilized to treat water quality issues, including those related to nitrogen compounds (ammonia, cyanate and thiocyanate) and heavy metals (AMEC 2013c). Notably, the Musselwhite Mine treatment wetland has been successfully operating for 13 years in an area several hundred kilometres north of the RRP.

The RRP constructed wetland has been designed as a free water surface wetland. The wetland will resemble a natural marsh having open water and intersected by low height dams or berms. Open water within the system is expected to cover a maximum of 60 ha. The preliminary design includes placement of five low height, low permeability dams or berms across the Loslo Creek valley to impede flow and allow the establishment of open water marsh environments. Once the wetland system is established and sufficient water is available, appropriate non-invasive wetland plants will be placed and encouraged to grow if natural colonization is considered insufficient, or if a specific species mix is desired

Natural flow from an area of approximately 209 ha will flow through the RRP constructed wetland. Water will be released from the water discharge pond at flow rate designed to ensure sufficient retention time within the constructed wetland. The majority of the discharge will occur during the plant growing season, in order to maximize uptake by plants. Early winter use of the wetland will also occur, during which time accumulated waters within the wetland will be gradually displaced by a small volume of treated effluent. The purpose of this winter release is to help to maintain and enhance winter low flows in the Pinewood River. A sump may be placed in the southernmost wetland pond in order allow greater flexibility of wetland effluent to the Pinewood River.

The total area of fish bearing waters overlaid by the proposed Water Discharge Pond and Constructed Wetland is 47,437 m^2 and 10,941 WUA units all of which will be associated with the mid-reaches of Loslo Creek (Figure 4-1 and Table 4-1).

Loslo Creek

The lower approximately 3.3 km of Loslo Creek leading to its outflow into the Pinewood River has been altered to act dominantly as an agricultural drain and has been designated as a municipal drain (Cowser Drain) under the *Drainage Act* of 1980. The creek/drain flows through forested and agricultural lands through this section. Substrates were variable and particle sizes increased in a downstream fashion from a more silt dominated matrix to one of mixed sand and silt.

This section of the creek is associated with several relatively large Beaver impoundments (Habitat Type 5) which are joined by habitat Types 3 and 4 sections. Type 3 was characterized by 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. 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. Fish species present in this sub-watershed are included in Section 4.1.

4.3 Mine Rock and Overburden Stockpiles

The west mine rock stockpile and the overburden stockpile to the west of the open pit will be created due to extraction of overburden and mine rock to access ore. The west mine rock stockpile will be designated for non-potentially acid generating mine rock and overburden, some of which will be used for construction and reclamation purposes at various locations on the Project site.

The lower section of Marr Creek will be overlaid by the proposed stockpiles. The total area of fish bearing waters overlaid by the west mine rock stockpile is 5,514 m^2 and 1,230 WUA units with the overburden stockpile overprinting and additional 1,945 m^2 and 428 WUA units (Figure 4-1 and Table 4-1).

Marr Creek

Marr Creek flows through pasture land with limited riparian vegetation, before entering forested lands in the Pinewood River valley. Cover for fish is relatively limited through the pasture lands, but is provided by overhanging riparian grasses and woody debris in localized areas. As typified by other creeks in the study area, Marr Creek also has a low gradient and morphology is affected by Beaver activity, restricting flow along its length, creating a step/pool morphology potentially isolating fish within pond habitats, with reduced connectivity.

Directly upstream of its inflow into the Pinewood River, Marr Creek becomes braided into multiple distinct channels. Stream banks in this area are vertical with an abundance of undercut banks providing adequate cover for fish. Substrate through the lower downstream reaches was comprised of a silt/muck and clay type bottom. Emergent aquatic vegetation, primarily sedge species, broad-leaved arrowhead and graminoid species occupy the riparian zone within pasture lands, while submergent aquatic macrophytes such as pondweed dominate the open water pooled areas. Fish community members for this sub-watershed were previously listed under Section 4.1.

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 NNL 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 2013d). The proposed offset efforts associated with the MMER Schedule 2 listing will be directed toward a like for like offset of habitat replacement within the Project site and therefore within the same ecological unit. Specifically, the habitat replacement will consist of the realignment of West Creek and a tributary of West Creek and Clark Creek as well as creation of inline pond features associated with these diversions (Figure 4-1 and Table 4-1).

The rational for using the onsite like for like habitat replacement to address the MMER Schedule 2 impacts are as follows:

- The available offset opportunity associated with the onsite habitat development closely matches the amount of habitat impacts associated with mine waste deposition, and better facilitates the need to segregate the MMER Schedule 2 listing from the Section 35 Authorization;

- The habitat impact and replacement will occur within roughly the same timeframe, reducing lag time and uncertainty of the offset benefits; and

- The onsite habitat replacement is a more conventional and known means of providing habitat offsets, and will better harmonize with the MMER Schedule 2 amendment process as it reduces uncertainties related to habitat benefits, schedule and costing of the plan.

Habitats associated with the West Creek, Stockpile Pond and Clark Creek Pond offset measures would consist of both creek channel (Types 3 and 4) and pond (Type 5) habitats. One of the limiting conditions within the existing small creek systems is the lack of deeper pools that would provide for summer and winter refuge during the naturally occurring low flow conditions, often resulting in periods of no notable flow. As such, the offset habitat would make good use of frequent pool habitats in the channels with depth up to 0.9 m, and deeper water ponds with productive littoral zones and wetland features. Ponds will vary in depth but deeper sections greater than 1 m will ensure abundant overwintering conditions in all of the pond habitat, while providing large shallow littoral areas for greater productivity and wetland attributes. Maximum depth will range from 1.5 to 2.25 m in the Clark Pond, 3.5 to 4 m in the Stockpile Pond and 3 to 3.5 m in the West Pond.The larger permanent water bodies associated with the ponds may result in larger bodied fish becoming established in the system as well.

5.1 Watercourse Diversion and Pond Construction

The West Creek (including the tributary east of the plant site know as the stockpile pond) will be diverted upstream of the open pit to the West Creek Pond which in turn will outlet at its western margin by the West Creek Diversion (Figure 4-1 and Appendix D. The diversion will be constructed to flow in a north-westerly direction before changing direction and flowing in a south-westerly direction where it will converge with the existing Loslo Creek (Cowser Drain) downstream of the proposed constructed wetland (Figure 4-1). The impoundment will be used as a fresh water source for the mine during operation, but will maintain a functional wetted habitat throughout mine life and beyond. Currently the proposed usage of the pond would only be for potable water to the plant (~150 m^3/day) which represents only a small portion of the existing channel average daily flow. All other West Creek flow would be conveyed through the diversion. The diversion channel (Appendix D) downstream of the pond will be constructed with frequent pooled habitats (0.9 m deep) to provide fish refuge during periods of reduced or intermittent flow which occurs naturally within the system. The pond outlet channel through the emergency spillway will be constructed with a similar low flow channel and slope as the main diversion channel to maintain fish passage between the constructed diversion channel, the pond and upstream sections of the watercourse.

The diversion and impoundment will be created within the Project site and in the same ecotype as the habitat which will be altered / displaced through deposition of mine rock or tailings. It is proposed that the habitat created will be characteristic of habitat Type 4 in channelized sections and habitat Type 5 in the impoundment. However, the inclusion of specific habitat enhancement features (frequent pools) to maximize the potential for fish productivity have been incorporated, consistent with representative habitat types within the Project site. The West Creek Diversion will have a total linear length of approximately 4.5 km with the channel designed to accommodate a 100 year event. It will have a bottom channel width of 3.0 m, maximum depth of 2 m and 4H:1V bank slopes. Under this design a conservative estimate of functional wetted width under the 2 year flood event (bank full) scenario is 9 m. Applying this width to the total linear length (~4.5 km) provides an area of offset habitat for the West Creek Diversion of approximately 40,725 m^2. The West Creek Tributary associated with the Stockpile Pond east of the plant site will also be diverted through a similar constructed channel with a length of approximately 0.8 km with a bank full width of approximately 8 m, for an additional area of ~6,516 m^2. The currently designed West Creek Pond will have an area of 110,089 m^2 and the Stockpile Pond and area of approximately 40,000 m^2 for a combined West Creek Pond habitat area of 150,089 m^2 The mean depth of both ponds will be greater than 1 m, with maximum depths greater than 3 m. Preliminary drawings (plans) for the West Creek Diversion Channel and West Creek Pond with surface areas by water depth are provided as Appendix D. As the detailed design process and closure planning is completed a change in this area may result due to elevation changes of the impoundment structures.

The weight suitability value for these habitat types were calculated to be 0.21 (Type 4) and 0.23 (Type 5) (Table 3-8). Applying these values to the area of offset habitat provides a WUA for offset of 9,921 units for the diversion channels and 34,520 units for the pond areas (Table 4-1).

Similarly, the Clark Creek system will be intercepted and diverted through the Clark Creek Diversion Channel to either a tributary of the Gallinger Creek system or a direct tributary of the Pinewood River(see figure 4-1). In either case the flows would be diverted to the Pinewood River upstream of the proposed east mine rock stockpile. The developed impoundment structure and the Clark Creek Pond, will create sufficient water elevation to redirect flows into the Clark Creek Diversion Channel. The diversion and impoundment will be created in the same ecotype as the habitat overlaid from Clark Creek and as such it is assumed that the habitat created will be characteristic of habitat Type 3 in channelized sections and habitat Type 5 in the impoundment.

The weighted suitability value for habitat Type 3 in Clark Creek was calculated to be 0.22 and habitat Type 5 was 0.23. This realignment will have a total linear length of 1.2 km with the channel design having a bottom channel width of 3.0 m, a maximum depth of 0.5 m with 4H:1V bank slopes. Under this design a conservative estimate of bankfull width is 7 m. Applying this width to the total linear length provides the total area of habitat offset for the Clark Creek Diversion of 8,470 m^2. The total area of the proposed impoundment will be approximately 30,000 m^2. Applying these values to the area of offset habitat provides a WUA for offset of 1,863 units for the Clark Creek Diversion and 6,900 units for the Clark Creek Pond (Table 4-1). The proposed channel configuration and Clark Creek Pond design is provided in Appendix D. The channel will have pools with a depth of approximately 0.9 m to promote standing water during periods of low to no flow, and the pond itself will be constructed to have water depths up to 2.25 m with more than half the area greater than 0.5 m in depth.

The total area and WUA which will be altered or displaced due to the placement of mine waste is 213,189 m^2 and 48,928 units, respectively. The proposed habitat compensation balance provides for approximately 235,800 m^2 and 53,204 WUA of replacement habitats or a net gain in area and WUA of approximately 26,494 m^2 and 5,165 units, an approximate 1.1 ratio of net increase.

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 and construction of the TMA, stockpiles and Constructed Wetland as well as offset features (replacement habitat) to reduce or eliminate the potential impacts during implementation:

- Construction timing window guidelines will be adhered to 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 DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995).
- 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.
- Collection ditching around the TMA and stockpiles will be installed to collect and manage runoff and seepage originating these components.
- Clean non-acid generating materials will be used to construct dams or berms.
- The site will be accessed via 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 development and access to the site.
- 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.

- Fabricated geotextiles will be used, 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.

- Any excess materials removed from the work site will be stabilized to prevent them from entering any waterbody.

- Machinery will be operated 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.

- Daily visual inspections of the site will be conducted to ensure that effective controls are being implemented and maintained as necessary.

- Overburden will be removed from the work area and taken to the overburden stockpile.

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 and addressed in a timely and 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) to ensure offset measures are in place prior to deposition of waste.

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

The proposed West Creek and Clark Creek Diversion Channels and pond habitat construction will be simplistic in design and construction, with little risk of not providing the proposed habitat features. 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.

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 MNR and implemented, if necessary.

9.0 SCHEDULE OF PLAN IMPLEMENTATION

A description of the plan implementation timeline, specifically associated with the deposition of deleterious substances within fish bearing waters, and construction of offset habitats is provided in Table 9-1. Note that in the case of the TMA construction, the dates shown are for when the dams would overprint the waters frequented by fish which requires Schedule 2 listing of Loslo and Marr Creeks. Sections of the dams not overprinting waters frequented by fish would commence in advance of the Schedule 2 listings. Likewise, development of the overburden and mine rock stockpile (west stockpile) may occur in areas not overprinting waters frequented by fish in advance of the Schedule 2 listing providing that all drainage from the stockpile is collected and managed as per MMER requirements.

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 we are providing a cost for the construction of the NNLP plan, and the proposed monitoring as per Table 10-1.

As per Section 27(4) of the MMER, RRR will arrange the provision of an irrevocable letter of credit. We welcome further discussion regarding this aspect.

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Table 3-1: Habitat Type Criteria

Typical Watershed Association	Habitat Type Classification	Watercourse versus Waterbody Dominated	Permanent / Intermittent / Ephemeral	Characteristic Morphology Features					% Dominant Land Use / Riparian Features	Substrate Composition (% Ranges)	Instream Cover (% by Category)
				Habitat Attributes	Bankfull Width (m)	Average Depth (m)	Floodplain Width (m)	% Riffle, Run, Flat, Pool			
Upper Pinewood River	Type 1	Watercourse	Permanent	• Low gradient (0.05 - 1%) • Well defined and forested valley • Moderate entrenchment - banks 1:2 - 1:1 ratio • Narrower Floodplain • Moderately sinuous flow path	5 - 10	0.25 - 1.75	10 - 15	• Flats: > 80 • Pools: < 20 • Primarily flat morphology • Occasional pools in thalweg meanders	• Mixed Forest: 80 • Graminoid/Sedge Floodplain: 10 • Agricultural: 10	• 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	• 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
	Type 2	Watercourse	Permanent	• Low gradient (0.05 - 1%) • Low entrenchment - banks 1:5 - 1:2 ratio • Moderate past/present beaver activity • Hummocky	10 - 20	0.75 - 2.25	15 - 50	• Flats: >90 • Pools: < 10 • Pools and flats due to occasional beaver activity	• Graminoid/Sedge Floodplain: 60 • Agricultural: 30 • Mixed Forest: 10	• 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	• 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
Upper Reaches of Pinewood River Tributaries	Type 3	Watercourse	Permanent	• 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	2 - 5	0.25 - 1.75	50 - 150	• Flats: >90 • Pools: < 5 • Runs: < 5 • Braided/diffuse channels • Deep narrow channels • Low width/depth ratio	• Graminoid/Sedge Floodplain: 80 • Mixed Forest: 20 • Beaver influenced/Floodplain • Alder/Willow thickets interspersed	• Silt/Muck: 15 – 25 • Sand: 20 – 40 • Clay: 15 – 25 • Detritus: 10 – 20 • Loose organics, silt and detritus over firm silty clay	• 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
	Type 4	Watercourse	Intermittent; leading to permanent	• 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	1 - 8	0.75 - 2.5	50 - 100	• Flats: > 60 • Pools: > 40 • Primarily flats	• Graminoid/Sedge Floodplain: 50 • Agricultural: 40 • Mixed Forest: 10	• Detritus: 20 – 40 • Silt/Muck: 20 – 4 • Sand: 25 – 50 • Clay: 5 – 10 • Loose organics, silt and detritus over firm silty clay	• 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
	Type 5	Water Body	Permanent	• Beaver Pond • Wide floodplain • Extensive beaver activity • Regulated flow • Low entrenchment - banks 1:10 - 1:5 ratio • Low gradient (0.05 - 1%)	10 - 50	0.25 - 2.00	150 >	• Pools: 100 • Pond habitat	• Graminoid/Sedge Floodplain: 80 • Mixed Forest: 20 • Beaver influenced/Floodplain • Alder/Willow thickets interspersed	• Sand: 20 – 30 • Silt/Muck: 20 – 40 • Clay: 10 -20 • Detritus: 10 – 20 • Loose organics, silt and detritus over firm silty clay	• 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

Typical Watershed Association	Habitat Type Classification	Watercourse versus Waterbody Dominated	Permanent / Intermittent / Ephemeral	Characteristic Morphology Features					% Dominant Land Use / 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

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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 Schedule 2 Amendment Waterbodies

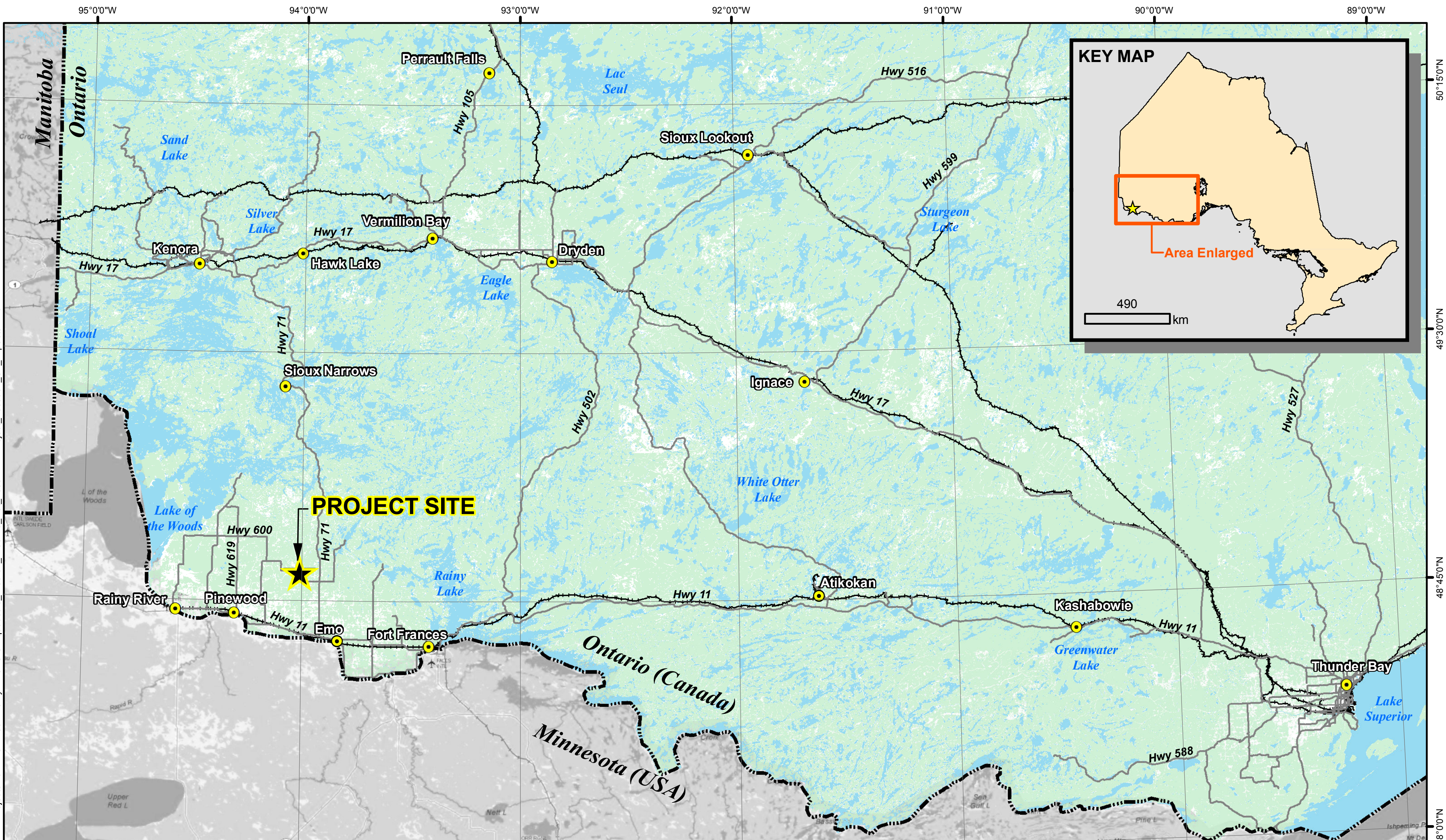
Mine Feature	Total Area Overprinted (m^2)			Weighted Usable Area Overprinted			Offset Feature	Total Area of Offset (m^2)	Weighted Usability Value	Weighted Useable Area Offset
	Loslo Creek (Cowser Drain)	Marr Creek	Total	Loslo Creek (Cowser Drain)	Marr Creek	Total				
Tailing Management Area (including TMA Pond)	143,344	14,949	158,293	32,895	3,434	36,329	West Creek Diversion Channel and Stockpile Pond Diversion Channel	47,241	0.21	9,921
Constructed Wetland/Water Discharge Pond	47,437	0	47,437	10,941	0	10,941	West Creek Pond	150,089	0.23	34,520
West Mine Rock Stockpile	0	5,514	5,514	0	1,230	1,230	Clark Creek Diversion Channel	8,470	0.22	1,863
Overburden Stockpile	0	1,945	1,945	0	428	428	Clark Creek Pond	30,000	0.23	6,900
Total	**186,898**	**22,408**	**213,189**	**42,947**	**5,092**	**48,928**	**Total**	**235,800**		**53,204**
							Net Gain = 22,611 m^2		**Net Gain = 4,276 WUA**	

Table 9-1: Schedule of Plan Implementation

Offset Component / Activity	Estimated Time of Occurrence
Construction of West Creek Diversions and Ponds Habitat Offsets	October 2014 to November 2014
Construction of Clark Creek Diversion and Pond Habitat Offsets	December 2014 to December 2014
Expected Schedule 2 Listing of Loslo Creek and Marr Creek	June 2015
Construction of Tailings Management Area within former Loslo Creek and Marr creek Channels (dam footprints within waters that require Schedule 2 listing)	June 2015
Deposition of Mine Rock and Overburden (West Mine Rock Stockpile) within former Marr Creek	June 2015 to end of mine
Construction of Constructed Wetland	September 2015 to October 2015
Deposition of Tailings into TMA	August 2016 to end of mine
Monitoring Schedule	
As-built Survey of Offset Components and Photo Documentation	December 2015
Year 1 Annual Monitoring Report	December 2015
Year 2 Annual Monitoring Report	December 2016
Year 3 Annual Monitoring Report (Include Fish Surveys)	December 2017
Year 5 Final Monitoring Report (Include Fish Surveys)	December 2019

Table 10-1: Estimated Cost of Plan Implementation

Offset Feature	Estimated Cost
Construction of West Creek Realignment	Pending
Construction of West Creek Pond	Pending
Construction of Clark Creek Realignment	Pending
Construction of Clark Creek Pond	Pending
Total Cost to Implement Plan	**Pending**



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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

N W E S

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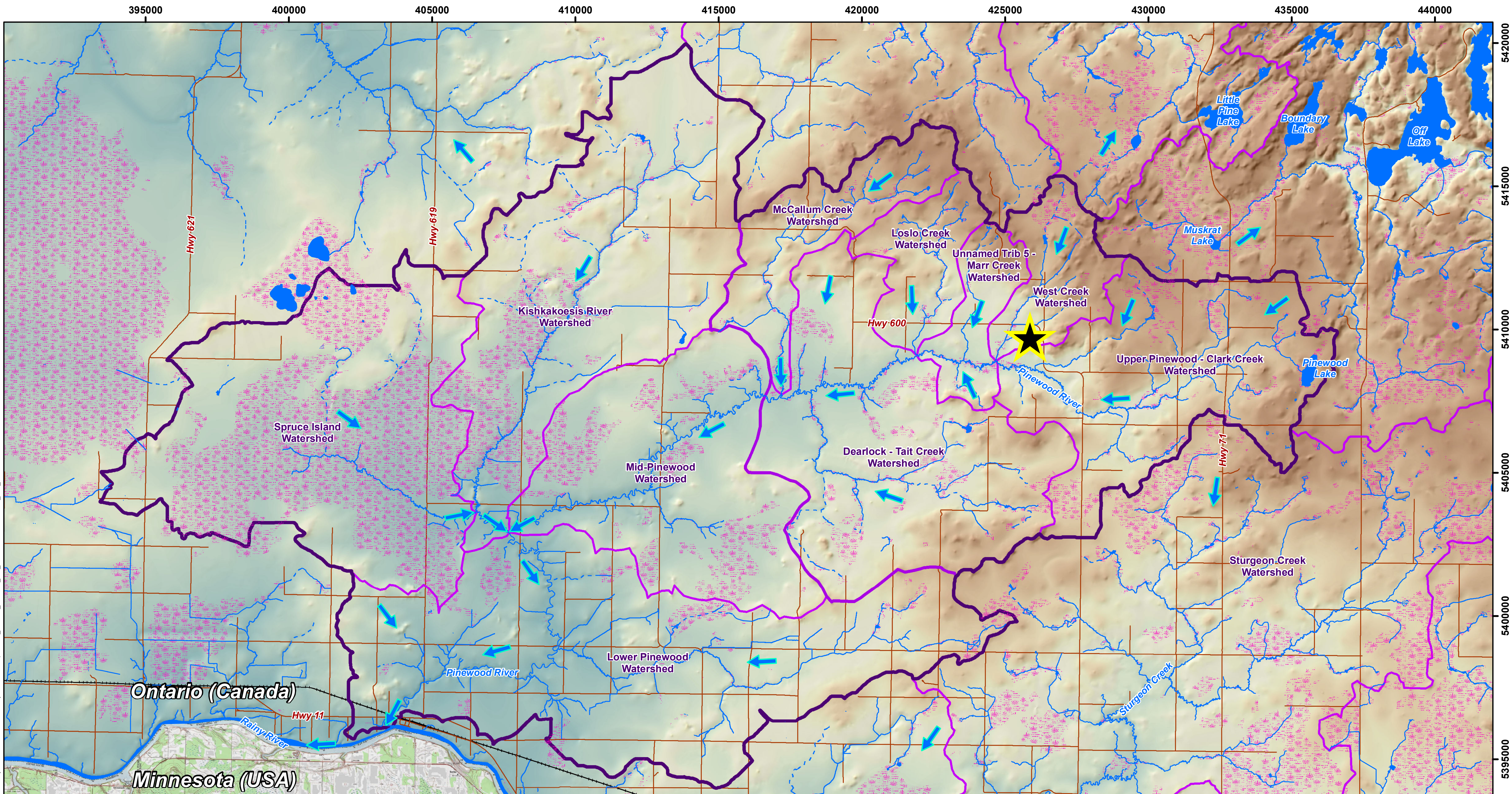
RAINY RIVER PROJECT

Project Location

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

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



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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

0 3.5 7 14 21 28 35 Kilometres

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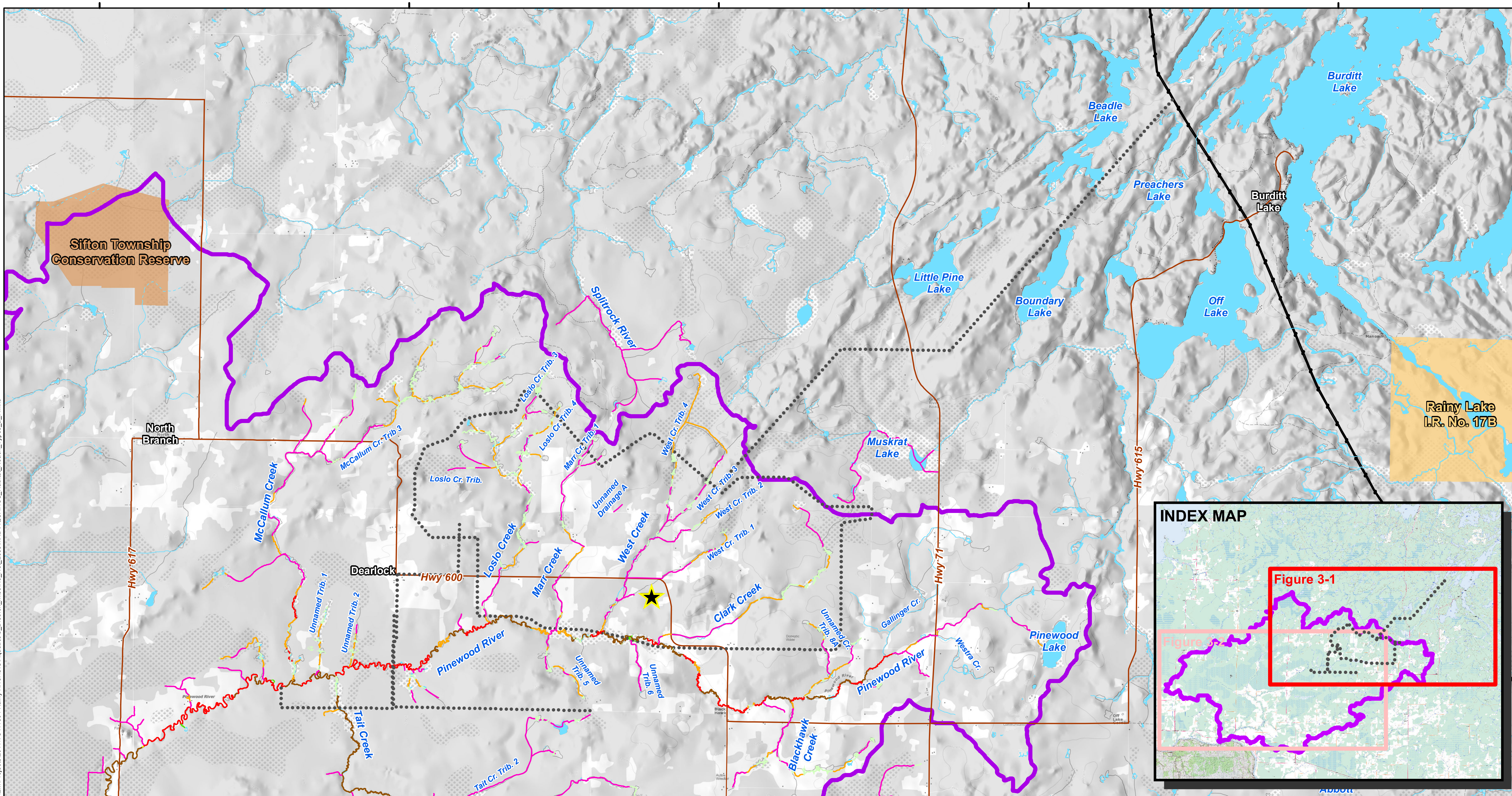
RAINY RIVER PROJECT

Regional Topography, Watershed and Subwatershed Boundaries

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



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

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RAINY RIVER PROJECT

Aquatic Habitat Types (Upper Pinewood River Watershed)

PROJECT Nº: TC111504 | FIGURE: 3-1

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

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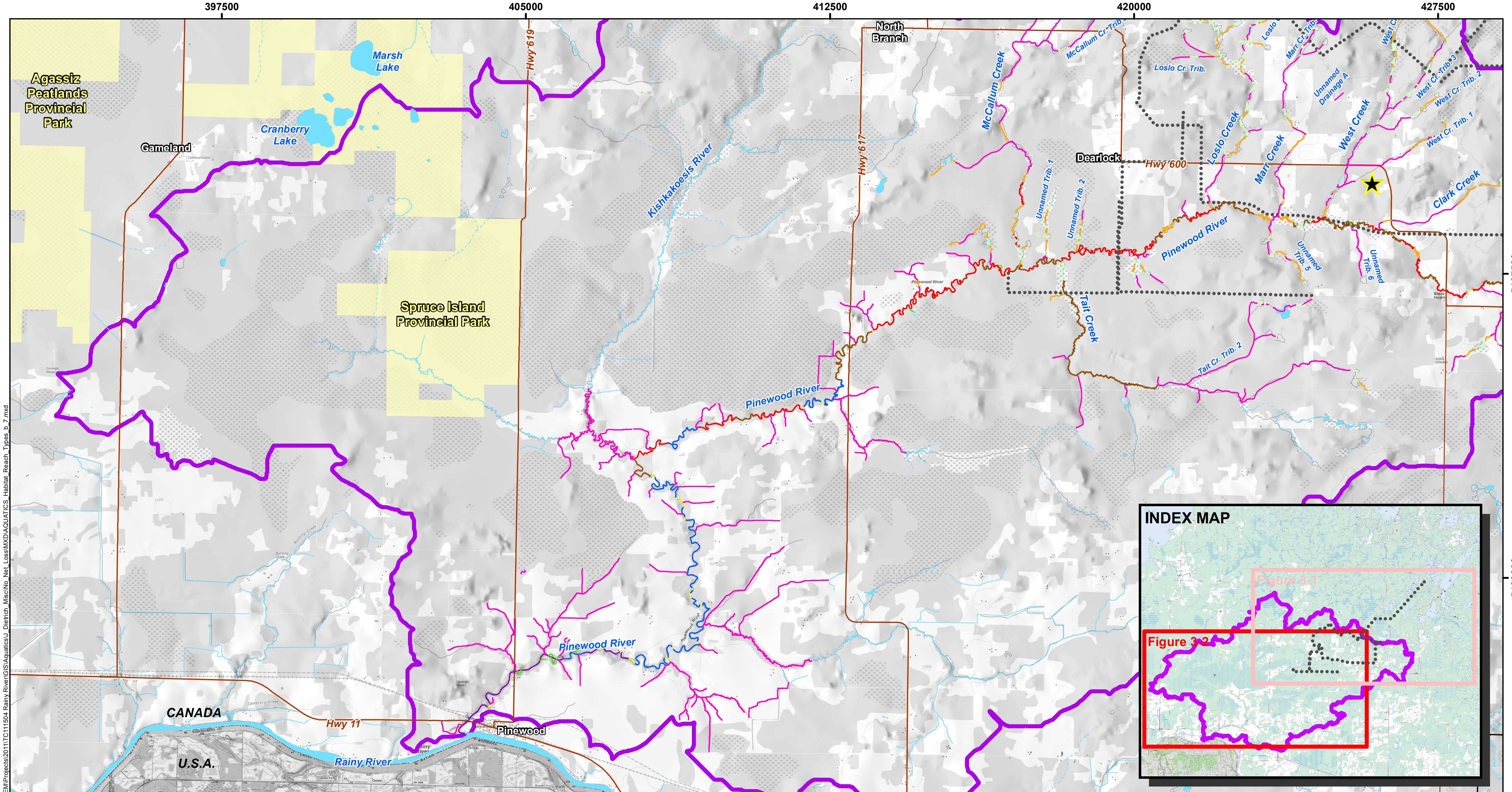

LEGEND

- 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

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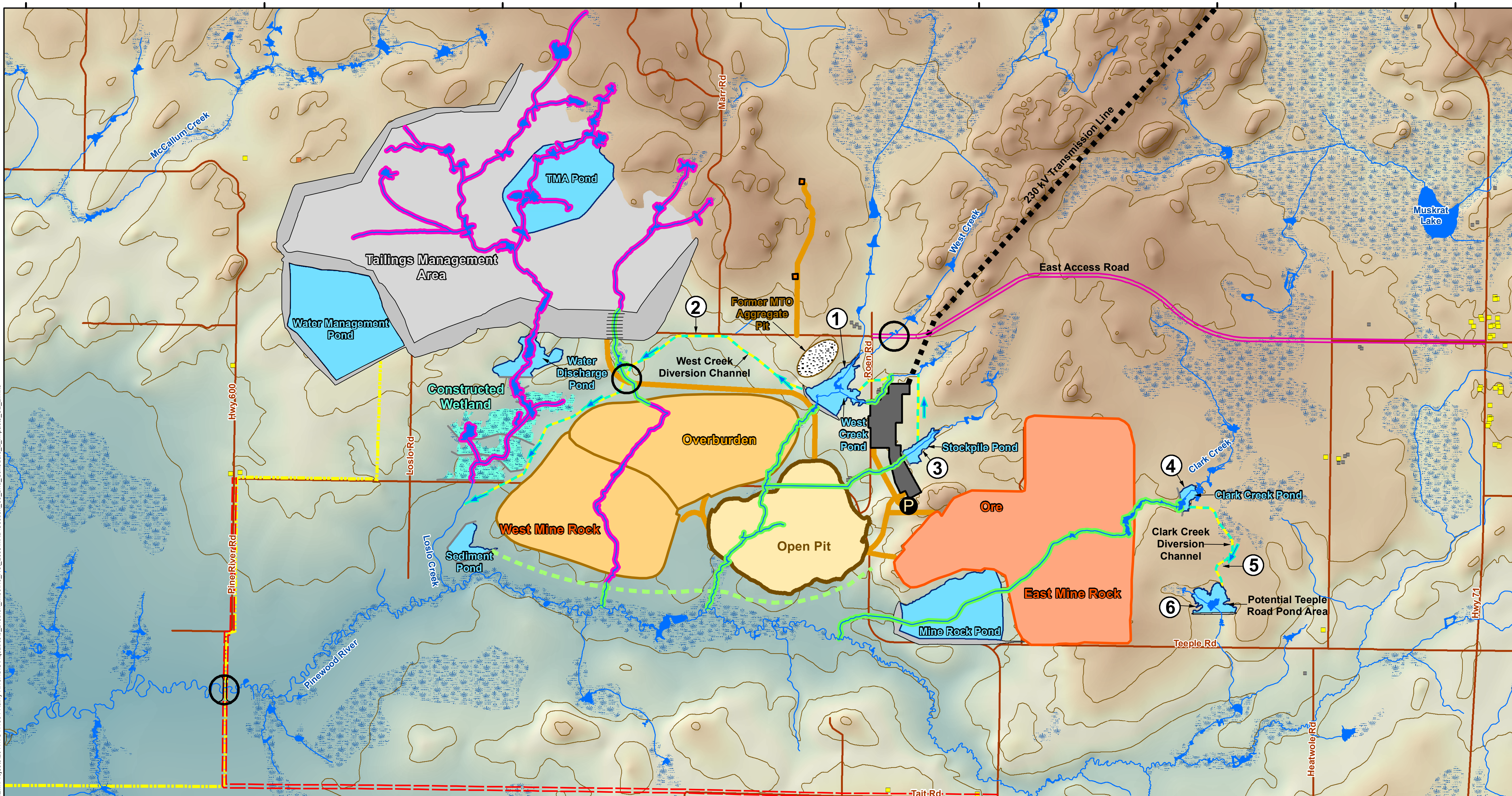
RAINY RIVER PROJECT

Aquatic Habitat Types (Lower Pinewood River Watershed)

PROJECT N°: TC111504	FIGURE: 3-2
SCALE: 1:90,000	DATE: October 2013



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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

- P 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

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RAINY RIVER PROJECT

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

PROJECT Nº: TC111504	FIGURE: 4-1
SCALE: 1:39,000	DATE: October 2013

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APPENDIX A

HABITAT TYPE ILLUSTRATIONS

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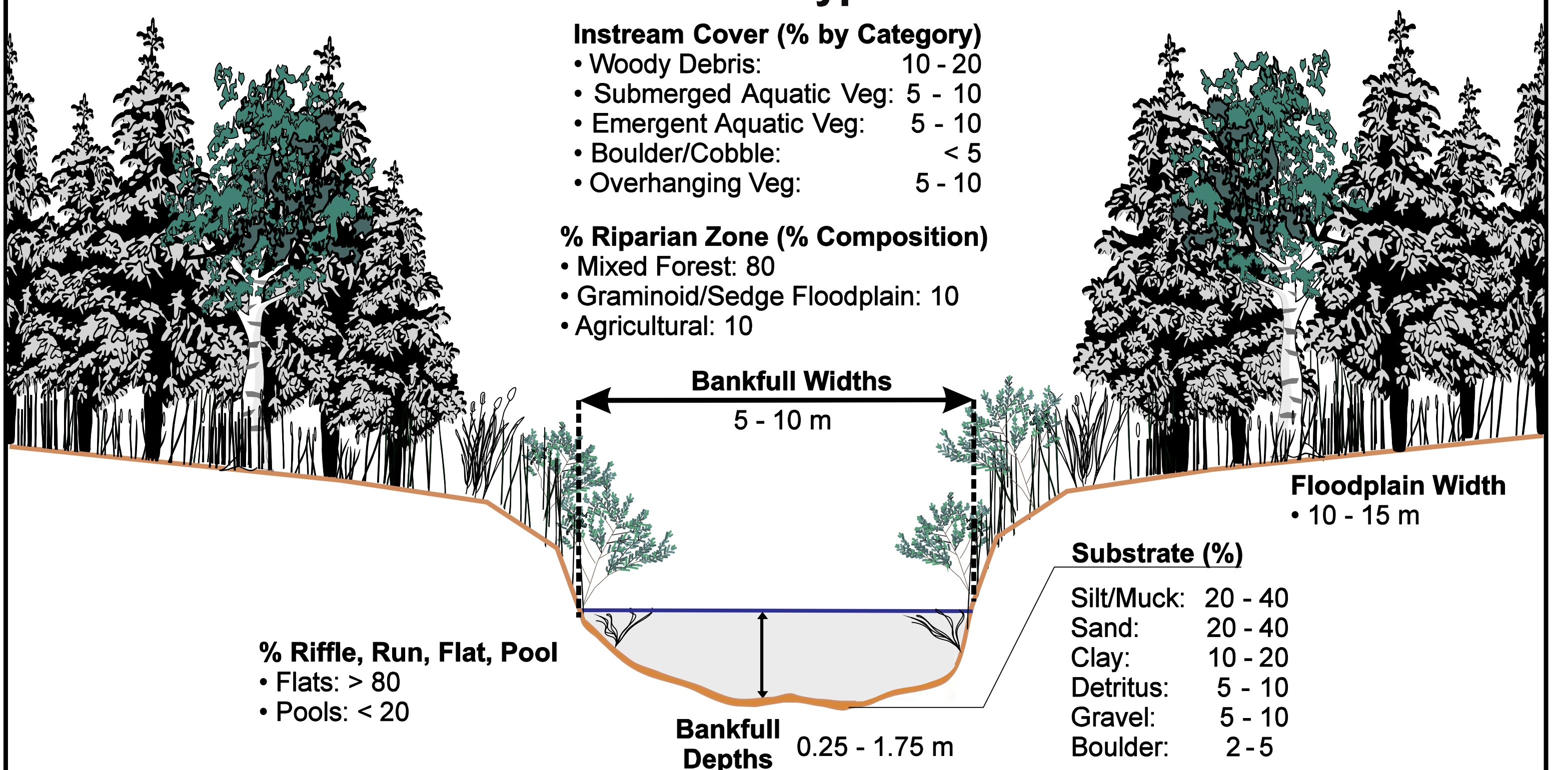
Habitat Type 1



Pinewood River: PIN-10A - Facing Downstream

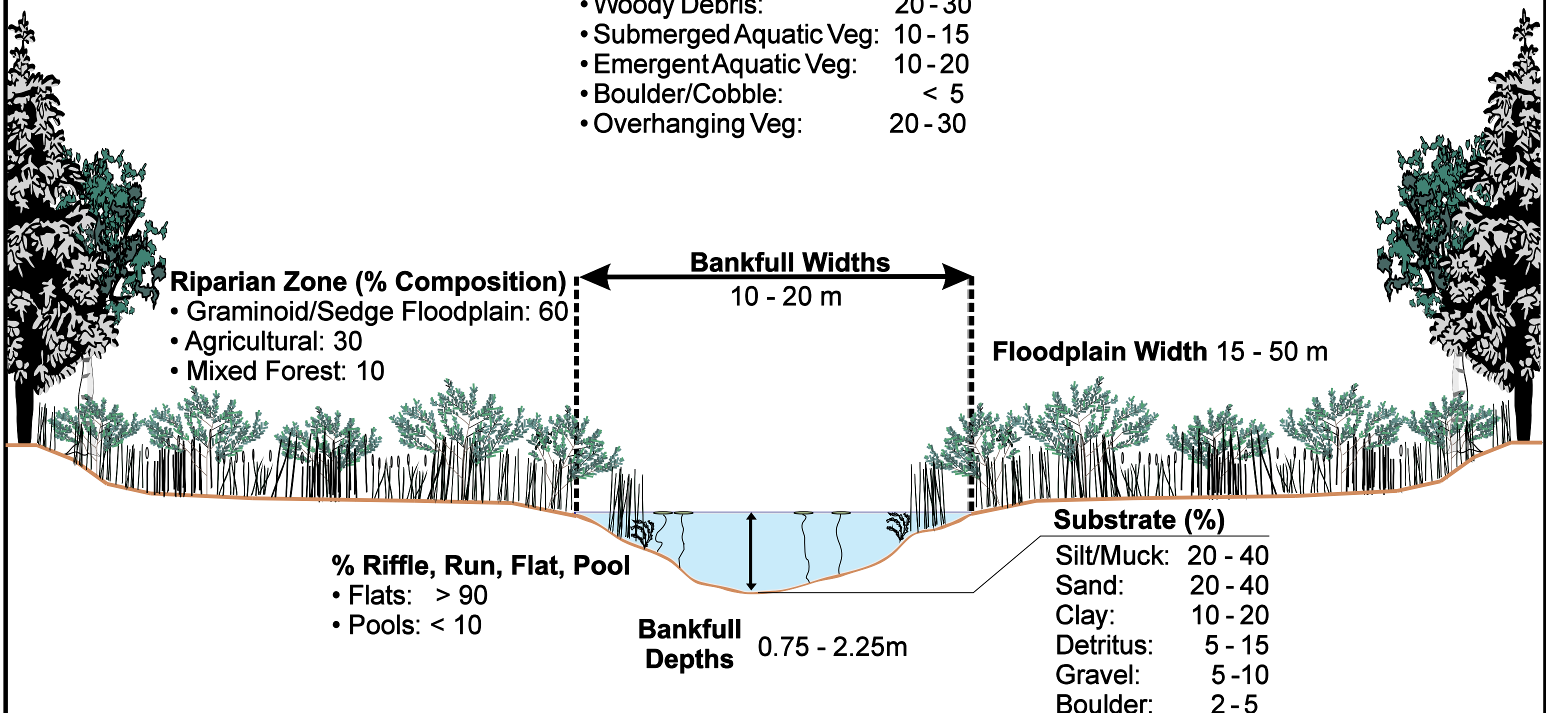
Pinewood River: PIN-10A - Facing Upstream

Pinewood River: PIN-9 - Facing Downstream

Pinewood River: PIN-9 - Facing Downstream

Habitat Type 2

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



Pinewood River: PIN-2A - Facing Upstream

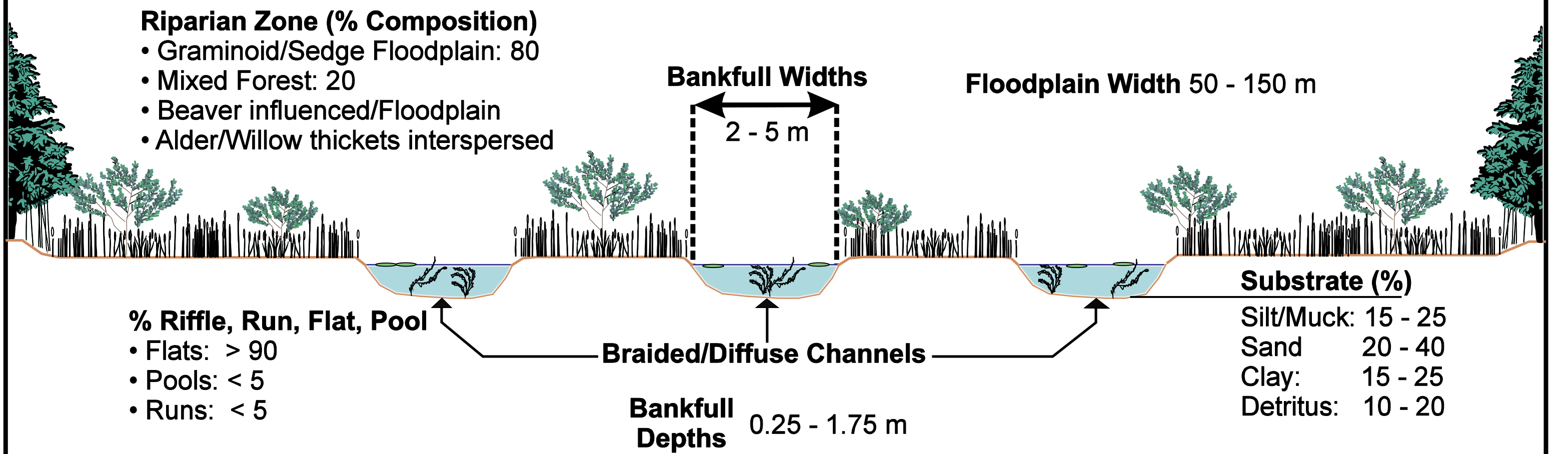
Pinewood River: PIN-2A - Facing Downstream

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



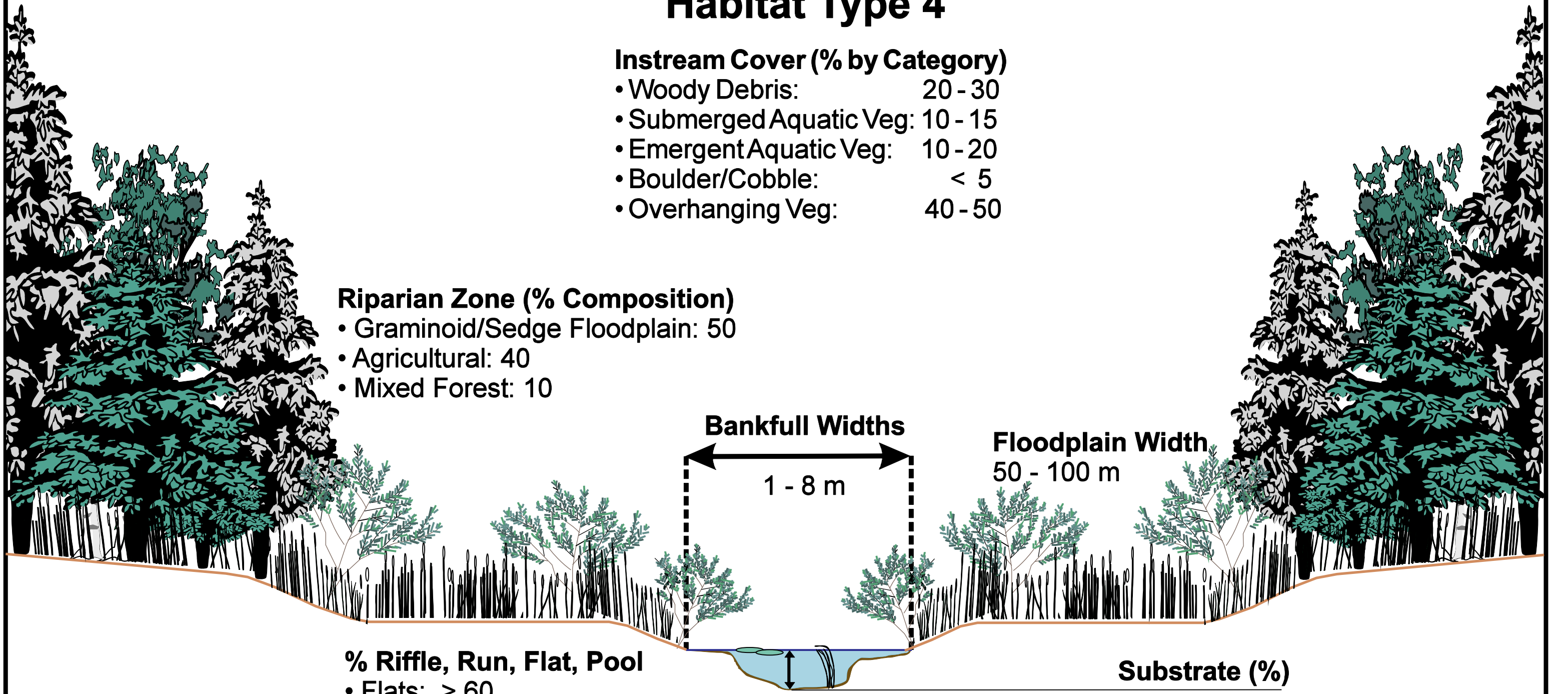
Clark Creek: CLA-5A - Vegetated Floodplain

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

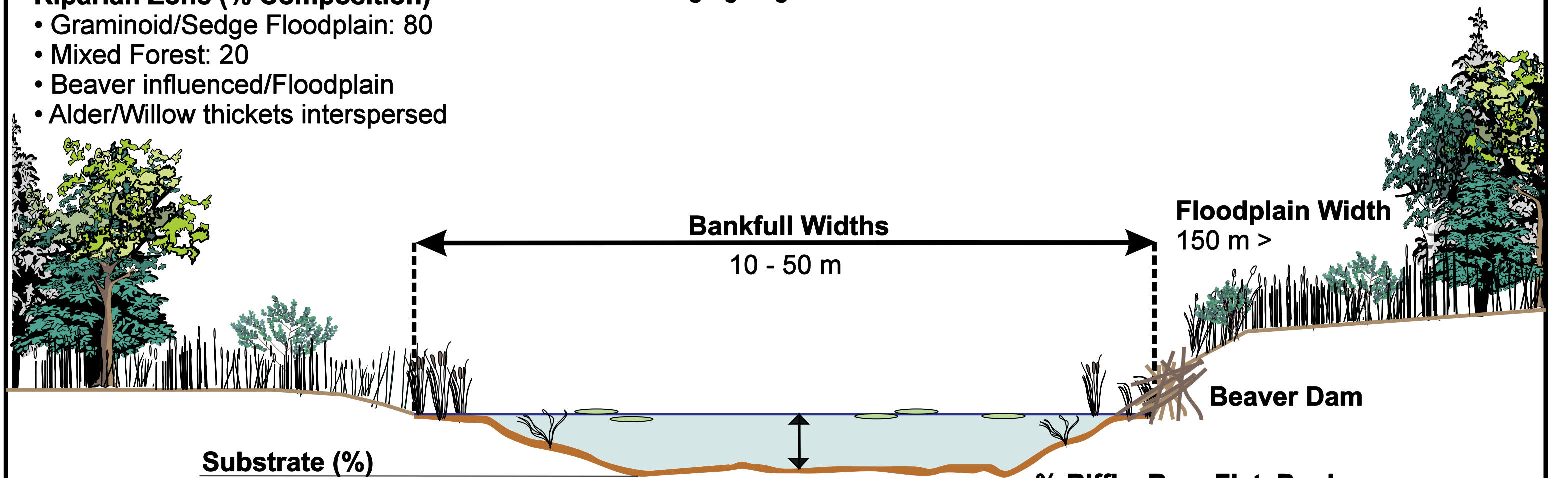
Loslo Creek: LOS-10 - Saturated Intermittent Channel

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

Bankfull Depths 0.25 - 2.0 m

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

Clark Creek: CLA-5A - Beaver Pond

Clark Creek: CLA-5A - Beaver Pond

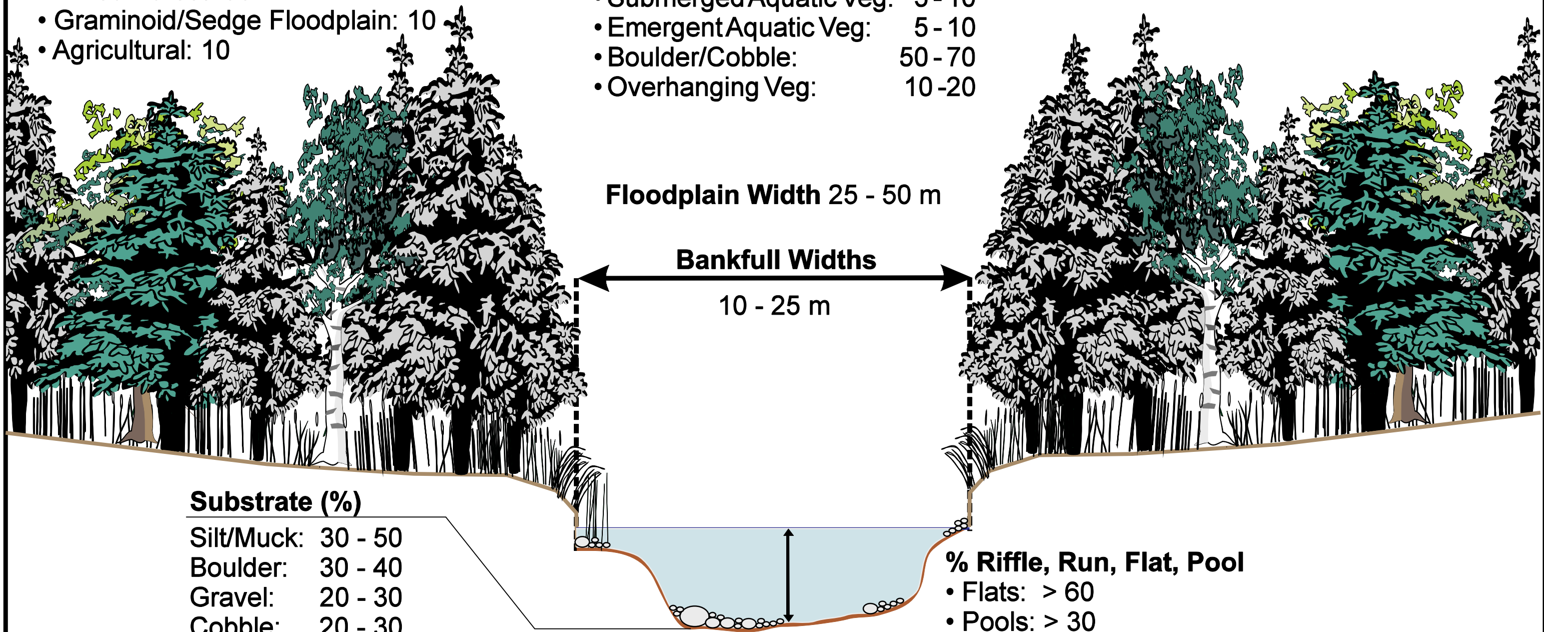
Clark Creek: CLA-5A - Beaver Pond

Clark Creek: CLA-5A - Beaver Pond

Habitat Type 6

Riparian Zone (% Composition)
- Mixed Forest: 80
- Graminoid/Sedge Floodplain: 10
- Agricultural: 10

Instream Cover (% by Category)
- Woody Debris: 20 -40
- Submerged Aquatic Veg: 5 - 10
- Emergent Aquatic Veg: 5 - 10
- Boulder/Cobble: 50 - 70
- Overhanging Veg: 10 -20



Substrate (%)

Silt/Muck:	30 - 50
Boulder:	30 - 40
Gravel:	20 - 30
Cobble:	20 - 30
Sand:	15 - 25
Clay:	5 - 10

% Riffle, Run, Flat, Pool
- Flats: > 60
- Pools: > 30
- Runs: < 10

Pinewood River: PIN-15 - Facing Upstream

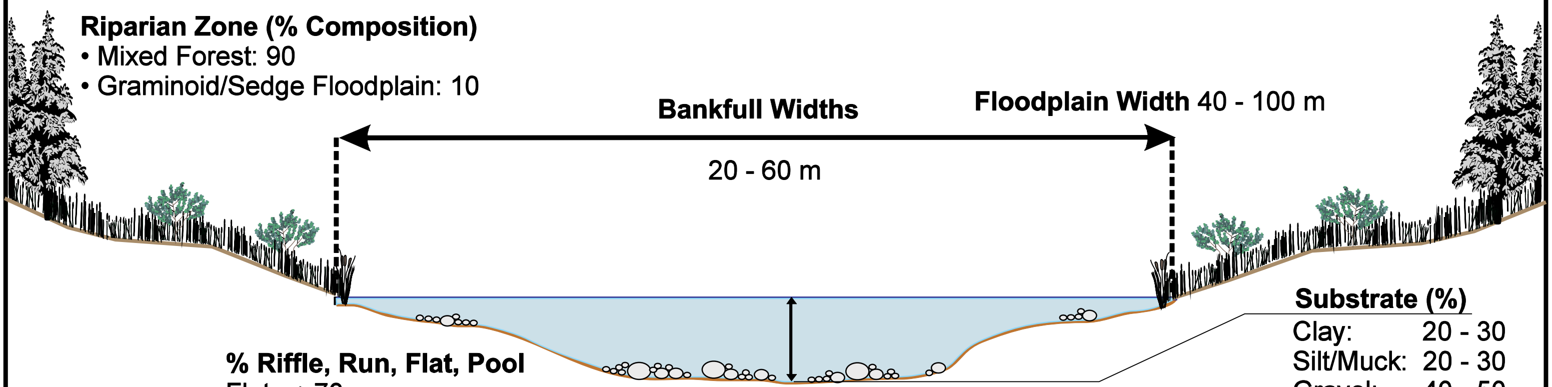
Pinewood River: PIN-15 - Facing Downstream

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




Lower Pinewood River: PIN-18 Facing Upstream


Lower Pinewood River: Upstream of PIN-18

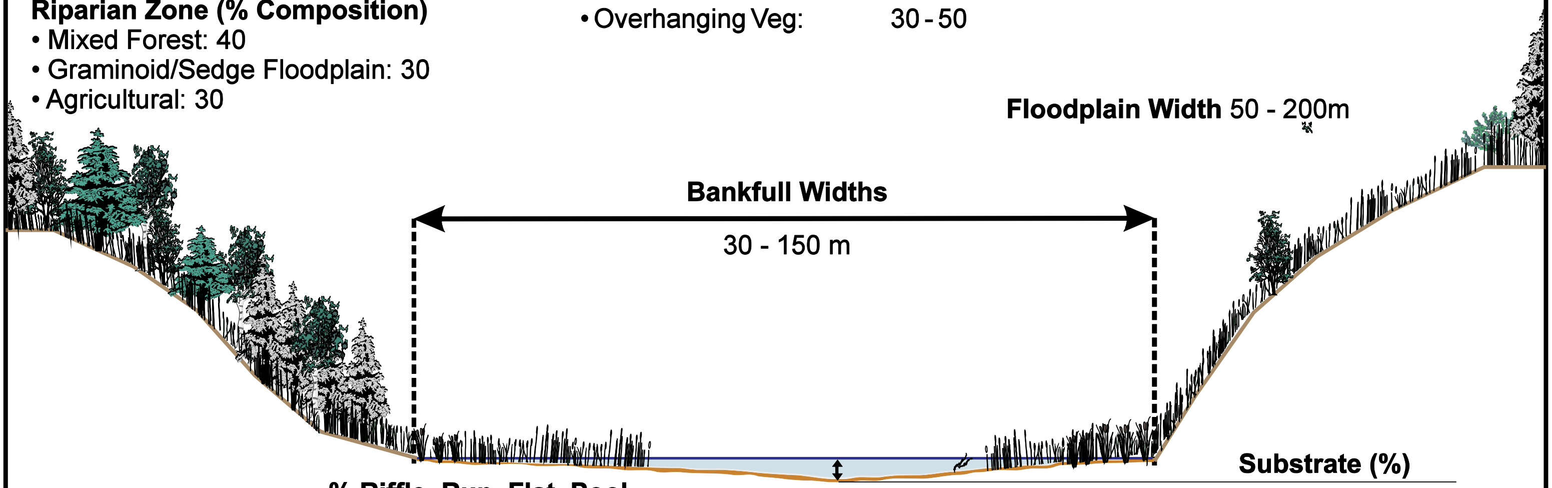

Lower Pinewood River: PIN-17 Facing Upstream


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



% 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

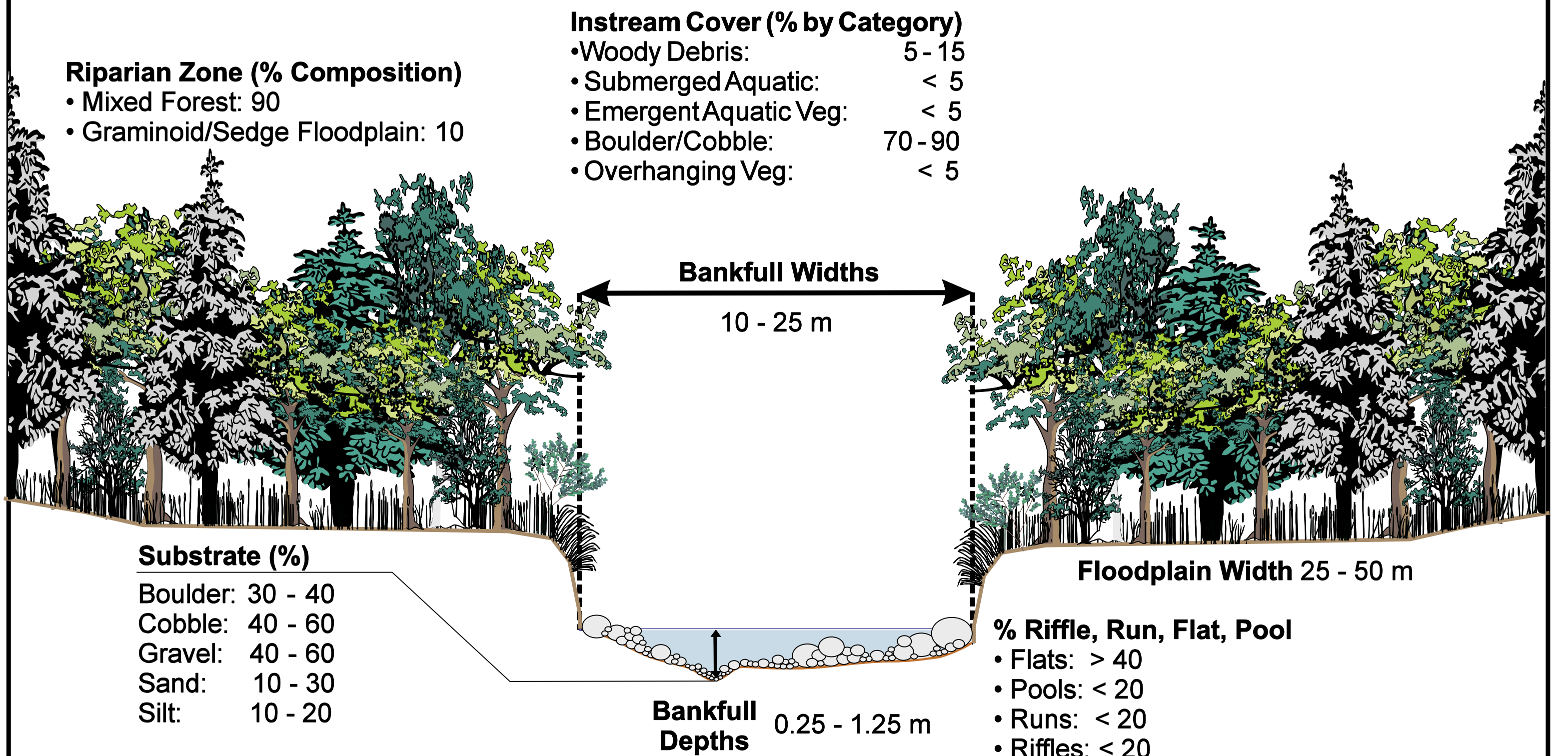
Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 3

Lower Pinewood River: Back Bay 2

Habitat Type 9



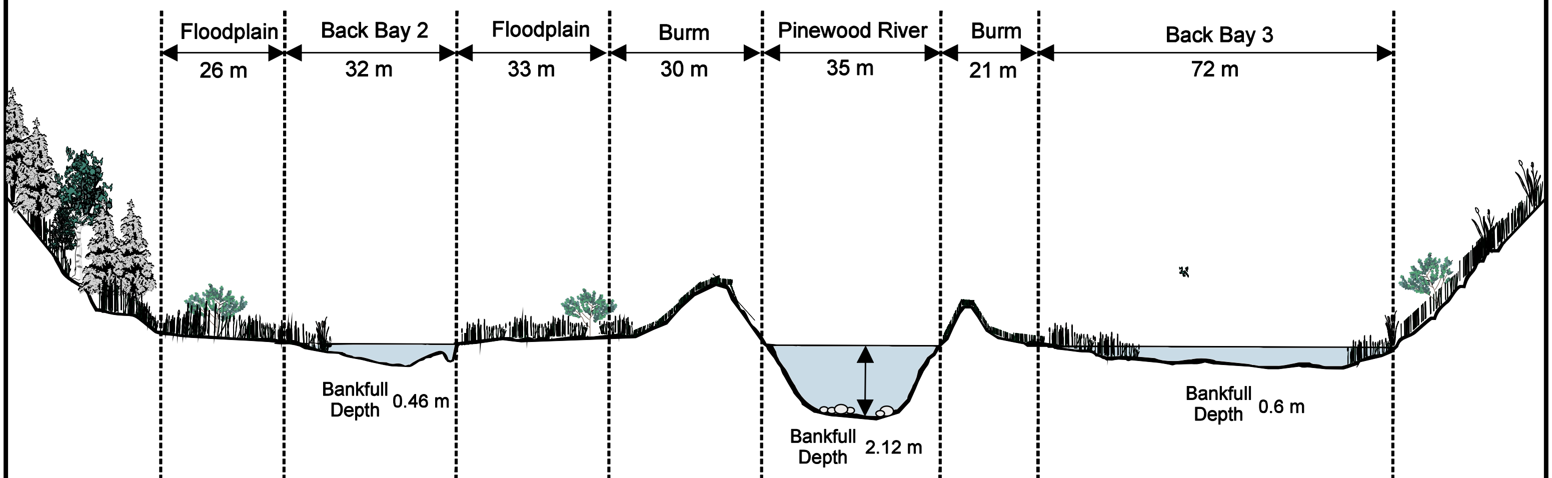
Lower Pinewood River: PW-24 - Facing downstream

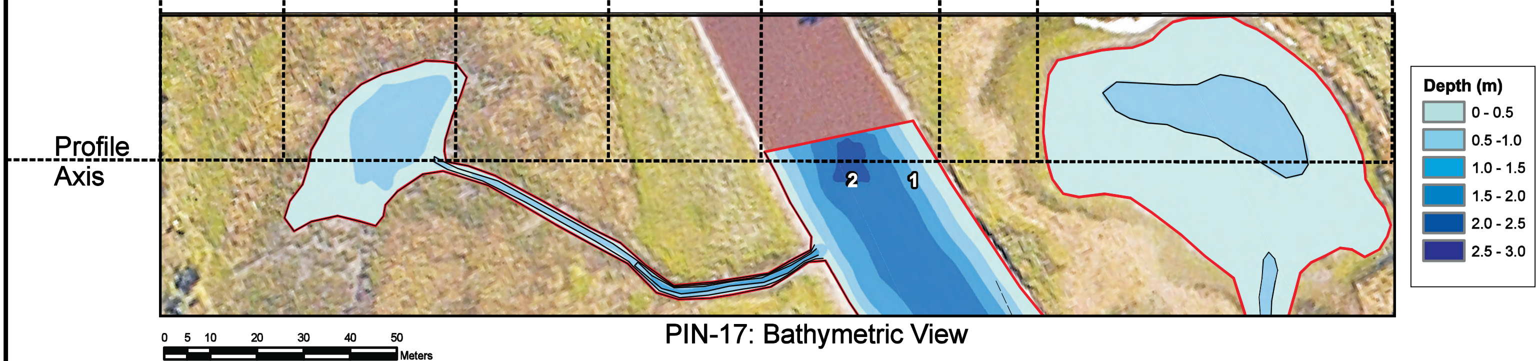
Lower Pinewood River: PW-24 - Cobble Shoal

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

newgold Rainy River Project

APPENDIX B

FISH HABITAT SUITABILITY INDEX VALUES

amec

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	

APPENDIX C

FISH HABITAT SUITABILITY INDEX CRITERIA

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

FISH HABITAT OFFSET PLANS

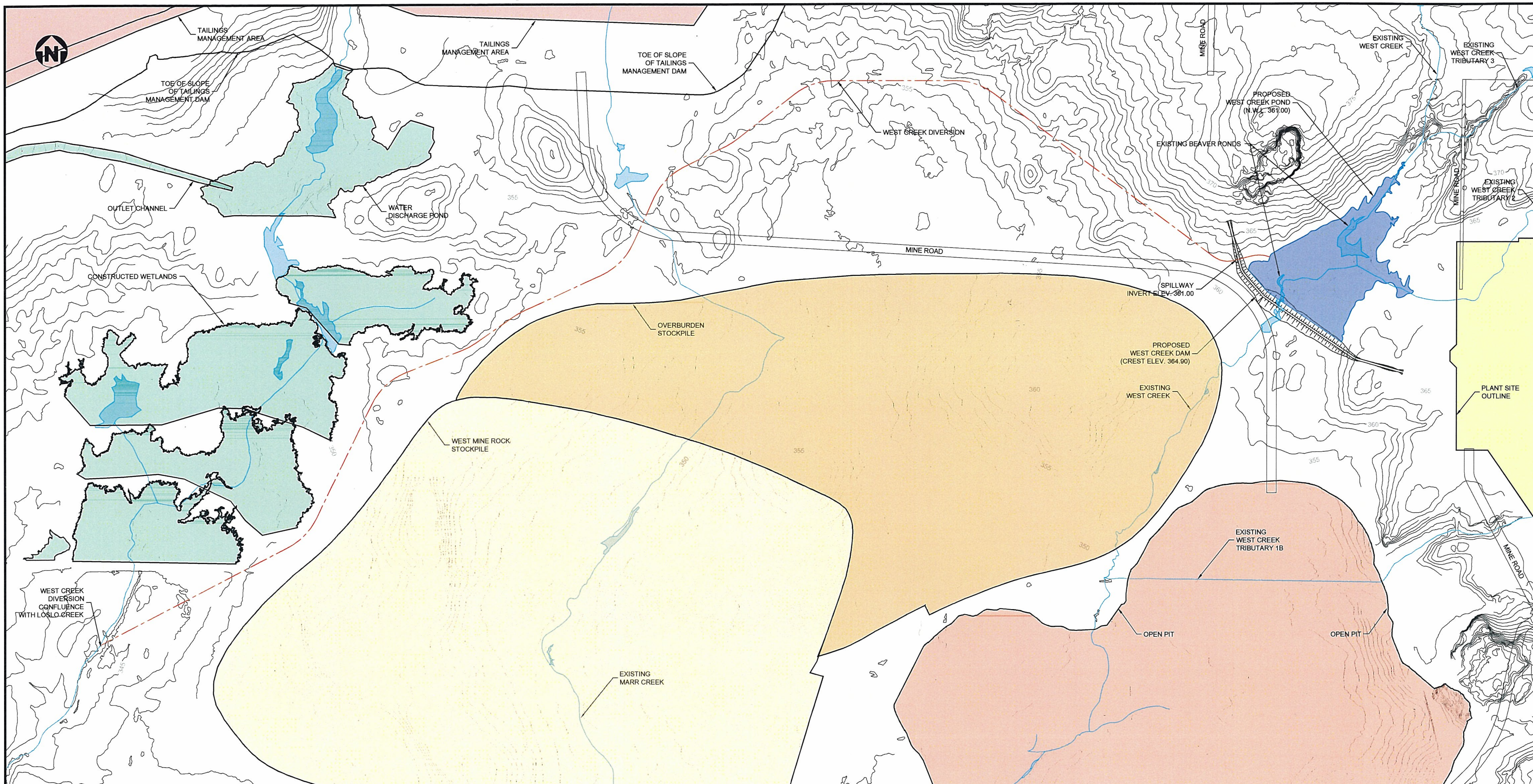
D-1 West Creek Pond and Diversion Channel
D-2 Clark Creek Pond and Diversion Channel
D-3 Stockpile Pond and Diversion Channel

newgold Rainy River Project

APPENDIX D-1

WEST CREEK POND AND DIVERSION CHANNEL

amec



CONCEPTUAL DRAWINGS

DRAFT

WEST CREEK POND PLAN VIEW

SCALE : 1:6000

0m 50 100 150 200m
1 : 6000

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
-						
-						
-						
-						
-						
B						
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 WEST CREEK OVERVIEW

PROJECT NO.:	TC111504
REVISION NO.	A
DATE:	OCT. 2013
SCALE:	AS SHOWN
DRAWING NO.:	111504-100-001

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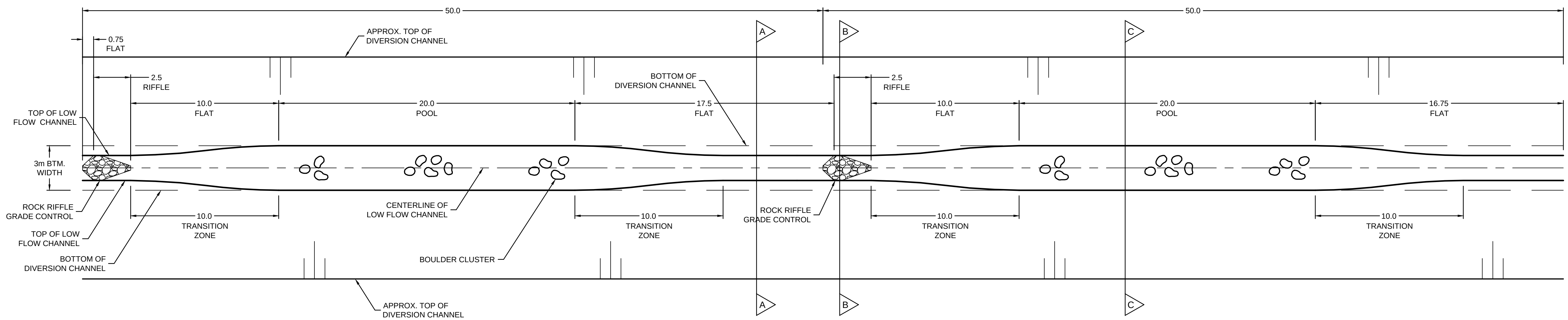
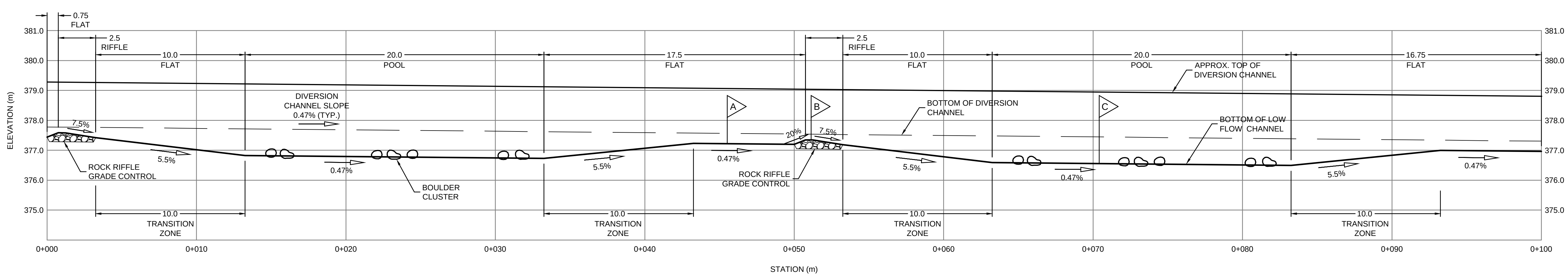


TYPICAL DIVERSION 3m BOTTOM WIDTH PLAN VIEW

SCALE : 1:150



TYPICAL DIVERSION 3m BOTTOM WIDTH PROFILE

SCALE : H=1:150 V=1:75

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR
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Client: newgold Rainy River Project

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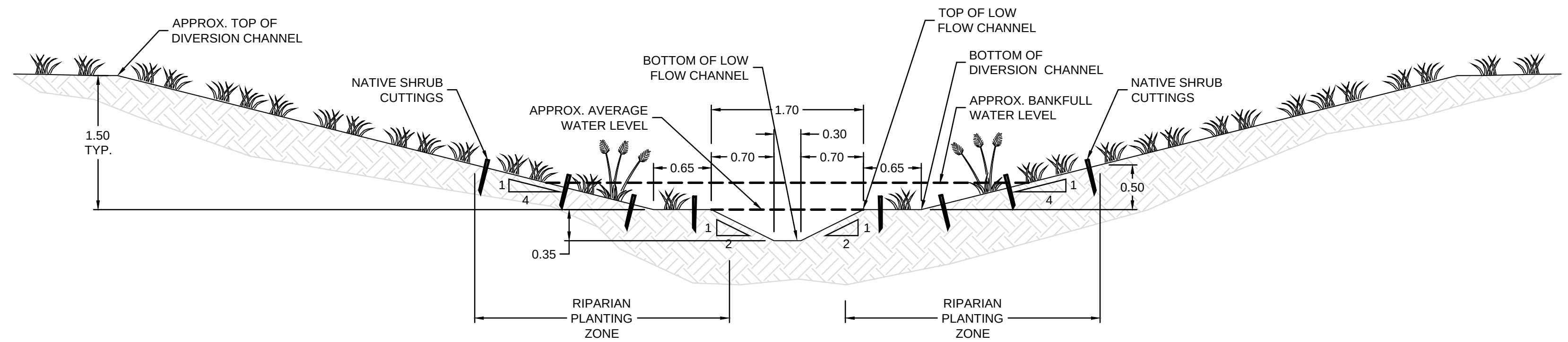
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

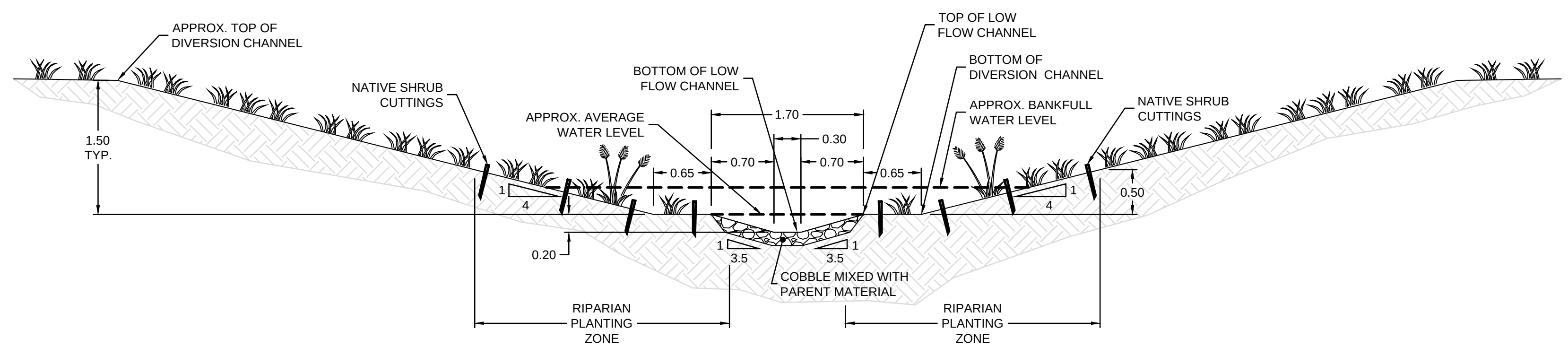
TITLE: CONCEPTUAL DESIGN
WEST CREEK AND STOCKPILE POND DIVERSIONS
3m BOTTOM WIDTH TYPICAL PLAN AND PROFILE

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-002



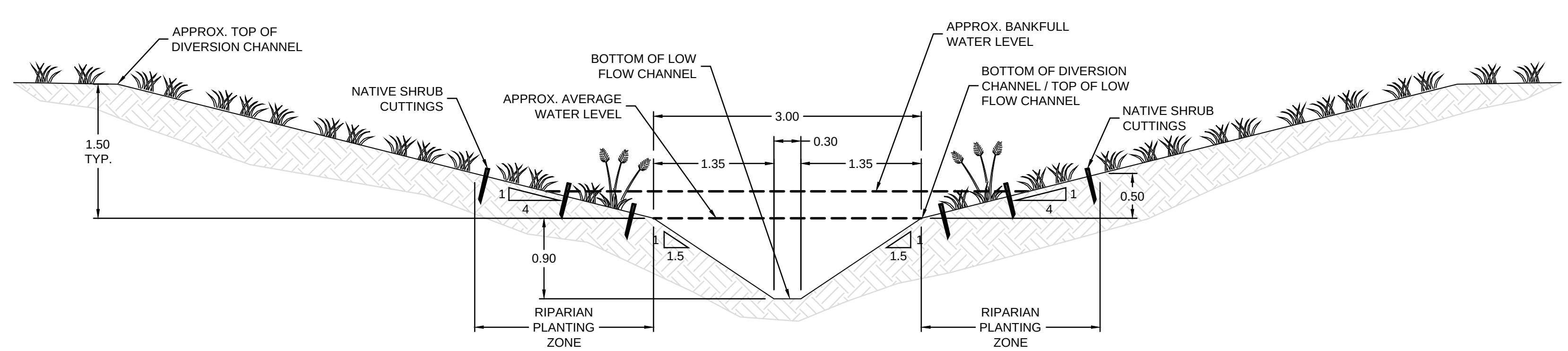
SECTION A-A: TYPICAL 3m BOTTOM WIDTH FLAT SECTION

SCALE : H=1:40 V=1:40



SECTION B-B: TYPICAL 3m BOTTOM WIDTH TOP OF RIFFLE SECTION

SCALE : H=1:40 V=1:40



SECTION C-C: TYPICAL 3m BOTTOM WIDTH POOL SECTION

SCALE : H=1:40 V=1:40

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 EXCEPT THOSE WITHIN THE LOW FLOW CHANNEL SHALL BE STABILIZED WITH A NURSE CROP AS OUTLINED IN TABLE 1.
5. RIPARIAN PLANTING ZONE SHALL BE SEEDED WITH NATIVE RIPARIAN SEED MIX IN ADDITION TO NURSE CROP SEED.
6. IF STABILIZATION IS REQUIRED PRIOR TO ESTABLISHMENT OF SEED MIXES THEN THE USE OF AN APPROPRIATE EROSION CONTROL BLANKET IS RECOMMENDED.
7. A TOTAL OF 15%-25% OF THE RIPARIAN PLANTING ZONE SHALL BE PLANTED WITH NATIVE SHRUB CUTTINGS AT A 0.75m SPACING.
8. NATIVE SHRUB CUTTINGS SHALL BE TAKEN FROM WILLOW AND DOGWOOD SPECIES PRESENT ON SITE AND IN SURROUNDING AREA.
9. 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

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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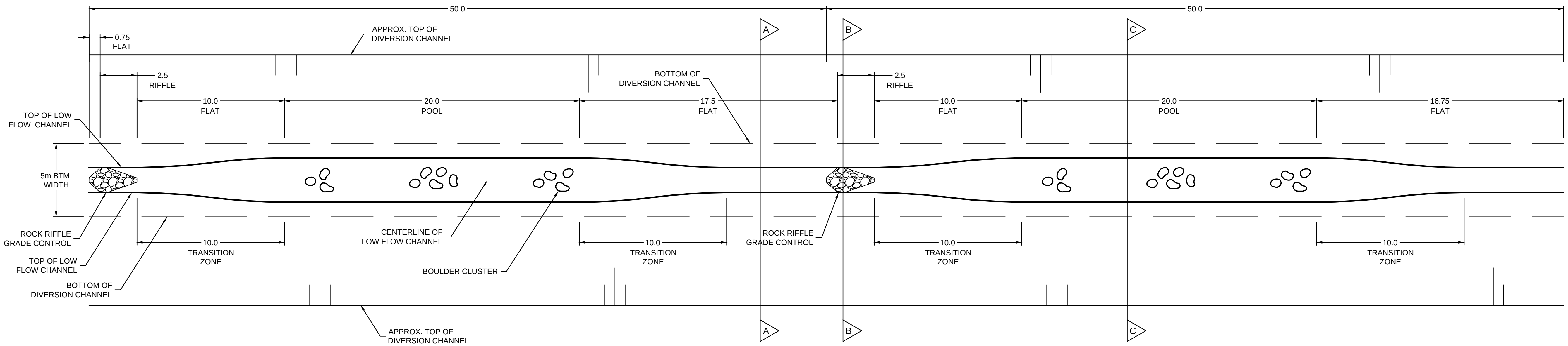
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT FISH HABITAT OFFSET STRATEGY

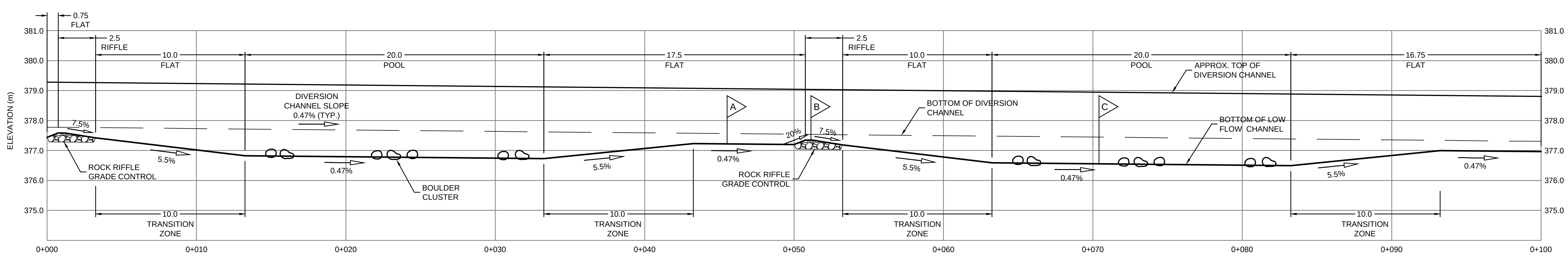
TITLE: CONCEPTUAL DESIGN WEST CREEK AND STOCKPILE POND DIVERSION 3m BOTTOM WIDTH TYPICAL CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-003



TYPICAL WEST CREEK DIVERSION 5m BOTTOM WIDTH PLAN VIEW

SCALE : 1:150



TYPICAL WEST CREEK DIVERSION 5m BOTTOM WIDTH PROFILE

SCALE : H=1:150 V=1:75

CONCEPTUAL DRAWINGS

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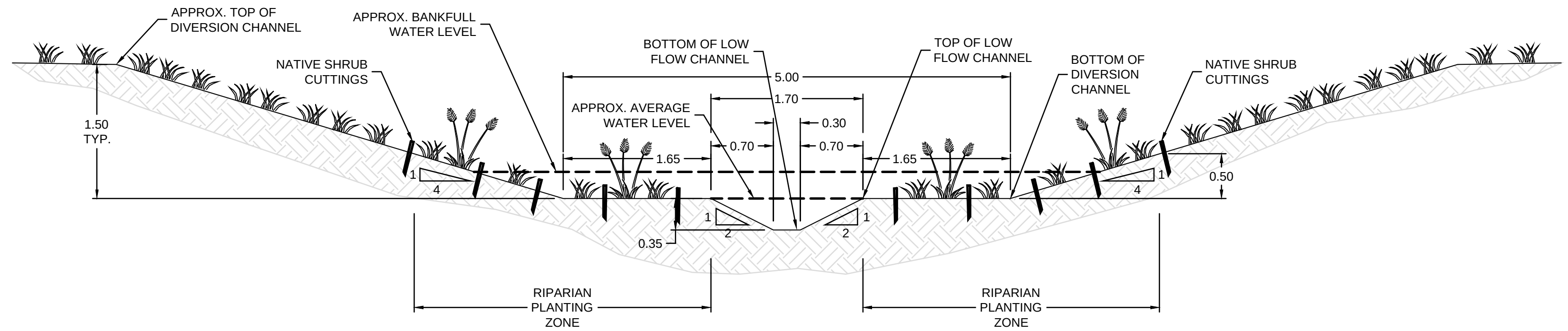
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

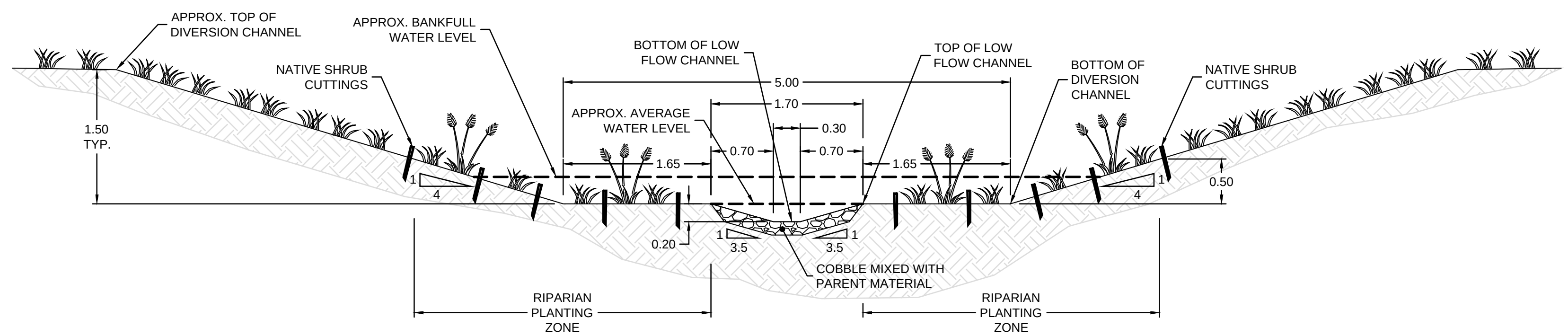
TITLE: CONCEPTUAL DESIGN
WEST CREEK DIVERSION
5m BOTTOM WIDTH TYPICAL PLAN AND PROFILE

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-004



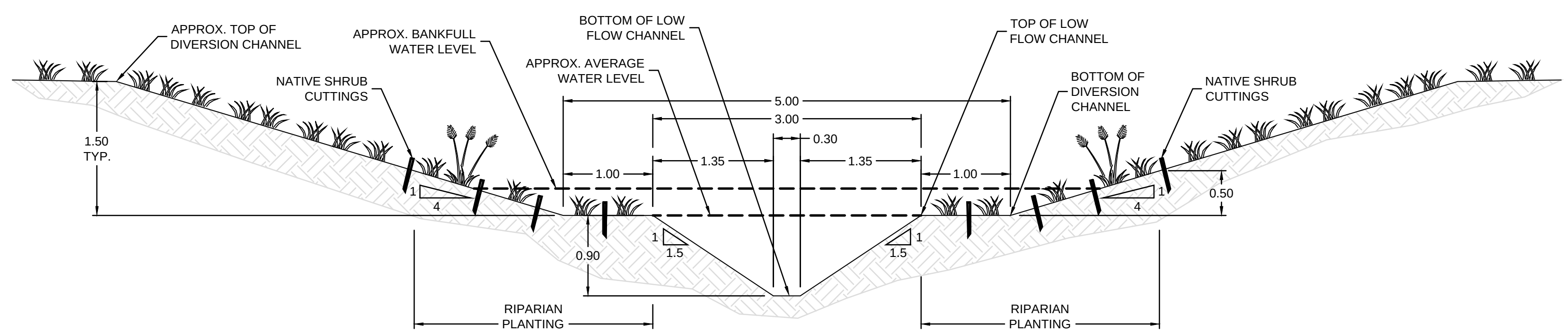
SECTION A-A: TYPICAL 5m BOTTOM WIDTH FLAT SECTION

SCALE : H=1:40 V=1:40



SECTION B-B: TYPICAL 5m BOTTOM WIDTH TOP OF RIFFLE SECTION

SCALE : H=1:40 V=1:40



SECTION C-C: TYPICAL 5m BOTTOM WIDTH POOL SECTION

SCALE : H=1:40 V=1:40

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 EXCEPT THOSE WITHIN THE LOW FLOW CHANNEL SHALL BE STABILIZED WITH A NURSE CROP AS OUTLINED IN TABLE 1.
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6. IF STABILIZATION IS REQUIRED PRIOR TO ESTABLISHMENT OF SEED MIXES THEN THE USE OF AN APPROPRIATE EROSION CONTROL BLANKET IS RECOMMENDED.
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CONCEPTUAL DRAWINGS

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REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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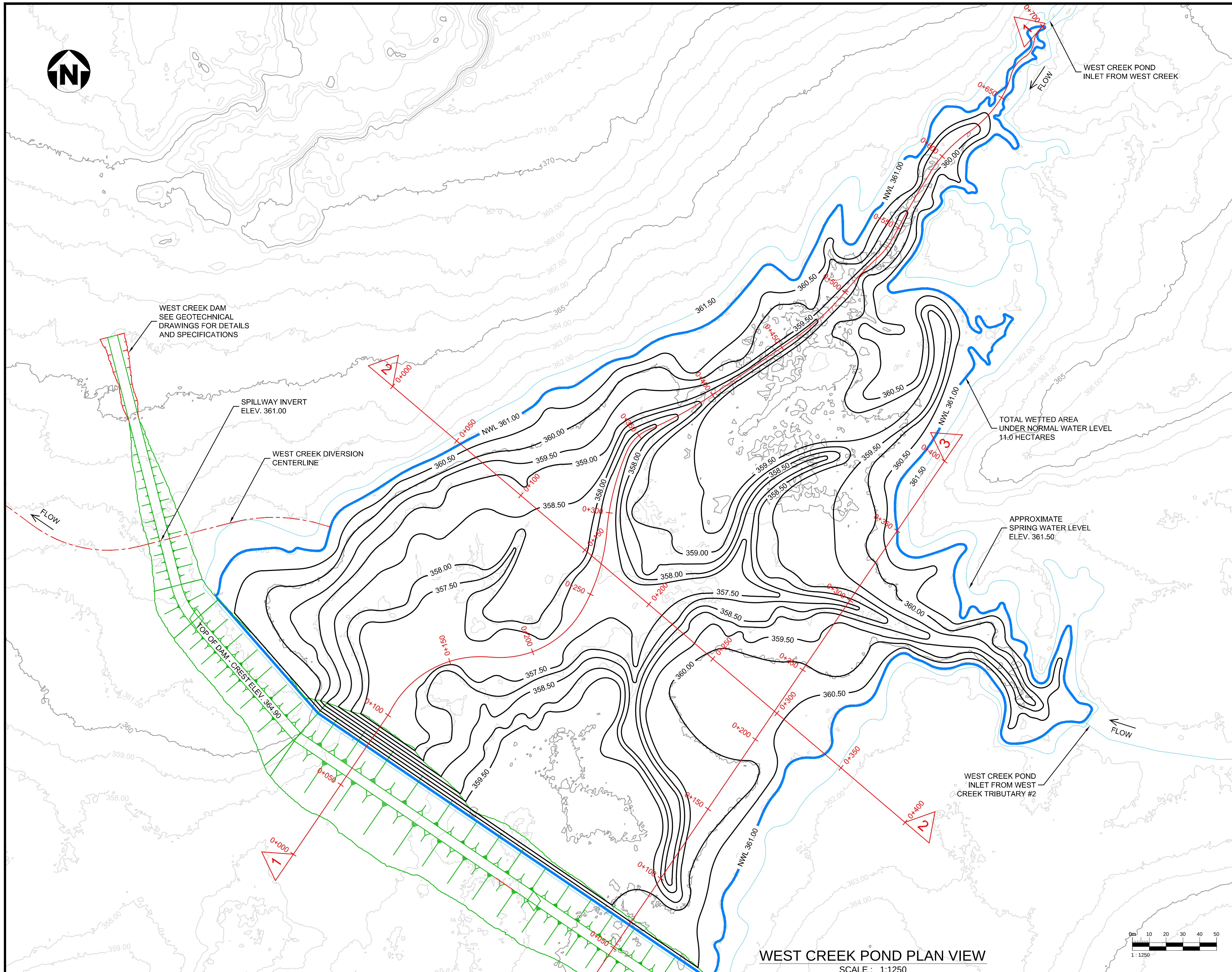
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN WEST CREEK DIVERSION 5m BOTTOM WIDTH TYPICAL CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-005



WEST CREEK POND PLAN VIEW

SCALE : 1:1250

Elevations Table				
Minimum Elevation	Maximum Elevation	Area (m²)	% Area	Water Depth
357.50	358.00	14,915	13.5%	3.00 - 3.50
358.00	358.50	10,875	9.9%	2.50 - 3.00
358.50	359.00	9,447	8.6%	2.00 - 2.50
359.00	359.50	13,535	12.3%	1.50 - 2.00
359.50	360.00	28,607	26.0%	1.00 - 1.50
360.00	360.50	16,559	15.0%	0.50 - 1.00
360.50	361.00	16,150	14.7%	0.00 - 0.50
TOTAL		110,089		

CONCEPTUAL DRAWINGS

DRAFT

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A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR
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DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
WEST CREEK POND
PLAN VIEW

PROJECT NO.: TC111504
REVISION NO. A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-006

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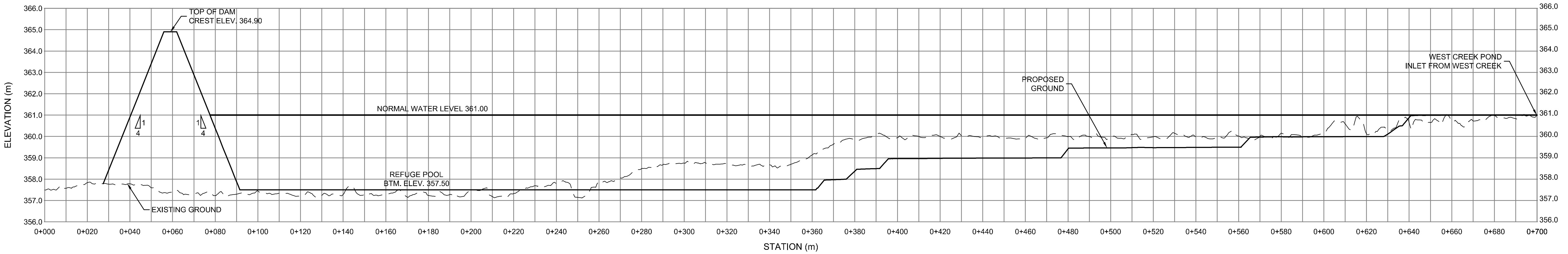
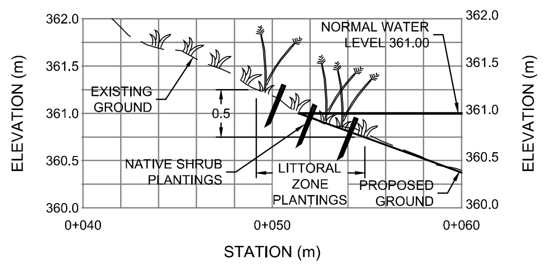


SECTION 1-1: WEST CREEK POND

SCALE : H=1:1000 V=1:100

HORIZONTAL SCALE: 1 : 1000

VERTICAL SCALE: 1 : 100

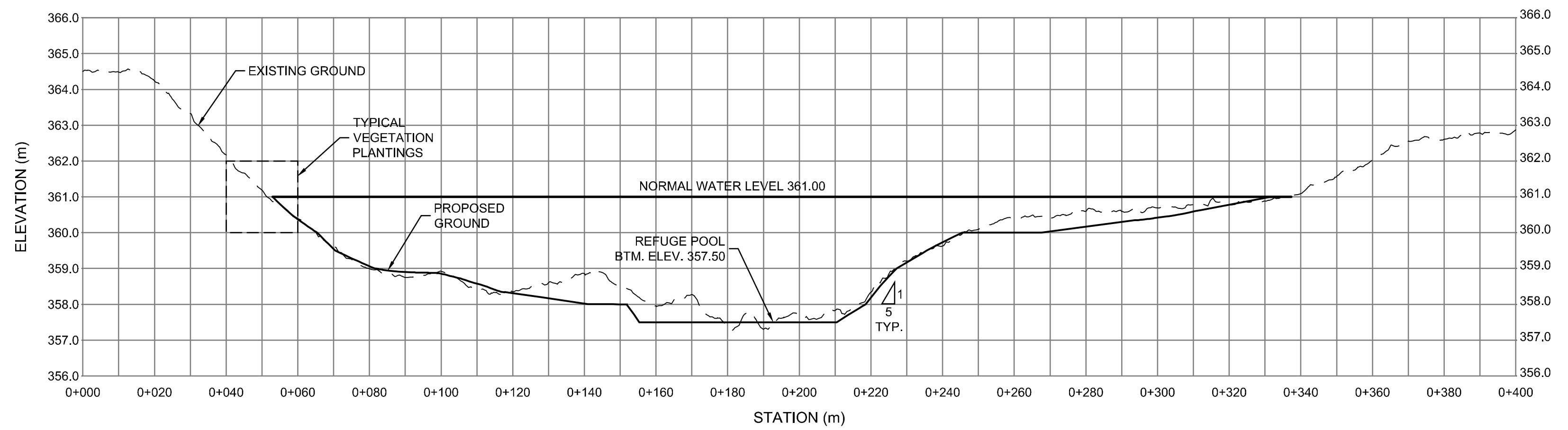


TYPICAL VEGETATION PLANTINGS

SCALE : H=1:200 V=1:40

HORIZONTAL SCALE: 1 : 200

VERTICAL SCALE: 1:40

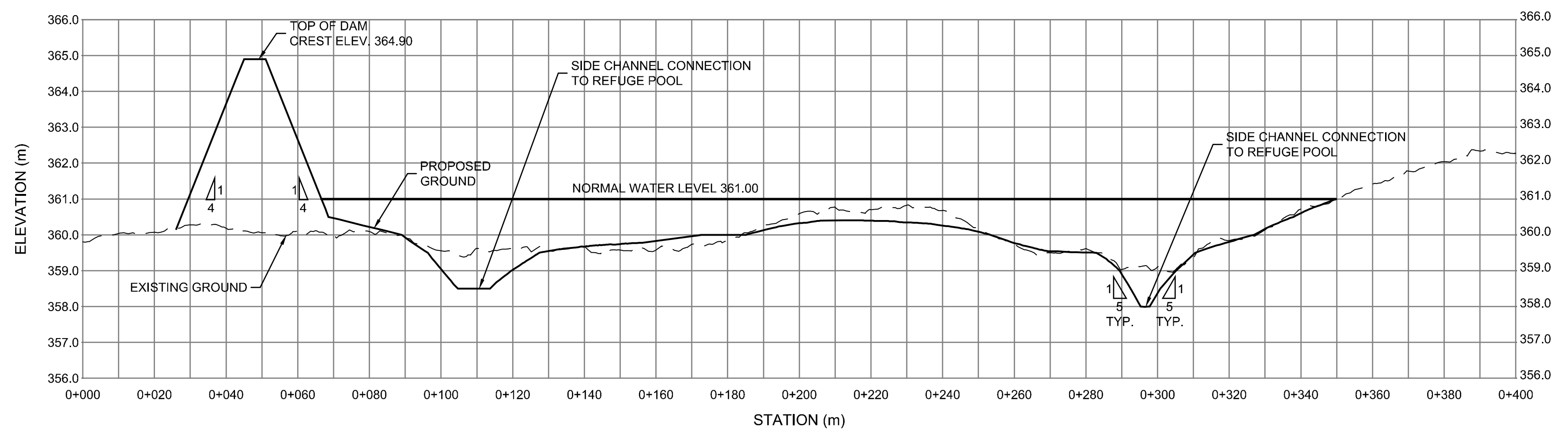


SECTION 2-2: WEST CREEK POND

SCALE : H=1:1000 V=1:100

HORIZONTAL SCALE: 1 : 1000

VERTICAL SCALE: 1 : 100



SECTION 3-3: WEST CREEK POND

SCALE : H=1:1000 V=1:100

HORIZONTAL SCALE: 1 : 1000

VERTICAL SCALE: 1 : 100

VEGETATION RESTORATION NOTES:

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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.
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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

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR
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Client: newgold Rainy River Project

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

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
WEST CREEK POND
CROSS SECTIONS

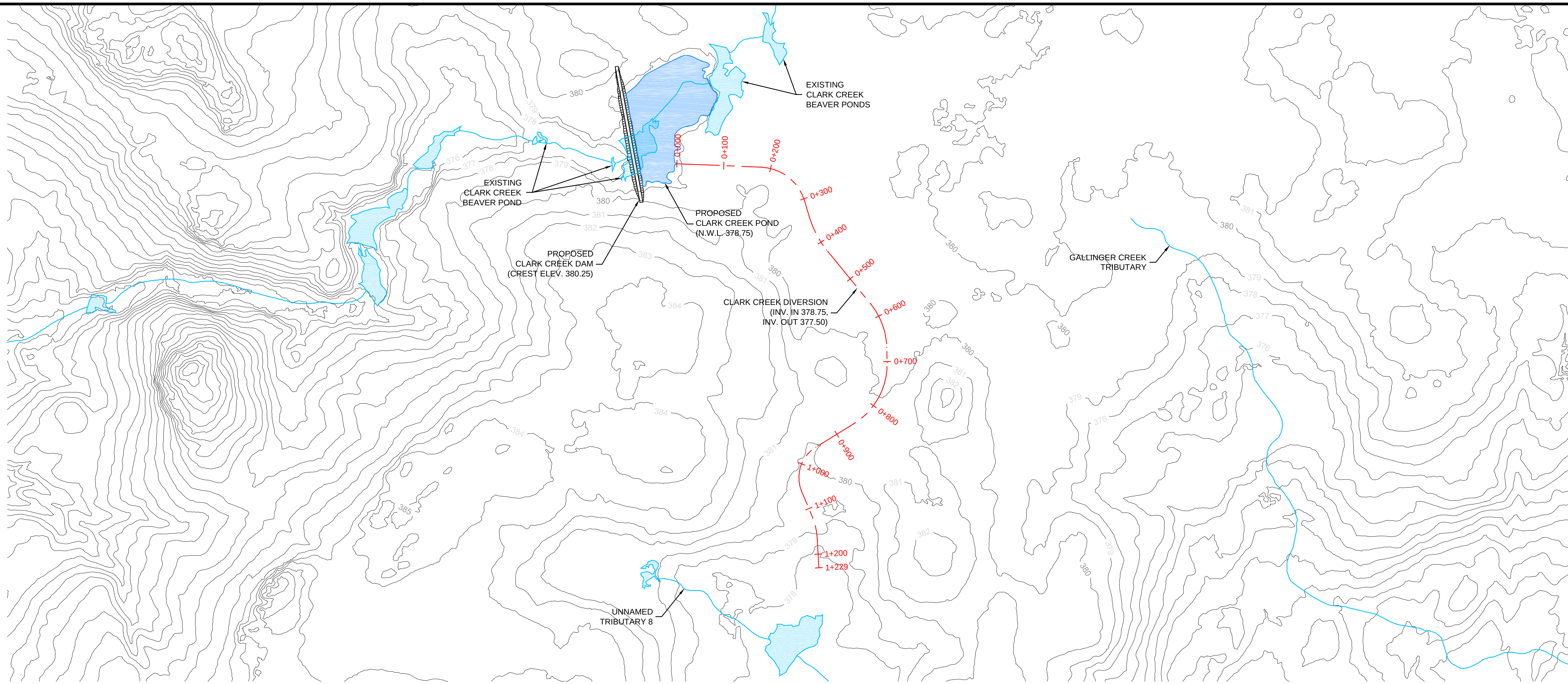
PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-100-007

newgold Rainy River Project

APPENDIX D-2

CLARK CREEK POND AND DIVERSION CHANNEL

RAINY RIVER PROJECT
Fish Habitat No Net Loss Plan
Schedule 2 Amendment Waterbodies
October 2013 – Version B

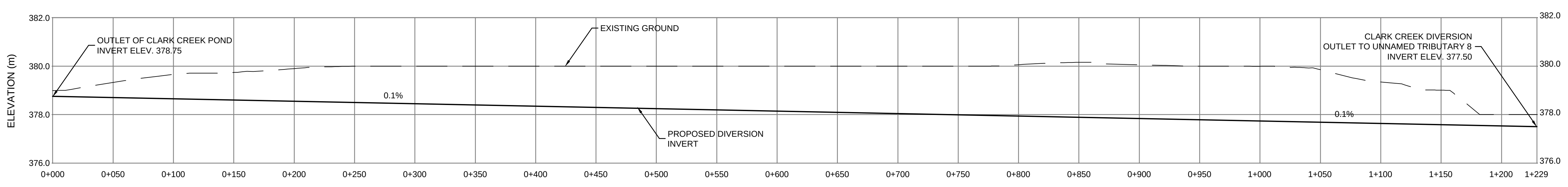


CLARK CREEK POND PLAN VIEW

SCALE : H=1:5000 V=1:5000

HORIZONTAL SCALE: 0m 50 100 150 200 1 : 5000

VERTICAL SCALE: 0m 50 100 150 200 1 : 5000



CLARK CREEK DIVERSION CHANNEL PROFILE

SCALE : H=1:2000 V=1:100

HORIZONTAL SCALE: 0m 20 40 60 80 1 : 2000

VERTICAL SCALE: 0m 1 2 3 4 1 : 100

CONCEPTUAL DRAWINGS

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

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
CLARK CREEK POND
OVERVIEW

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-200-001

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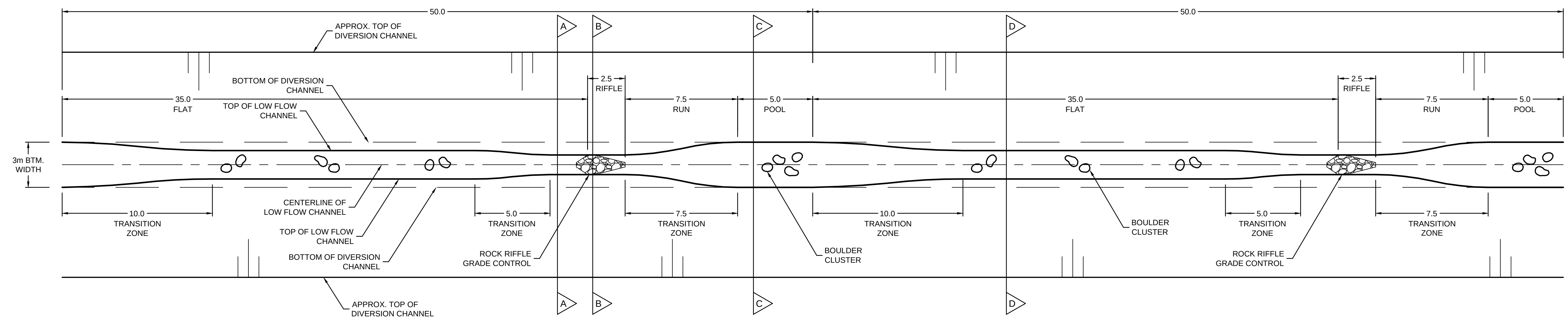
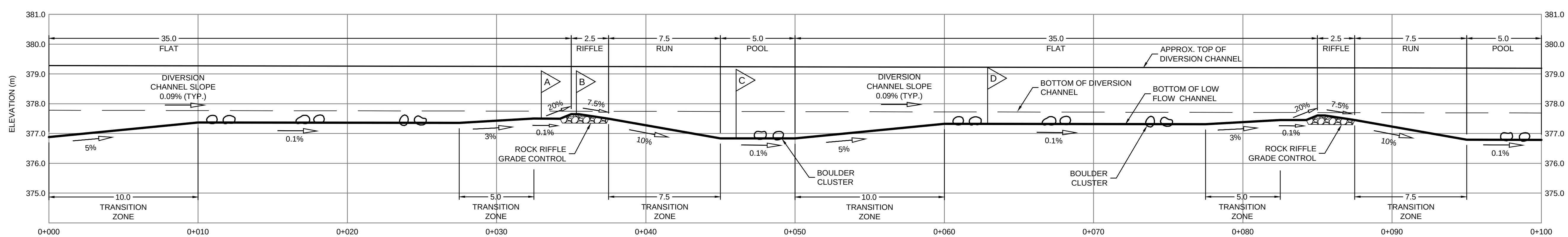


TYPICAL CLARK CREEK DIVERSION PLAN VIEW

SCALE : 1:150



TYPICAL CLARK CREEK DIVERSION PROFILE

SCALE : H=1:150 V=1:75

CONCEPTUAL DRAWINGS

DRAFT

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

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CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
CLARK CREEK DIVERSION
TYPICAL PLAN AND PROFILE

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-200-002

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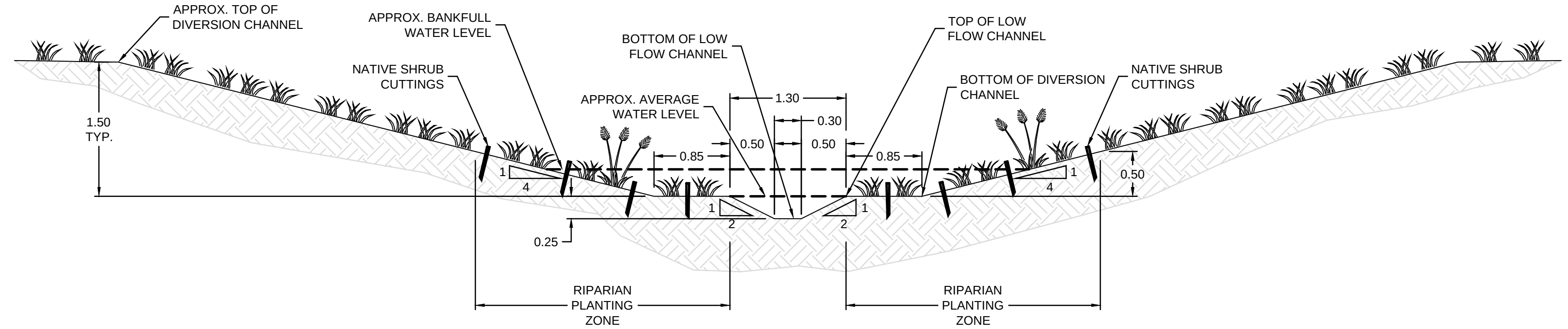
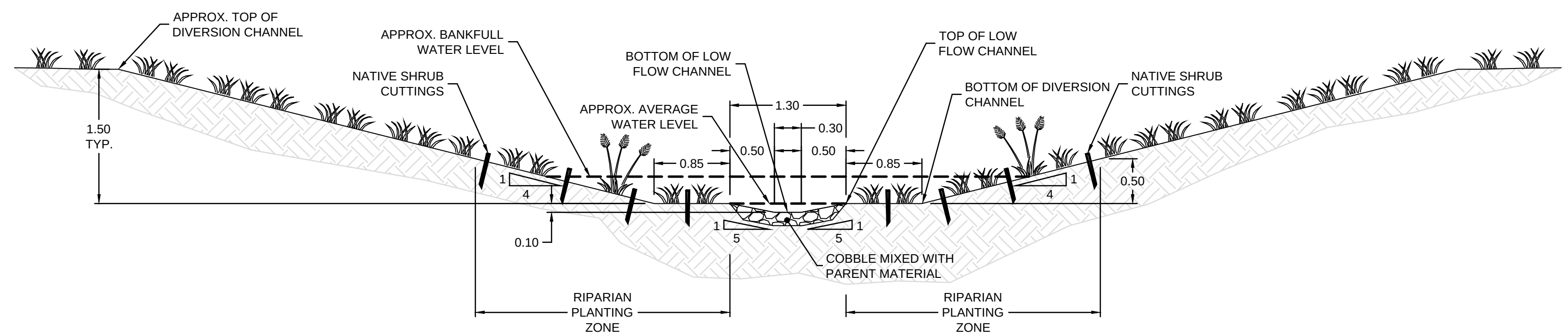


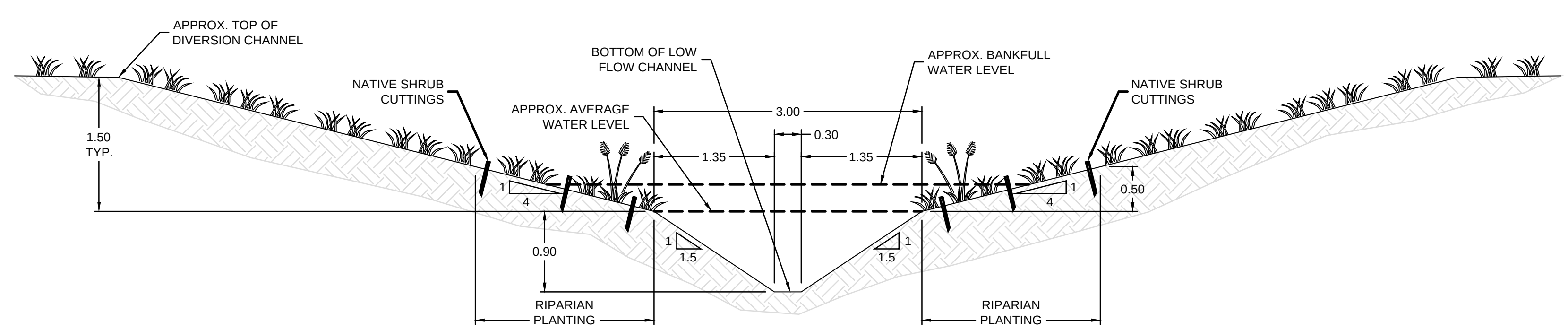
SECTION A-A: TYPICAL RUN / END OF RIFFLE SECTION

SCALE : H=1:40 V=1:40



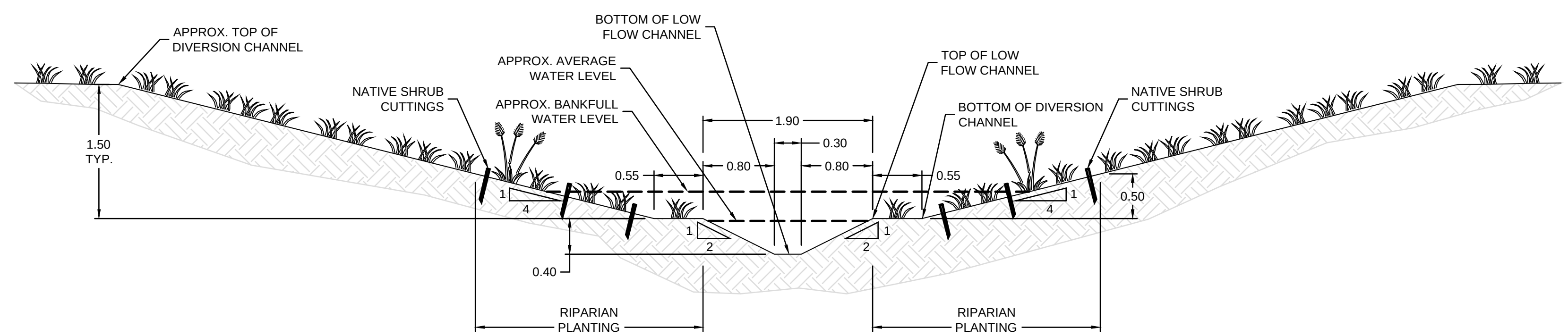
SECTION B-B: TYPICAL TOP OF RIFFLE SECTION

SCALE : H=1:40 V=1:40



SECTION C-C: TYPICAL POOL SECTION

SCALE : H=1:40 V=1:40



SECTION D-D: TYPICAL FLAT SECTION

SCALE : H=1:40 V=1:40

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 EXCEPT THOSE WITHIN THE LOW FLOW CHANNEL SHALL BE STABILIZED WITH A NURSE CROP AS OUTLINED IN TABLE 1.
5. RIPARIAN PLANTING ZONE SHALL BE SEEDED WITH NATIVE RIPARIAN SEED MIX IN ADDITION TO NURSE CROP SEED.
6. IF STABILIZATION IS REQUIRED PRIOR TO ESTABLISHMENT OF SEED MIXES THEN THE USE OF AN APPROPRIATE EROSION CONTROL BLANKET IS RECOMMENDED.
7. A TOTAL OF 15%-25% OF THE RIPARIAN PLANTING ZONE SHALL BE PLANTED WITH NATIVE SHRUB CUTTINGS AT A 0.75m SPACING.
8. NATIVE SHRUB CUTTINGS SHALL BE TAKEN FROM WILLOW AND DOGWOOD SPECIES PRESENT ON SITE AND IN SURROUNDING AREA.
9. 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

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

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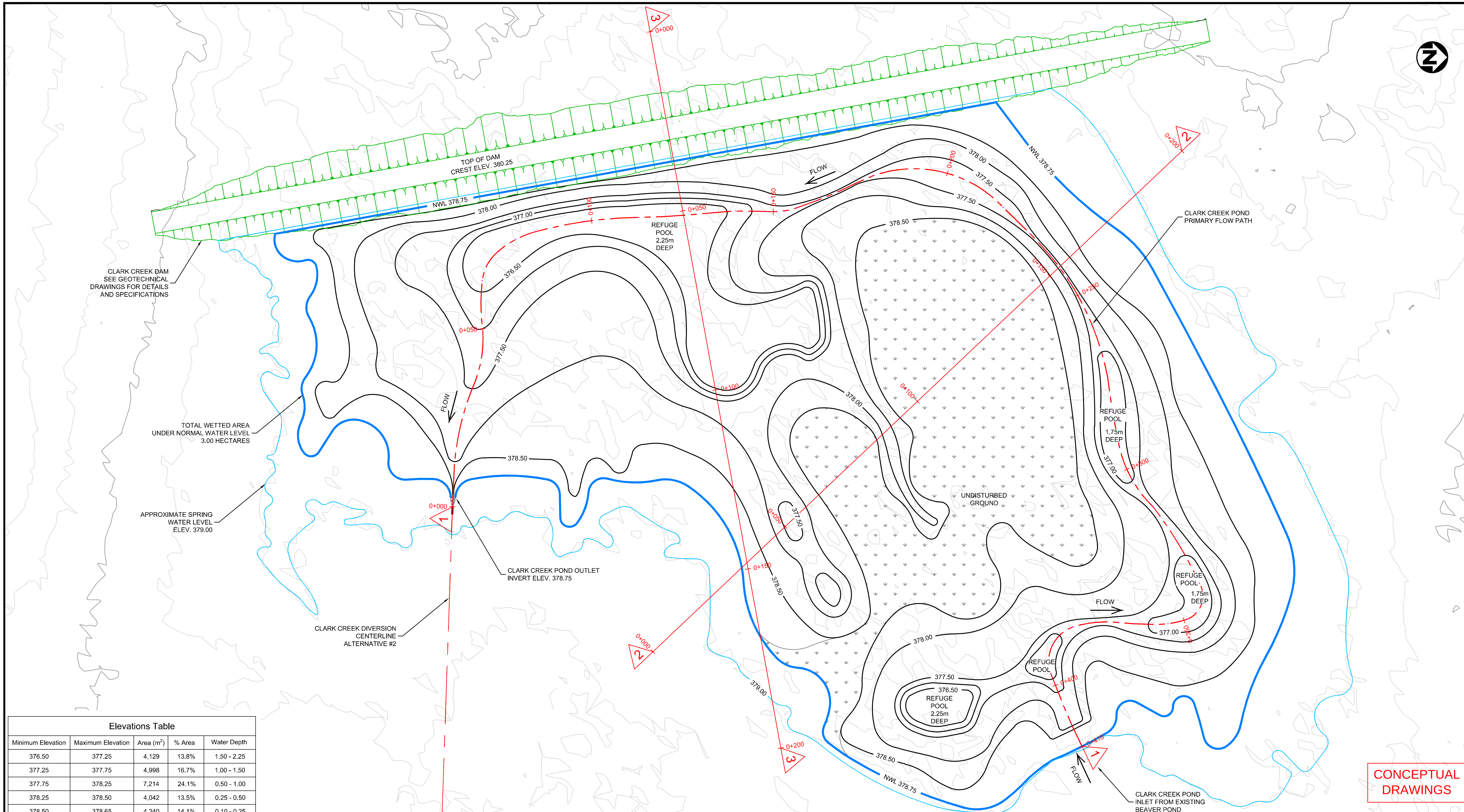
DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN CLARK CREEK DIVERSION TYPICAL CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-200-003



Elevations Table				
Minimum Elevation	Maximum Elevation	Area (m^2)	% Area	Water Depth
376.50	377.25	4,129	13.8%	1.50 - 2.25
377.25	377.75	4,998	16.7%	1.00 - 1.50
377.75	378.25	7,214	24.1%	0.50 - 1.00
378.25	378.50	4,042	13.5%	0.25 - 0.50
378.50	378.65	4,240	14.1%	0.10 - 0.25
378.65	378.75	5,370	17.9%	0.00 - 0.10
TOTAL		29,993		

CLARK CREEK POND PLAN VIEW

SCALE : 1:200

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

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APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN CLARK CREEK POND PLAN VIEW

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-200-004

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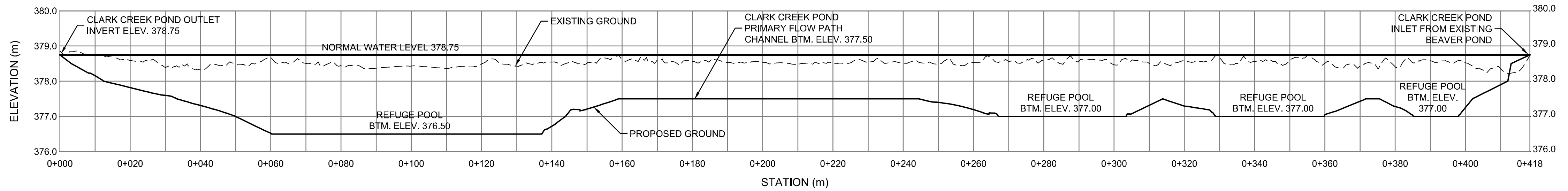
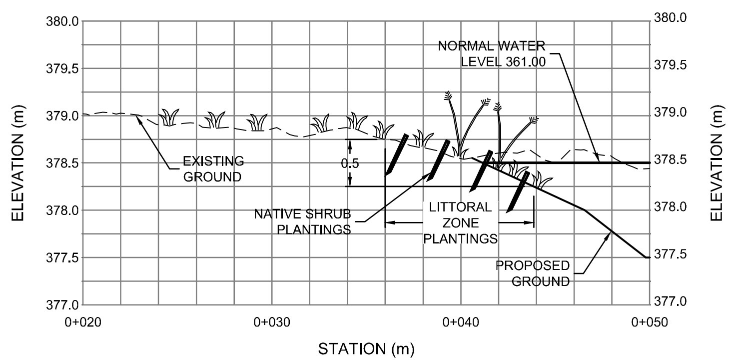


SECTION 1-1: CLARK CREEK POND

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

HORIZONTAL SCALE: 1 : 750

VERTICAL SCALE: 1 : 75

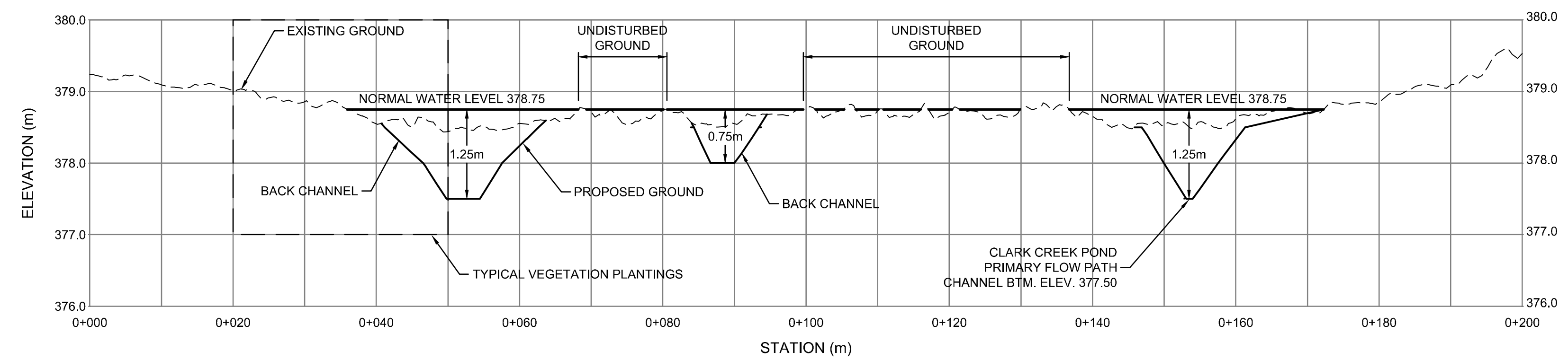


TYPICAL VEGETATION PLANTINGS

SCALE : H=1:200 V=1:40

HORIZONTAL SCALE: 1 : 200

VERTICAL SCALE: 1:40



SECTION 2-2: CLARK CREEK POND

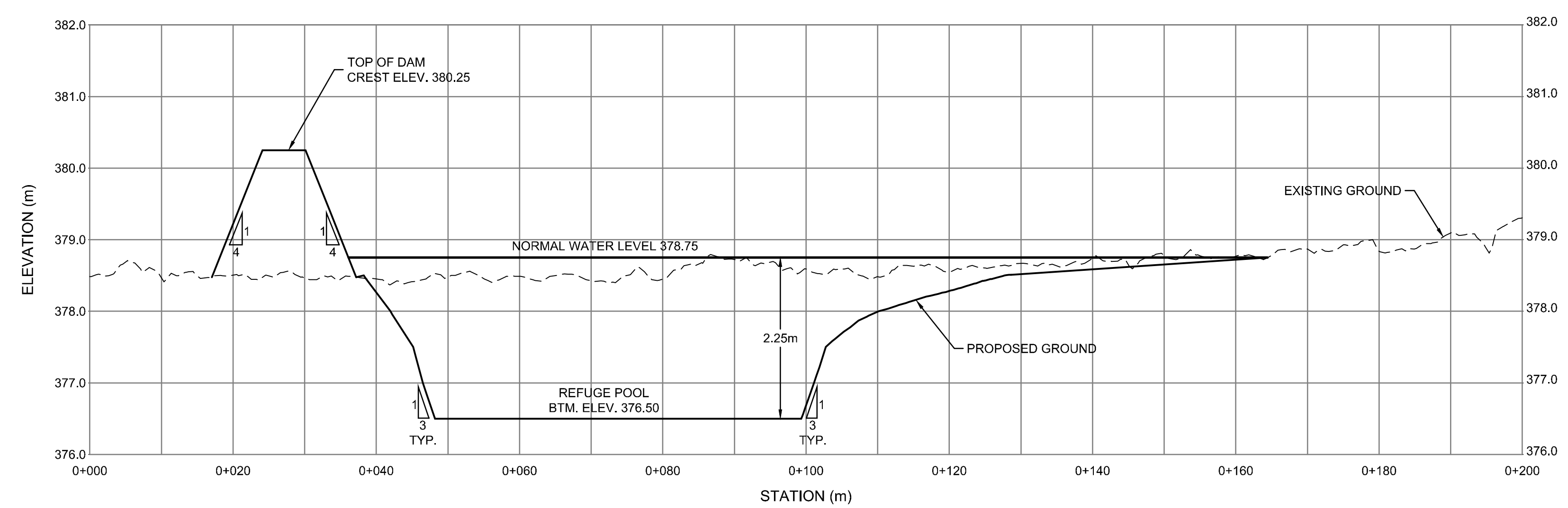
SCALE : H=1:500 V=1:50

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.



SECTION 3-3: CLARK CREEK POND

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

HORIZONTAL SCALE: 1 : 500

VERTICAL SCALE: 1 : 50

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

CONCEPTUAL DRAWINGS

DRAFT

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	DES.	APPR.
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Mississauga, Ontario, Canada L4Z 3K7

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

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
CLARK CREEK POND
CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-200-005

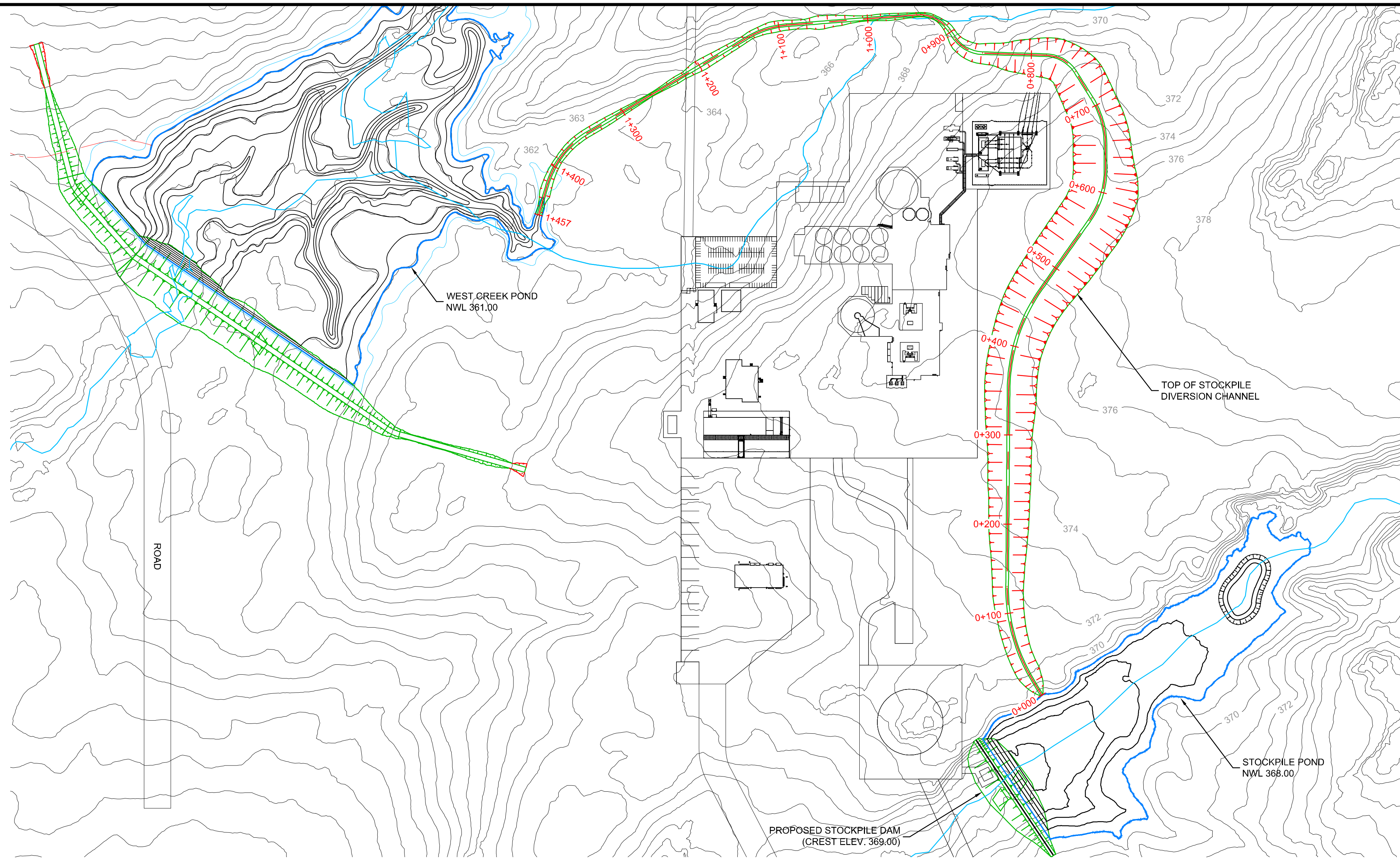
newgold Rainy River Project

APPENDIX D-3

STOCKPILE POND AND DIVERSION CHANNEL

RAINY RIVER PROJECT
Fish Habitat No Net Loss Plan
Schedule 2 Amendment Waterbodies
October 2013 – Version B

amec

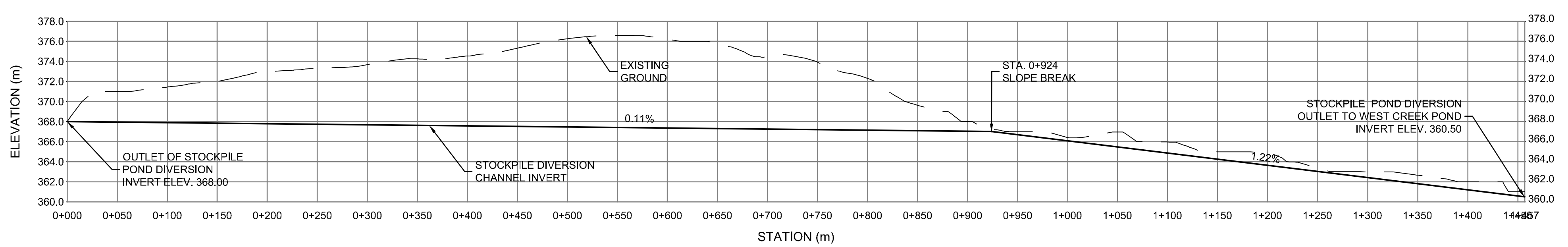


STOCKPILE POND PLAN VIEW

SCALE : H=1:3000 V=1:3000

HORIZONTAL SCALE: 0m 30 60 90 120 1 : 3000

VERTICAL SCALE: 0m 30 60 90 120 1 : 3000



STOCKPILE POND DIVERSION CHANNEL PROFILE

SCALE : H=1:2000 V=1:200

HORIZONTAL SCALE: 0m 20 40 60 80 1 : 2000

VERTICAL SCALE: 0m 2 4 6 8 1 : 200

CONCEPTUAL DRAWINGS

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A	30	10	2013	PRELIMINARY FOR DISCUSSION	NSH	MCR
B						

Client: newgold Rainy River Project

AMEC Environment & Infrastructure
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DESIGNED BY: NSH
CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
STOCKPILE POND AND DIVERSION
OVERVIEW

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-300-001

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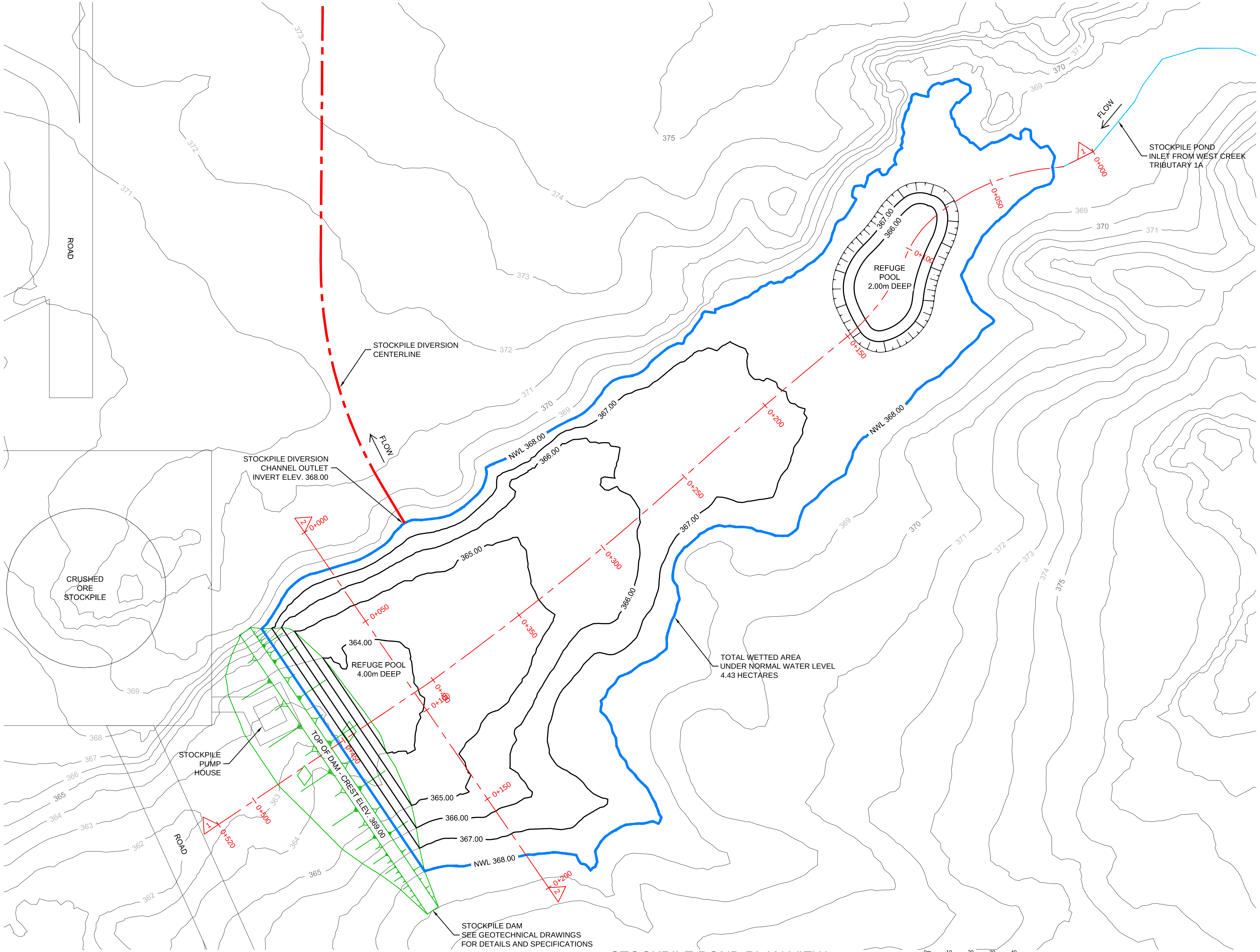

STOCKPILE POND PLAN VIEW

SCALE : 1:1000

Elevations Table				
Minimum Elevation	Maximum Elevation	Area (m^2)	% Area	Water Depth
364.00	364.50	3,396	7.7%	3.50 - 4.00
364.50	365.00	4,537	10.2%	3.00 - 3.50
365.00	365.50	2,774	6.3%	2.50 - 3.00
365.50	366.00	5,772	13.0%	2.00 - 2.50
366.00	366.50	3,500	7.9%	1.50 - 2.00
366.50	367.00	7,346	16.6%	1.00 - 1.50
367.00	367.50	5,947	13.4%	0.50 - 1.00
367.50	368.00	11,030	24.9%	0.00 - 0.50
TOTAL		44,302		

CONCEPTUAL DRAWINGS

DRAFT

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Client: newgold Rainy River Project

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CHECKED BY: MCR
REVIEWED BY: MCR
APPROVED BY: MCR

PROJECT: RAINY RIVER PROJECT
FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN
STOCKPILE POND
PLAN VIEW

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-300-002

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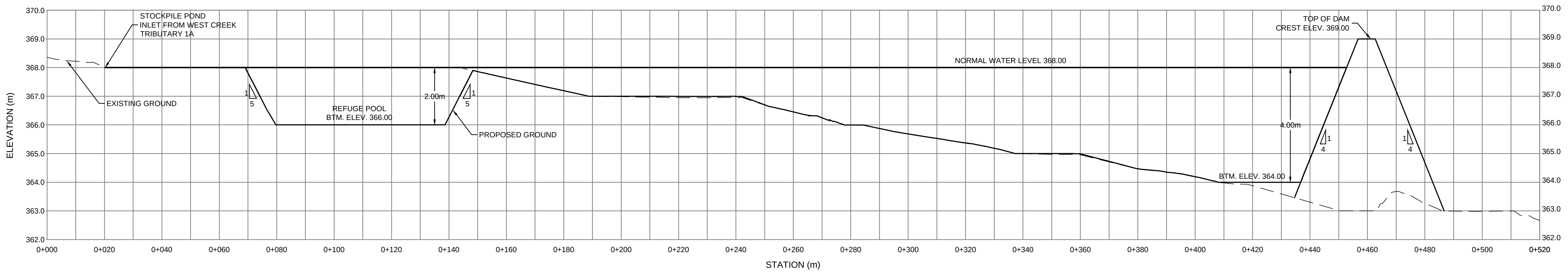

SECTION 1-1: STOCKPILE POND

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

HORIZONTAL SCALE: 1 : 750

VERTICAL SCALE: 1 : 75

VEGETATION RESTORATION NOTES:

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TABLE 1. NURSE CROP SEEDING

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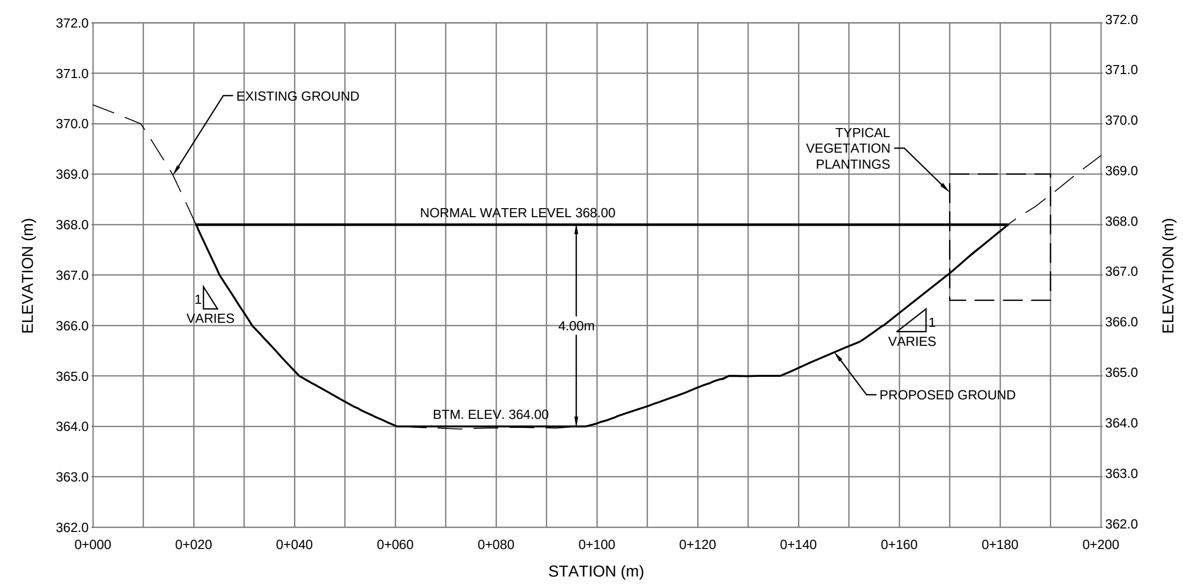
AUG. 15 TO OCT. 15	*Triticum aestivum*	Winter Wheat	30 kg/ha

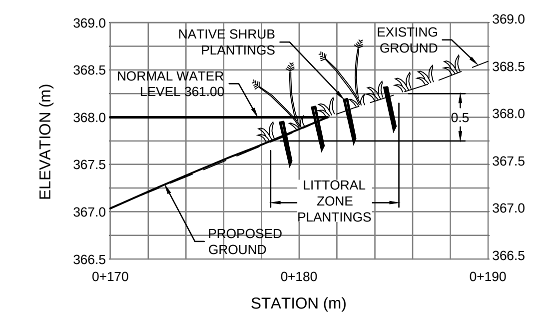


SECTION 2-2: STOCKPILE POND

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

HORIZONTAL SCALE: 1 : 750

VERTICAL SCALE: 1 : 75



TYPICAL VEGETATION PLANTINGS

SCALE : H=1:200 V=1:40

HORIZONTAL SCALE: 1 : 200

VERTICAL SCALE: 1:40

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

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

PROJECT: RAINY RIVER PROJECT FISH HABITAT OFFSET STRATEGY

TITLE: CONCEPTUAL DESIGN STOCKPILE POND CROSS SECTIONS

PROJECT NO.: TC111504
REVISION NO.: A
DATE: OCT. 2013
SCALE: AS SHOWN
DRAWING NO.: 111504-300-003

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